With the Compliments of

Geo. M. Wheeler

Lieut of Engineers.

ENGINEER DEPARTMENT, U. S. ARMY.

REPORT

UPON

UNITED STATES GEOGRAPHICAL SURVEYS

WEST OF THE ONE HUNDREDTH MERIDIAN,

IN CHARGE OF

FIRST LIEUT. GEO. M. WHEELER,
CORPS OF ENGINEERS, U. S. ARMY,

UNDER THE DIRECTION OF

BRIG. GEN. A. A. HUMPHREYS,
CHIEF OF ENGINEERS, U. S. ARMY.

PUBLISHED BY AUTHORITY OF THE HONORABLE THE SECRETARY OF WAR,

IN ACCORDANCE WITH ACTS OF CONGRESS OF JUNE 23, 1874, AND FEBRUARY 15, 1875.

IN SEVEN VOLUMES, ACCOMPANIED BY ONE TOPOGRAPHICAL AND ONE GEOLOGICAL ATLAS.

VOL. II.—ASTRONOMY AND BAROMETRIC HYPSOMETRY.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1877.

NOTE.

Seven volumes, accompanied by one Topographical and one Geological Atlas, embrace reports upon Geographical Surveys of the territory of the United States West of the One hundredth Meridian of longitude from Greenwich, as follows:

Volume I.—Geographical Report.
Volume II.—Astronomy and Barometric Hypsometry.
Volume III.—Geology and Mineralogy.
Volume IV.—Palæontology.
Volume V.—Zoölogy.
Volume VI.—Botany.
Volume VII.—Archæology.

The Topographical Atlas edition, consisting of Title-Page, Legend, and Conventional Sign Sheets, Index, Progress and Basin Maps, and Sheets Nos. 49, 50, 57, 58, 59, 66, 67, 75, 76, 83, 53 (C), 61 (B), 61 (C), 61 (C sub.), 61 (D), 65 (D), 69 (B), 69 (D), 70 (A), 70 (C), 78 (B), have been issued at date of sending forward the MS. of this volume. Other sheets, of which there are seventeen in various stages of completion, will follow as rapidly as they can be prepared, engraved, and printed.

Sheets 53 (C), 61 (B), 61 (C), 61 (D), 65 (D), 69 (B), 69 (D), 70 (A), 70 (C), and 78 (B), are projected upon a scale of 1 inch to 4 miles, while the scale of 1 inch to 2 miles has been used for sheet 61 (C sub.), the latter embracing a part of the San Juan mining region of Southwestern Colorado.

The following Geological Maps, forming a part of those supplementing

Volume III, based upon the topographical sheets, have been published, *i. e.*, Title-Page, Index Sheet, Restored Outline of Lake Bonneville, Nos. 50, 59, ½ of 58, and ½ of 66, 66, 67, 75, 76, and 83. Other sheets are in course of completion

The Topographical Atlas referred to will comprise 95 sheets, on a scale of 1 inch to 8 miles, numbered consecutively from 1 to 95, inclusive, while the "Geological Atlas" will consist of the same number, using the topographical maps as a base. (See Progress Map of 1877.)

The quarto reports embrace the results of the special branches of the Survey that are completed at the date at which each is separately submitted, while annual reports of the operations of the work, showing its progress during the fiscal year, are regularly submitted to the Chief of Engineers, and have appeared as appendixes to his Annual Reports

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

REPORTS

UPON

THE ASTRONOMICAL DETERMINATIONS AT MAIN STATIONS

OCCUPIED IN

THE YEARS 1872, 1873, AND 1874,

AND

RESULTS OF BAROMETRIC OBSERVATIONS

OF

THE YEARS 1871, 1872, 1873, 1874, AND 1875.

IN TWO PARTS.

ILLUSTRATED BY TWENTY-TWO PLATES AND THREE WOOD-CUTS.

TABLE OF CONTENTS.

PART I.

PART II.

LIST OF PLATES.

Plates 1 to 6, inclusive, have been produced by the photo-lithographic process at the establishment of the Graphic Company, New York City, under the direction of L. VAN CAMPEN.

The engraving and printing of the remaining plates from 7 to 22, inclusive, have been furnished by JULIUS BIEN, of New York City.

LETTER OF TRANSMITTAL.

UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., March 19, 1877.

GENERAL: I have the honor to submit herewith, for publication, the reports to constitute Volume II of those authorized by acts of Congress, approved June 23, 1874, and February 15, 1875.

The volume consists of the several reports upon determinations at main astronomical stations, with lists of geographical positions and altitudes of prominent points, together with results from the barometric work.

The necessity for astronomical determinations at points in the western interior, contiguous to the fields of survey, became apparent at an early stage of the work, since the principal longitudes in the region occupied were necessarily approximate for want of telegraphic communication, and other essentials of accuracy. The latitude determinations have been found to possess a much greater degree of accuracy, and are the only ones which could be relied upon, except an extremely limited number of longitudes. It is believed that the methods adopted for the observations and their computation have proven adequate for the requirements of standard field astronomical work, and the results are so grouped as to show in each case their greater or lesser probable values. The importance of these astronomical determinations with stations and meridian lines usually marked with permanent monuments in the prosecution of extended geographical surveys cannot be overestimated. In regions remote from railroad communication, more portable instruments and different methods, similar to those adopted in 1869, can be used with efficiency.

Prior to the establishment of a survey covering the entire interior of the country, it is not presumable that more elaborate means will be used for the fixing of geographical positions, so necessary in the construction of detailed topographical maps, since the cost of the establishment, in the rough mountain interior, of geodetic points of the highest order of accuracy is not justified by the uses to which they may be applied in the present development of connected surveys of this region. When topographical results are acknowledged as a want more frequent and wide-spread, a great geodetic survey of the entire territory of the United States may be begun; meanwhile, the geodesy of the mountains as it is now conducted, demanding primarily the determination of initial points at which measured and developed bases and subsequent schemes of triangulation may be laid out, such as shall meet present requirements, must be confined to such as are needed more particularly for mapping purposes, and for such geodetic points as may be required by the surveys of the public lands.

The observatory at Ogden, Utah, remains incomplete, but the importance of it, and such others as have been recommended to be established, suggests mention.

This volume will be found not without value to the future compiler, because of the geographical positions and altitudes that it contains, and serves to show the operations and results in this section up to the close of the season of 1874.

Lieut. William L. Marshall, Corps of Engineers, in charge of the barometric reductions from December 1, 1874, to August 8, 1876, submits the results of the labors of this section that had been previously carried on under the direction of Lieut. R. L. Hoxie, Corps of Engineers, after the plan of organization as laid down by the officer in charge.

It was at one time contemplated to extend the scope of the hourly observations so that the results would have been more widely distributed, but the additional force required in observations for altitude determinations and the temporary cessation of the annual occupancy of main astronomical stations, have led to their abandonment in other than exceptional cases. His report is a summary of the barometric and hypsometric observations, and results to date; other than those submitted in the regular annual reports.

The methods followed in the reduction of the barometric observations for altitudes have, with some slight modification in case of the aneroid readings, been those given in the invaluable treatise upon this subject by Lieut. Col. R. S. Williamson, Corps of Engineers, and forming Professional Paper No. 15, of the Engineer Department, United States Army.

The gradual and constant improvement in this section of the survey has been noticeable and merits approval. I take this occasion to signify appreciation of the great industry, often exhibited under the most trying circumstances, of the astronomical and meteorological observers, most of whose names appear in the several reports, while the results as shown are, in a measure, the test of their success.

All of which is respectfully submitted.

GEO. M. WHEELER,
Lieutenant of Engineers, in charge.

Brig Gen. A. A. HUMPHREYS,
Chief of Engineers, United States Army.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

PART I.

REPORTS

UPON

THE ASTRONOMICAL DETERMINATIONS AT MAIN STATIONS IN NEVADA, UTAH, MONTANA, WYOMING, NEBRASKA, COLORADO, AND NEW MEXICO, OCCUPIED IN THE YEARS 1872, 1873, AND 1874,

BY

Dr. F. KAMPF, JOHN H. CLARK, WM. W. MARYATT,
and Prof. T. H. SAFFORD.

WITH LISTS OF GEOGRAPHICAL POSITIONS, &c.

ORDER OF SEQUENCE FOR AN ASTRONOMICAL REPORT AT MAIN OR PRIMARY FIELD-STATIONS.

Longitude by telegraph; latitude by zenith-telescope (Talcott's method).

1. Geographical position of station; details of physical geography.
2. Meteorological conditions, both general and special; the latter while observations were made.
3. Description of observatory; *personnel* of party.
4. Description of instruments; instrumental values.
5. Points with which connections were made; nights of observation and observers; names of computers.
6. Circumstances of telegraphic communication; name of telegraph-operator, and of the company whose wire has been employed; length of circuit, number of batteries and repeaters.
7. Tabulation of stars used.
8. Uniform tables of time-reductions at receiving and sending stations.
9. Grouping of series of exchange-signals, including means of single and serial results.
10. Personal equation.
11. Probable error by least squares.
12. Reduction of the latitude-observations properly grouped, with discussion of results.
13. Resulting astronomical co-ordinates.

ABBREVIATIONS AND SIGNS.

a, b, c = azimuth, level, and collimation corrections.

A, B, C = azimuth, level, and collimation factors.

T = observed time reduced to mean of wires and corrected for rate.

T′ = observed time corrected for instrumental errors.

AR = apparent right ascension of star.

$\triangle_0 T$ = resulting error of the chronometer after the mean of the wires is corrected for rate and level.

$\triangle T_0$ = adopted mean error of chronometer.

$\delta T = \triangle T_0 - \triangle_0 T$.

$\triangle T$ = error of the chronometer.

v = difference between final correction of chronometer and $\triangle T$.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF, PROF. J. R. EASTMAN, JOHN H. CLARK, AND O. B. WHEELER, IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF OBSERVATORY AT OGDEN, UTAH,

SEASONS OF 1873 AND 1874.

COMPUTATIONS BY

Dr. F. KAMPF and Prof. J. R. EASTMAN.

ERRATA, VOL. II.

Page 491, Altitude of Fort Garland, Colo., for 4,853.7 read 7,937.0—R. R. level.
Page 556, Altitude of Agua Caliente, Cal., for 3,618.6 read 724.8
Page 557, Altitude of Buffalo Peak, Colo., for 3,328.6 read 13,328.6
Page 557, Altitude of Bullion City, Nev., for 16,386.4 read 6,386.4
Page 558, Altitude of Fort Craig, N. Mex., for 4,619.0 read 4,447.5
Page 559, Altitude of Engineer Pk., Colo., for 13,076.4 read 13,277.4
Page 559, Altitude of Granite Springs, Cal., for 4,115.2 read 4,015.2
Page 563, Altitude of Provo, Utah, for 4,544.0 read 4,567.3
Page 563, Altitude of Rosita (sun dial), Colo., for 8,932.0 read 8,736.0
Page 564, Altitude of San Carlos Agency, Ariz., for 2,456.0 read 2,558.7
Page 565, Altitude of Trinidad, Colo., for 6,043.1 read 5,989.9
Page 566, Altitude of Winnemucca, Nev., (Signal Office,) for 4,365.6 read 4,355.0

ABBREVIATIONS AND SIGNS.

a, b, c = azimuth, level, and collimation corrections.

A, B, C = azimuth, level, and collimation factors.

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DR. F. KAMPF AND PROF. J. R. EASTMAN.

OGDEN, UTAH.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . 111° 59′ 54″.64 ± 0″.40 west from Greenwich.
34° 56′ 52″.84 west from U. S. Naval Observatory, Washington, D. C.
Latitude, . . . 41° 13′ 08″.56 ± 0″.03 north.
Altitude of observatory above sea (railroad level), 4374.0 feet.

Ogden is a Mormon town of nearly 2,000 inhabitants, the junction of the Union Pacific and Central Pacific Railroads. The astronomical station is situated on a low hill west of the town, near the Utah Central Railroad, about 2,000 feet from the Weber River, which flows by in a southerly direction; the *niveau* of the stream being about 100 feet below the floor of the observatory.

DESCRIPTION OF OBSERVATORY.

The foundation of this building is of granite and sandstone, and rises $3\frac{1}{2}$ feet above the ground, inclosing a cellar, which has a depth of 4 feet from the floor. The structure consists of three parts: the eastern wing, which is intended for the use of the officer in charge; the western wing, occupied as an observing transit room; and the center, which will contain a solid pyramidal pier to support an equatorial. The dimensions of the two wings are the same, being 11 feet by 15 feet on the ground and $9\frac{1}{2}$ feet in height. The central compartment is 15 feet square, and will have two floors. The eastern room is lighted by six windows, each $2\frac{5}{6}$ feet by $6\frac{1}{2}$ feet, which, in size and position, are similar to the apertures which are cut into the western wing for purposes of meridional observation. The latter openings extend to the top of the wall and thence across the roof, and are closed by vertical shutters upon the side of the building and a horizontal pair upon the top, by which the interior is sheltered from the dust and rain. The observing room contains two piers of solid sandstone, which are planted 6 feet below the floor, and protrude 2 feet above the same. A third pier, which is of brick-work, insulated, and intended to carry a clock, has been erected in the southeastern corner of the observing room. Chronographic and telegraphic apparatus are placed on separate stands. The whole building is covered with a heavy tin roof.

CONNECTIONS—OBSERVERS—METHODS.

The longitude of Ogden observatory was determined in three different ways: first, Ogden was connected with Salt Lake City observatory in 1873, by Dr. F. Kampf and Mr. John H. Clark, observers; second, Detroit was connected with Ogden in 1873 by Mr. O. B. Wheeler, assistant in the United States Lake Survey, and Dr. F. Kampf, observers; and, third, the United States Naval Observatory at Washington, D. C., was connected with Ogden in 1874, by Prof. J. R. Eastman, of the Naval Observatory, and Mr. John H. Clark, observers. In all cases, observations were recorded at both places by means of the chronograph, and the longitude was determined by automatic signals of the chronometer, as well as by arbitrary breaks on the chronograph.

In reference to the first determination, it should be stated that each observer reduced his own observations, after leaving the field, by means of the method of least squares.

A description of the second determination will be found in the report of the Chief of Engineers for 1874, page 434 *et seq.* The observations taken at Detroit have been computed in a different way from those made at Ogden, and have afterward been recomputed by the method employed in this office. The result thereby attained is taken for the comparison of the final results.

The last determination, which was obtained in 1874 by a direct connection with Washington, is based upon the computations made by Professor Eastman and those of Dr. F. Kampf, who reduced the corresponding Ogden observations.

INSTRUMENTS—TELEGRAPHIC COMMUNICATION.

In the season of 1873, the Würdemann combined transit-instrument No. 28 was used. This had been previously employed in the determination of Colorado Springs, and is described, with its values, in the report on that station, published in 1874. In 1874, observations for latitude were made with the same instrument, but the time observations were taken with the 32-inch astronomical transit Würdemann No. 29.

All telegraphic signals were transmitted over the wires of the Western Union Company. The length of circuit from Ogden to Salt Lake was 37 miles; from Ogden to Detroit, 1,800 miles; and from Ogden to Washington, 2,365 miles. Signals were dispatched in 1873 by means of a battery of three Grove's cells, belonging to the Survey; in 1874, a Hill battery of two cells was used. On the eastern routes, there were repeaters at Cheyenne, Omaha, Chicago, Pittsburgh, and Harrisburgh.

Tabulation of stars used for determination of time at Ogden, Utah; Salt Lake City, Utah; and Detroit, Michigan, 1873.

Name of star.		OGDEN.												SALT LAKE CITY.						DETROIT.				
		September 29.	September 30.	October 1.	October 2.	October 3.	October 4.	October 5.	October 7.	October 8.	October 9.	October 10.	October 11.	September 29.	October 1.	October 2.	October 3.	October 4.	October 5.	September 29.	September 30.	October 1.	October 9.	October 10.
α	Andromedæ																						×	
12	Ceti																			×				
α	Cassiopeiæ																			×				
β	Ceti																			×				
ε	Piscium																			×				
θ[1]	Ceti																			×				
η	Piscium																			×				
o	Piscium																			×				
α	Ceti								×															
ρ	Persei								×															
β	Persei								×															
48	Cephei (H.)								×															
ζ	Arietis								×															
α	Persei								×															
o	Tauri								×															
ξ	Tauri								×															
f	Tauri								×															
ε	Eridani								×															
δ	Persei								×															
α	Lyræ	×	×																					
5 ε	Lyræ	×	×																					
β	Lyræ	×	×																					

Tabulation of stars, &c.—Continued.

Name of star.		OGDEN.												SALT LAKE CITY.						DETROIT.				
		September 29.	September 30.	October 1.	October 2.	October 3.	October 4.	October 5.	October 7.	October 8.	October 9.	October 10.	October 11.	September 29.	October 1.	October 2.	October 3.	October 4.	October 5.	September 29.	September 30.	October 1.	October 9.	October 10.
σ	Sagittarii	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
o	Draconis	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50	Draconis	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
ε	Aquilæ	×	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..
ζ	Aquilæ	×	×	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..
π	Sagittarii	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	×	..	..	..	..	..	..	..
d	Sagittarii	..	×	×	×	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
δ	Draconis	×	×	×	×	..	×	..	..	..	..	..	..	..	×	×	×	×	..	..	..	..	..	..
τ	Draconis	×	×	×	×	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
δ	Aquilæ	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	×	..	..	..	..	..	..
a	Vulpeculæ	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	×	×	..	..	..	..	..
β	Cygni	×	×	×	×	..	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
ι	Cygni	×	..	×	×	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
μ	Aquilæ	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	×	×	..	..	..	..	..
κ	Aquilæ	×	..	×	×	×	×	×	..	..	..	..	..	..	×	×	×	×	×	..	..	..	..	..
θ	Cygni	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	×	×	..	..	..	..	..
γ	Aquilæ	..	×	×	×	..	×	×	..	..	..	..	..	..	×	×	×	×	×	..	..	..	..	..
a	Aquilæ	..	×	×	×	×	×	×	..	..	..	..	..	..	×	×	×	×	×	..	..	..	..	..
ε	Draconis	..	×	×	×	×	×	×	..	..	..	..	..	..	×	×	×	×	×	..	..	..	..	..
ψ	Cygni	..	×	×	..	..	×	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
τ	Aquilæ	..	×	..	×	×	..	×	..	×	..	..	..	..	..	×	..	..	×	..	..	..	..	..
θ	Aquilæ	..	..	..	..	×	..	×	..	×	..	..	..	..	..	×	..	..	×	..	..	×	..	..
31 o^1	Cygni	..	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
a^2	Capricorni	..	×	..	..	×	..	×	..	×	×	×	..	..	..	..	..	..	×	..	..	×	×	×
κ	Cephei	..	..	..	..	×	..	×	..	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..
β	Capricorni	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
γ	Cygni	..	..	..	..	×	..	..	..	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..
π	Capricorni	..	..	..	..	×	..	..	..	×	×	×	..	..	..	..	..	..	..	..	..	×	..	×
ε	Delphini	..	..	..	..	×	..	..	..	×	×	×	..	..	..	..	..	..	..	..	×	×	×	×
	Groombridge 3241	..	..	..	..	×	..	..	..	×	×	×	..	..	..	..	..	..	..	..	..	..	..	..
a	Cygni	..	×	×	..	..	..	..	..	×	×	×	..	..	×	..	..	..	..	..	..	..	×	×
γ	Delphini	..	×	×	..	..	..	..	..	×	×	×	×	..	..	..	..	..	..	..	×	×	..	..
ε	Aquarii	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..
μ	Aquarii	..	×	×	..	..	..	..	..	×	×	×	×	..	×	..	..	..	..	..	×	×	×	×
32	Vulpeculæ	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	..	..
ν	Cygni	..	..	×	..	..	..	..	..	..	..	..	..	×	×	..	..	×	×	..	..	..	×	..
	12-year Catalogue, 1879	..	..	..	..	..	×	..	..	×	×	×	×	..	..	..	..	..	..	..	..	..	..	..
f^1	Cygni	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..
61	Cygni (*pr.*)	..	..	..	×	..	×	..	..	×	×	×	×	×	..	×	..	×	×	..	..	..	×	×
61	Cygni (*seq.*)	..	..	..	..	..	..	..	..	..	..	..	..	×	..	×	..	×	×	..	..	..	..	..
ζ	Cygni	..	..	×	×	..	×	..	..	×	×	×	×	×	..	×	..	×	×	..	×	×	..	×
τ	Cygni	..	..	×	×	..	×	..	..	×	..	..	×	..	..	..	..	..	..	..	..	..	..	..
a	Cephei	..	..	×	×	..	×	..	..	×	..	..	×	×	×	×	..	×	×	..	..	..	..	..
1	Pegasi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..
1	Draconis L. C	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..
β	Aquarii	..	..	..	×	..	×	..	..	×	..	..	×	×	..	×	..	×	×	..	×	×	..	×
β	Cephei	..	..	..	×	..	×	..	..	×	..	..	×	..	×	..	..	..	..	..	..	..	..	..
ξ	Aquarii	..	..	..	×	..	×	..	..	..	..	..	×	×	×	×	..	×	×	..	×	×	×	×
13	Cephei (II.)	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
ε	Pegasi	..	..	..	×	..	×	..	..	..	..	..	×	×	×	×	×	×	..	..	×	×	×	×
11	Cephei	×	..	..	×	..	×	..	..	..	..	..	×	..	..	×	..	..	..	..	..	..	..	..
μ	Capricorni	..	..	..	..	..	..	..	..	..	..	..	..	×	..	×	×	..	..	..	×	×	×	×
79	Draconis	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	×	..	..	..	..	..	..	..
20	Pegasi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..
a	Aquarii	..	..	..	..	..	..	..	..	..	..	..	..	×	..	×	×	..	..	..	..	×	×	×
θ	Pegasi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	..	..

Tabulation of stars, &c.—Continued.

Name of star.		Ogden.												Salt Lake City.						Detroit.				
		September 29.	September 30.	October 1.	October 2.	October 3.	October 4.	October 5.	October 7.	October 8.	October 9.	October 10.	October 11.	September 29.	October 1.	October 2.	October 3.	October 4.	October 5.	September 29.	September 30.	October 1.	October 9.	October 10.
θ	Aquarii	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	×	×	×	..
γ	Aquarii	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	..
π	Aquarii	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	×	×	×	..
η	Aquarii	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	×	×
ϰ26	Cephei (B.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	..
ζ	Pegasi	×	..	..	..	..	..	..	..		..	..	..	..	..	..	×	..	..	..	×	×	..	..
λ	Pegasi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×	..
ι	Cephei	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..	..
λ	Aquarii	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×
o	Andromedæ	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
α	Pegasi	×	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×	×
ϑ	Piscium	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
ι	Piscium	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
ω	Piscium	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..

SEASON OF 1873.

Observations and reductions for time taken at sending station.

OGDEN, UTAH, SEPTEMBER 29, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α Lyræ	19 15 11.08	— 0.70	+ 0.01	+ 0.82	19 15 11.21	18 32 39.28	—42 31.93
W.	5 ε Lyræ	22 42.98	— 0.40	— 0.01	+ 0.83	22 43.40	40 11.29	32.11
W.	β Lyræ	27 57.66	— 1.59	— 0.01	+ 0.77	27 56.83	45 24.58	32.25
W.	ο Draconis	31 45.03	+ 5.96	0.00	+ 1.25	31 52.24	49 20.02	32.22
W.	ε Aquilæ	36 28.98	— 4.47	0.00	+ 0.66	36 25.17	53 52.97	32.20
W.	ζ Aquilæ	42 12.10	— 4.77	0.00	+ 0.67	42 08.00	59 35.78	32.22
E.	δ Draconis	54 54.16	+11.43	— 0.26	— 1.66	55 03.67	19 12 31.49	32.18
E.	τ Draconis	20 00 15.31	+18.08	— 0.32	— 2.21	20 00 30.86	17 58.76	32.10
E.	β Cygni	08 12.97	— 2.58	— 0.12	— 0.72	08 09.55	25 37.45	32.10
E.	ι Cygni	09 01.65	+ 2.88	— 0.17	— 1.02	09 03.34	26 31.21	32.13
E.	κ Aquilæ	12 45.79	— 7.55	— 0.07	— 0.65	12 37.52	30 05.40	—42 32.12
	Mean at $19^h\ 0^m$ local sidereal time							—42 32.16

NORMAL EQUATIONS.

$$0 = +\ 1.46 + 11.00\,\delta t - 1.64\,a' + 2.00\,c \qquad \delta t = -0^s.16$$
$$0 = -\ 0.10 - 1.64\,\delta t + 6.18\,a' - 8.80\,c \qquad a' = -0^s.94$$
$$0 = +\ 13.98 + 2.00\,\delta t - 8.80\,a' + 34.24\,c \qquad c = -0^s.64$$

Adopted azimuth (to avoid large numbers) $= -9^s.00$; therefore, $a = -9^s.94$.

OGDEN, UTAH, SEPTEMBER 29, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	13 H. Cephei	22 17 31.60	+ 5.00	0.00	— 1.08	22 17 35.52	21 35 03.27	—42 32.25
E.	11 Cephei	22 21.45	+15.01	0.00	— 1.78	22 37.68	40 05.44	32.24
E.	θ Aquarii	52 51.07	— 7.71	— 0.01	— 0.60	52 42.75	22 10 10.51	32.24
E.	γ Aquarii	57 48.04	— 6.81	— 0.01	— 0.59	57 40.63	15 08.30	32.33
E.	π Aquarii	23 01 29.30	— 6.50	— 0.01	— 0.59	23 01 22.20	18 49.99	32.21
W.	ζ Pegasi	17 46.92	— 5.20	+ 0.05	+ 0.59	17 42.36	35 10.14	32.22
W.	ο Andromedæ	38 38.40	+ 0.10	+ 0.10	+ 0.79	38 39.39	56 07.34	32.05
W.	α Pegasi	41 04.72	— 4.70	+ 0.07	+ 0.61	41 00.70	58 28.68	—42 32.02
	Mean at $22^h\ 12^m$ local sidereal time							—42 32.19

NORMAL EQUATIONS.

$$0 = +\ 5.30 + 8.00\,\delta t + 1.08\,a' + 4.49\,c \qquad \delta t = -0^s.19$$
$$0 = +\ 2.13 + 1.08\,\delta t + 4.46\,a' - 4.36\,c \qquad a' = -1^s.01$$
$$0 = +\ 7.95 + 4.40\,\delta t - 4.36\,a' + 19.53\,c \qquad c = -0^s.59$$

Adopted azimuth $= -9^s.00$; therefore, $a = -10^s.01$.

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, SEPTEMBER 30, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	α Lyræ	19 15 11.05	− 0.77	0.00	+ 0.87	19 15 11.15	18 32 39.25	−42 31.90
E.	5 ε Lyræ	22 42.77	− 0.44	0.00	+ 0.88	22 43.21	40 11.27	31.94
E.	β Lyræ	27 57.63	− 1.76	0.00	+ 0.82	27 56.69	45 24.56	32.13
E.	σ Sagittarii	30 08.08	−11.40	0.00	+ 0.75	29 57.43	47 25.35	32.08
E.	50 Draconis	32 31.75	+24.35	0.00	+ 2.67	32 58.77	50 26.43	32.34
W.	ζ Aquilæ	42 13.78	− 5.31	− 0.14	− 0.71	42 07.62	59 35.76	31.86
W.	d Sagittarii	52 57.24	−10.18	− 0.08	− 0.72	52 46.26	19 10 14.17	32.09
W.	δ Draconis	54 52.74	+12.73	− 0.32	− 1.77	55 03.38	12 31.43	31.95
W.	τ Draconis	20 00 12.91	+20.14	− 0.41	− 2.35	20 00 30.29	17 58.68	31.61
W.	β Cygni	08 13.12	− 2.88	− 0.15	− 0.77	08 09.32	25 37.43	−42 31.89
	Mean at 19h 0m local sidereal time							−42 31.98

NORMAL EQUATIONS.

$$0 = -\ 7.44 + 10.00\,\delta t - \ 2.21\,a' - \ 0.47\,c \qquad \delta t = +0^s.54$$
$$0 = +13.48 - \ 2.21\,\delta t + 11.71\,a' + \ 0.34\,c \qquad a' = -1^s.07$$
$$0 = -25.73 - \ 0.47\,\delta t + \ 0.34\,a' + 43.55\,c \qquad c = +0^s.68$$

Adopted azimuth $= -10^s.00$; $a = -11^s.07$.

OGDEN, UTAH, SEPTEMBER 30, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	γ Aquilæ	20 22 53.53	− 5.77	− 0.09	− 0.67	20 22 47.00	19 40 15.02	−42 31.98
W.	α Aquilæ	27 15.62	− 5.99	− 0.08	− 0.67	27 08.88	44 36.98	31.90
W.	ε Draconis	30 54.61	+15.53	− 0.26	− 1.91	31 07.97	48 35.94	32.03
W.	ψ Cygni	34 51.71	+ 3.44	− 0.17	− 1.07	34 53.91	52 21.92	31.99
W.	τ Aquilæ	40 37.07	− 6.43	− 0.09	− 0.67	40 29.88	57 58.00	31.88
E.	31 o¹ Cygni	52 08.86	+ 1.44	0.00	+ 0.95	52 11.25	20 09 39.36	31.89
E.	α² Capricorni	53 43.17	− 9.20	0.00	+ 0.68	53 31.65	11 02.60	32.05
E.	α Cygni	21 19 37.64	+ 1.00	+ 0.01	+ 0.93	21 19 39.58	37 07.77	31.81
E.	γ Delphini	23 24.18	− 4.99	+ 0.01	+ 0.68	23 19.88	40 97.84	32.04
E.	μ Aquarii	28 30.53	− 8.65	+ 0.01	+ 0.66	28 22.55	45 50.43	−42 32.12
	Mean at 20h 8m local sidereal time							−42 31.97

NORMAL EQUATIONS.

$$0 = -2.40 + 10.00\,\delta t + 1.77\,a' - \ 1.66\,c \qquad \delta t = +0^s.53$$
$$0 = +0.87 + \ 1.77\,\delta t + 4.49\,a' + \ 4.69\,c \qquad a' = -1^s.09$$
$$0 = -8.06 - \ 1.66\,\delta t + 4.69\,a' + 21.43\,c \qquad c = +0^s.66$$

Adopted azimuth $= -10^s.00$; $a = -11^s.09$.

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 1, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	*d* Sagittarii	19 52 55.60	−10.29	− 0.01	+ 0.72	19 52 46.02	19 10 14.16	−42 31.86
W.	*δ* Draconis	54 48.59	+12.86	− 0.07	+ 1.76	55 03.14	12 31.37	31.77
W.	*τ* Draconis	20 00 07.74	+20.36	− 0.11	+ 2.34	20 00 30.33	17 58.61	31.72
W.	*β* Cygni	08 11.33	− 2.91	− 0.04	+ 0.77	08 09.15	25 37.41	31.74
W.	*i* Cygni	08 58.74	+ 3.24	− 0.06	+ 1.08	09 03.00	26 31.16	31.84
E.	*κ* Aquilæ	12 46 36	− 8.50	− 0.09	− 0.69	12 37.08	30 05.37	31.71
E.	*γ* Aquilæ	22 53.34	− 5.82	− 0.11	− 0.69	22 46.72	40 15.00	31.72
E.	*α* Aquilæ	27 15.57	− 6.04	− 0.11	− 0.69	27 08.73	44 36.97	31.76
E.	*ε* Draconis	30 54.30	+15.66	− 0.30	− 1.97	31 07.69	48 35.89	31.80
E.	*ψ* Cygni	20 34 51.55	+ 3.47	− 0.19	− 1.10	34 53.73	52 21.90	−42 31.83
	Mean at $19^h\ 31^m$ local sidereal time							−42 31.775

NORMAL EQUATIONS.

$$0 = -\ 1.11 + 10.00\,\delta t - 1.97\,a' - \ 2.25\,c \qquad \delta t = -\,0^s.275$$
$$0 = +\,13.85 - \ 1.97\,\delta t + 8.83\,a' + \ 5.78\,c \qquad a' = -\,1^s.19$$
$$0 = +\,31.90 - \ 2.25\,\delta t + 5.78\,a' + 37.83\,c \qquad c = -\,0^s.68$$

Adopted azimuth $= -\,10^s.00$; $= -\,11^s.19$.

OGDEN, UTAH, OCTOBER 1, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	*α* Cygni	21 19 39.55	+ 1.02	− 0.14	− 0.93	21 19 39.50	20 37 07.75	−42 31.75
E.	*γ* Delphini	23 25.43	− 5.10	− 0.07	− 0.69	23 19.57	40 47.83	31.74
E.	*μ* Aquarii	28 31.94	− 8.85	− 0.07	− 0.67	28 22.35	45 50.42	31.93
E.	*ν* Cygni	35 01.04	− 0.11	− 0.16	− 0.87	34 59.90	52 28.06	31.84
W.	*ζ* Cygni	50 07.50	− 2.61	− 0.14	+ 0.76	50 15.51	21 07 33.82	31.69
W.	*τ* Cygni	52 17.10	− 0.91	− 0.03	+ 0.84	52 17.00	09 45.22	31.78
W.	*α* Cephei	57 56.44	+ 8.62	0.00	+ 1.41	58 06.47	15 34.59	−42 31.88
	Mean at $20^h\ 56^m$ local sidereal time							−42 31.801

NORMAL EQUATIONS.

$$0 = +\ 3.20 + 7.00\,\delta t + 0.70\,a' + \ 0.23\,c \qquad \delta t = -\,0^s.301$$
$$0 = +\ 3.76 + 0.70\,\delta t + 1.46\,a' + \ 2.40\,c \qquad a' = -\,1^s.342$$
$$0 = +\,12.10 + 0.23\,\delta t + 2.40\,a' + 13.50\,c \qquad c = -\,0^s.662$$

Adopted azimuth $= -\,10^s.00$; $a = -\,11^s.342$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 2, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	*d* Sagittarii	19 52 47.64	− 1.49	− 0.06	− 0.10	19 52 45.99	19 10 14.14	−42 31.85
W.	δ Draconis	55 01.91	+ 1.87	− 0.28	− 0.25	55 03.25	12 31.30	31.95
W.	τ Draconis	20 00 27.92	+ 2.95	− 0.32	− 0.33	20 00 30.22	17 58.52	31.70
W.	β Cygni	08 09.73	− 0.42	− 0.12	− 0.11	08 09.08	25 37.38	31.70
W.	*i* Cygni	09 02.80	+ 0.47	− 0.17	− 0.15	09 02.95	26 31.13	31.82
E.	κ Aquilæ	12 38.42	− 1.23	− 0.14	+ 0.10	12 37.15	30 05.35	31.80
E.	γ Aquilæ	22 47.72	− 0.84	− 0.19	+ 0.10	22 46.79	40 14.99	31.80
E.	α Aquilæ	27 09.66	− 0.88	− 0.18	+ 0.10	27 08.70	44 36.95	31.75
E.	ε Draconis	31 05.59	+ 2.27	− 0.51	+ 0.28	31 07.63	48 35.82	31.81
E.	τ Aquilæ	40 30.74	− 0.94	− 0.08	+ 0.10	40 29.82	57 57.97	−42 31.85
	Mean at $19^h\ 34^m$ local sidereal time							−42 31.80

NORMAL EQUATIONS.

$$0 = -\ 3.47 + 10.00\,\delta t - 1.08\,a - \ 2.85\,c \qquad \delta t = +\,0.20$$
$$0 = +\,14.26 - \ 1.08\,\delta t + 9.07\,a + \ 6.87\,c \qquad a = -\,1.62$$
$$0 = +\ \ 8.19 - \ 2.85\,\delta t + 6.87\,a + 36.25\,c \qquad c = +\,0.10$$

OGDEN, UTAH, OCTOBER 2, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	61 Cygni	21 43 46.34	+ 0.11	− 0.25	+ 0.16	21 43 46.36	21 01 14.43	−42 31.93
E.	ζ Cygni	50 06.02	− 0.37	− 0.23	+ 0.14	50 05.56	07 33.80	31.76
E.	τ Cygni	52 17.13	− 0.13	− 0.25	+ 0.16	52 16.91	09 45.20	31.71
E.	α Cephei	58 05.20	+ 1.23	− 0.38	+ 0.27	58 06.32	15 34.55	31.77
W.	β Aquarii	22 07 27.90	− 1.20	− 0.02	− 0.13	22 07 26.55	24 54.76	31.79
W.	β Cephei	09 32.67	+ 2.28	− 0.08	− 0.37	09 34.50	27 02.57	31.93
W.	ξ Aquarii	13 35.08	− 1.25	− 0.03	− 0.13	13 33.67	31 01.85	31.82
W.	ε Pegasi	20 31.92	− 0.87	− 0.03	− 0.13	20 30.89	37 59.20	31.69
W.	11 Cephei	22 35.04	+ 2.43	− 0.10	− 0.38	22 36.99	40 05.30	−42 31.69
	Mean at $21^h\ 20^s$ local sidereal time							−42 31.79

NORMAL EQUATIONS.

$$0 = +\,5.27 + 9.00\,\delta t - 1.38\,a - \ 3.18\,c \qquad \delta t = -\,0^s.79$$
$$0 = +\,8.47 - 1.38\,\delta t + 6.31\,a + \ 5.22\,c \qquad a = -\,1^s.62$$
$$0 = +\,2.17 - 3.18\,\delta t + 5.22\,a + 29.88\,c \qquad c = +\,0^s.13$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 3, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	τ Draconis	20 00 29.99	+ 1.21	− 0.35	− 0.50	20 00 30.35	19 17 58.45	−42 31.90
W.	i Cygni	08 03.24	+ 0.19	− 0.16	− 0.23	08 03.04	26 31.09	31.95
W.	κ Aquilæ	12 38.00	− 0.50	− 0.07	− 0.15	12 37.28	30 05.33	31.95
W.	α Aquilæ	27 09.27	− 0.36	− 0.08	− 0.15	27 08.68	44 36.92	31.76
W.	ε Draconis	31 07.52	+ 0.93	− 0.26	− 0.42	31 07.77	48 35.75	32.02
E.	τ Aquilæ	40 30.18	− 0.39	− 0.13	+ 0.15	40 29.81	57 57.95	31.86
E.	θ Aquilæ	47 19.26	− 0.44	− 0.12	+ 0.14	47 18.84	20 04 47.04	31.80
E.	α^2 Capricorni	53 35.06	− 0.55	− 0.10	+ 0.15	53 34.56	11 02.55	32.01
E.	κ Cephei	55 37.63	+ 1.70	− 0.66	+ 0.66	55 39.33	13 07.45	31.88
E.	γ Cygni	21 00 13.73	− 0.03	− 0.25	+ 0.19	21 00 13.64	17 41.73	31.91
E.	π Capricorni	02 37.90	− 0.60	− 0.10	+ 0.15	02 37.35	20 05.31	32.04
E.	ε Delphini	09 42.91	− 0.34	− 0.18	+ 0.15	09 42.54	27 10.61	31.93
E.	Groom. 3241	13 04.03	+ 1.11	− 0.56	+ 0.47	13 05.05	30 33.12	−42 31.93
	Mean at 19^h 54^m local sidereal time							−42 31.92

NORMAL EQUATIONS.

$$0 = -\ 3.60 + 13.00\,\delta t - 2.90\,a + 4.23\,c \qquad \delta t = +0^s.08$$
$$0 = +12.85 - 2.90\,\delta t + 18.13\,a - 3.97\,c \qquad a = -0^s.66$$
$$0 = -12.15 + 4.23\,\delta t - 3.97\,a + 63.29\,c \qquad c = +0^s.14$$

OGDEN, UTAH, OCTOBER 4, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	d Sagittarii	19 52 46.72	− 0.27	+ 0.01	− 0.11	19 52 46.35	19 10 14.10	−42 32.25
W.	δ Draconis	55 03.37	+ 0.34	+ 0.05	− 0.28	55 03.48	12 31.19	32.29
W.	τ Draconis	20 00 30.17	+ 0.54	+ 0.07	− 0.37	20 00 30.41	17 58.36	32.05
W.	β Cygni	08 09.37	− 0.08	+ 0.03	− 0.12	08 09.20	25 37.34	31.86
W.	i Cygni	09 03.22	+ 0.08	+ 0.04	− 0.17	09 03.17	26 31.05	32.12
E.	κ Aquilæ	12 37.62	− 0.22	− 0.02	+ 0.11	12 37.49	30 05.32	32.17
E.	γ Aquilæ	22 47.17	− 0.15	− 0.03	+ 0.10	22 47.09	40 14.96	32.13
E.	α Aquilæ	27 09.08	− 0.16	− 0.03	+ 0.11	27 09.00	44 36.91	32.09
E.	ε Draconis	31 07.22	+ 0.41	− 0.12	+ 0.31	31 07.82	48 35.69	32.13
E.	ψ Cygni	34 53.72	+ 0.09	− 0.08	+ 0.17	34 53.90	52 21.79	−42 32.11
	Mean at 19^h 31^m local sidereal time							−42 32.12

NORMAL EQUATIONS.

$$0 = +0.85 + 10.00\,\delta t - 1.97\,a - 2.25\,c \qquad \delta t = -0^s.12$$
$$0 = +1.76 - 1.97\,\delta t + 8.83\,a + 5.78\,c \qquad a = -0^s.30$$
$$0 = -2.58 - 2.25\,\delta t + 5.78\,a + 37.83\,c \qquad c = +0^s.11$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 4, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	12-year Cat. 1879	21 35 47.31	+ 1.51	— 0.27	+ 0.78	21 35 49.33	20 53 17.20	—42 32.13
E.	61 Cygni	43 46.40	+ 0.03	— 0.07	+ 0.17	43 46.53	21 01 14.40	32.13
E.	ζ Cygni	50 05.88	— 0.10	— 0.07	+ 0.15	50 05.86	07 33.77	32.09
E.	τ Cygni	52 17.19	— 0.03	— 0.07	+ 0.17	52 17.26	09 45.16	32.10
E.	α Cephei	58 06.19	+ 0.32	— 0.12	+ 0.29	58 06.68	15 34.48	32.20
W.	β Aquarii	22 07 27.39	— 0.31	+ 0.03	— 0.14	22 07 26.97	24 54.73	32.24
W.	β Cephei	09 34.33	+ 0.59	+ 0.11	— 0.39	09 34.64	27 02.48	32.16
W.	ξ Aquarii	13 34.44	— 0.32	+ 0.03	— 0.14	13 34.01	31 01.83	32.18
W.	ε Pegasi	20 31.48	— 0.22	+ 0.05	— 0.13	20 31.18	37 59.18	32.00
W.	11 Cephei	22 36.89	+ 0.62	+ 0.21	— 0.41	22 37.31	40 05.21	—42 32.10
	Mean at 21h 17m local sidereal time							—42 32.13

NORMAL EQUATIONS.

$$0 = -\ 1.11 + 10.00\,\delta t - \ 5.02\,a + \ 2.62\,c \qquad \delta t = -\,0^s.13$$
$$0 = +\ 9.59 - \ 5.02\,\delta t + 19.56\,a - 15.89\,c \qquad a = -\,0^s.42$$
$$0 = -14.76 + \ 2.62\,\delta t - 15.89\,a + 63.52\,c \qquad c = +\,0^s.13$$

OGDEN, UTAH, OCTOBER 5, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	τ Draconis	20 00 31.69	+ 0.06	— 0.26	— 0.43	20 00 31.06	19 17 58.28	—42 32.78
W.	β Cygni	08 10.00	— 0.01	— 0.07	— 0.14	08 09.78	25 37.32	32.46
W.	ι Cygni	09 03.98	+ 0.01	— 0.09	— 0.20	09 03.70	26 31.01	32.69
W.	κ Aquilæ	12 38.16	— 0.03	— 0.03	— 0.13	12 37.97	30 05.30	32.67
W.	γ Aquilæ	22 47.71	— 0.02	— 0.04	— 0.13	22 47.52	40 14.94	32.58
E.	α Aquilæ	27 09.63	— 0.02	— 0.12	+ 0.12	27 09.61	44 36.89	32.72
E.	ε Draconis	31 08.54	+ 0.05	— 0.36	+ 0.37	31 08.60	48 35.62	32.98
E.	ψ Cygni	34 54.51	+ 0.01	— 0.20	+ 0.20	34 54.52	52 21.75	32.77
E.	τ Aquilæ	40 30.52	— 0.02	+ 0.12	+ 0.13	40 30.51	57 57.92	32.59
E.	θ Aquilæ	47 19.74	— 0.02	— 0.10	+ 0.12	47 19.74	20 04 47.02	32.72
E.	α^2 Capricorni	53 35.29	— 0.03	— 0.08	+ 0.13	53 35.31	11 02.52	32.79
E.	κ Cephei	55 39.55	+ 0.09	— 0.52	+ 0.57	55 39.69	13 07.26	—42 32.43
	Mean at 19h 45m local sidereal time							—42 32.68

NORMAL EQUATIONS.

$$0 = +\ 1.50 + 12.00\,\delta t - \ 2.22\,a + \ 4.94\,c \qquad \delta t = -\,0^s.18$$
$$0 = +\ 1.17 - \ 2.22\,\delta t + 14.69\,a - \ 8.43\,c \qquad a = -\,0^s.04$$
$$0 = -\ 6.18 + \ 4.94\,\delta t - \ .843\,a + 53.84\,c \qquad c = +\,0^s.13$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 7, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Ceti	3 38 15.61	+ 0.16	— 0.05	— 0.46	3 38 15.26	2 55 41.21	—42 34.05
W.	ρ Persei	39 40.44	+ 0.02	— 0.08	— 0.57	39 39.81	57 05.76	34.05
W.	β Persei	42 32.52	+ 0.00	— 0.08	— 0.59	42 31.85	59 57.84	34.01
W.	48 Cephei	47 01.57	— 0.68	— 0.18	— 2.04	46 58.67	3 04 24.56	34.11
W.	ζ Arietis	50 13.48	+ 0.10	— 0.05	— 0.48	50 13.05	07 39.06	33.99
E.	α Persei	57 52.91	— 0.05	— 0.31	+ 0.68	57 53.23	15 19.31	33.92
E.	ο Tauri	4 00 35.16	+ 0.14	— 0.18	+ 0.46	4 00 35.58	18 01.50	34.08
E.	ξ Tauri	02 53.61	+ 0.14	— 0.19	+ 0.46	02 54.02	20 19.80	34.22
E.	*f* Tauri	06 28.10	+ 0.13	— 0.21	+ 0.46	06 28.48	23 54.51	33.97
E.	ε Eridani	09 33.01	+ 0.20	— 0.16	+ 0.46	09 33.51	26 59.36	34.15
E.	δ Persei	16 30.51	— 0.04	— 0.40	+ 0.66	16 30.73	33 56.63	—42 34.10
	Mean at 3^h 14^m local sidereal time							—42 34.06

NORMAL EQUATIONS.

$$0 = + 1.69 + 11.00\,\delta t + 0.45\,a - 2.12\,c \qquad \delta t = -0^s.06$$
$$0 = - 7.99 + 0.45\,\delta t + 9.12\,a + 12.81\,c \qquad a = +0^s.26$$
$$0 = - 18.80 - 2.12\,\delta t + 12.81\,a + 34.58\,c \qquad c = +0^s.45$$

OGDEN, UTAH, OCTOBER 18, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	τ Aquilæ	20 40 32.75	— 0.19	+ 0.01	— 0.49	20 40 32.08	19 57 57.87	—42 34.21
W.	θ Aqnilæ	47 21.97	— 0.23	+ 0.01	— 0.49	47 21.26	20 04 46.97	34.29
W.	α² Capricorni	53 37.64	— 0.28	+ 0.01	— 0.50	53 36.87	11 02.47	34.40
W.	κ Cephei	55 42.36	+ 0.87	+ 0.11	— 2.23	55 41.11	13 06.94	34.17
W.	γ Cygni	21 00 16.49	— 0.01	+ 0.05	— 0.63	21 00 15.90	17 41.60	34.30
W.	π Capricorni	02 40.30	— 0.31	+ 0.02	— 0.51	02 39.50	20 05.23	34.27
W.	ε Delphini	09 45.44	— 0.17	+ 0.04	— 0.50	09 44.81	27 10.53	34.28
W.	Gr. 3241	13 08.05	+ 0.57	+ 0.14	— 1.59	13 07.17	30 32.77	34.40
E.	α Cygni	19 41.25	+ 0.03	— 0.11	+ 0.69	19 41.86	37 07.57	34.29
E.	γ Delphini	23 21.79	— 0.15	— 0.08	+ 0.51	23 22.07	40 47.73	34.31
E.	μ Aquarii	28 24.37	— 0.26	— 0.06	+ 0.49	28 24.54	45 50.32	34.22
E.	12-year Cat. 1879	35 47.54	+ 1.23	— 0.49	+ 2.83	35 51.11	53 16.72	34.39
E.	61 Cygui	43 48.15	+ 0.02	— 0.15	+ 0.62	43 48.64	21 01 14.32	34.32
E.	ζ Cygni	50 07.68	— 0.08	— 0.14	+ 0.56	50 08.02	07 33.70	34.32
E.	τ Cygni	52 18.84	— 0.03	— 0.15	+ 0.62	52 19.28	09 45.09	34.19
E.	α Cephei	58 07.68	+ 0.26	— 0.28	+ 1.04	58 07.70	15 34.33	34.37
E.	β Aqnarii	22 07 28.83	— 0.25	— 0.10	+ 0.49	22 07 28.97	24 54.69	34.28
E.	β Cephei	09 34.74	+ 0.48	— 0.38	+ 1.42	09 36.26	27 02.28	—42 33.98
	Mean at 20^h 42^m local sidereal time							—42 34.28

NORMAL EQUATIONS.

$$0 = + 1.19 + 18.00\,\delta t - 4.39\,a + 4.79\,c \qquad \delta t = -0^s.28$$
$$0 = + 14.13 - 4.39\,\delta t + 29.14\,a - 11.23\,c \qquad a = -0^s.34$$
$$0 = - 48.63 - 4.79\,\delta t - 11.23\,a + 94.61\,c \qquad c = +0^s.49$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 9, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α^2 Capricorni	20 53 38.11	− 0.07	− 0.07	− 0.47	20 53 37.50	20 11 02.46	−42 35.04
W.	κ Cephei	55 44.18	+ 0.21	− 0.41	− 2.07	55 41.91	13 06.84	35.07
W.	γ Cygni	21 00 17.32	0.00	− 0.12	− 0.59	21 00 16.61	17 41.59	35.02
W.	π Capricorni	02 40.84	− 0.08	− 0.04	− 0.47	02 40.25	20 05.22	35.03
W.	ϵ Delphini	09 46.18	− 0.04	− 0.06	− 0.46	09 45.62	27 10.52	35.10
W.	Groombr. 3241	13 09.54	+ 0.14	− 0.64	− 1.47	13 07.57	30 32.70	34.87
E.	α Cygni	19 42.10	0.00	− 0.32	+ 0.64	19 42.42	37 07.55	34.87
E.	γ Delphini	23 22.45	− 0.04	− 0.21	+ 0.47	23 22.67	40 47.71	34.96
E.	μ Aquarii	28 25.08	− 0.06	− 0.14	+ 0.46	28 25.34	45 50.31	35.03
E.	12-year Cat. 1879.	35 49.74	+ 0.30	− 1.03	+ 2.63	35 51.64	53 16.59	35.05
E.	61 Cygni	43 48.98	0.00	− 0.29	+ 0.57	43 49.26	21 01 14.30	34.96
E.	ζ Cygni	50 08.48	− 0.02	− 0.26	+ 0.52	50 08.72	07 33.68	−42 35.04
	Mean at $20^h\ 40^m$ local sidereal time							−42 35.00

NORMAL EQUATIONS.

$$0 = -\ 0.06 + 12.00\,\delta t - 4.28\,a - 0.53\,c \qquad \delta t = 0^s.00$$
$$0 = +\ 4.38 - 4.28\,\delta t + 25.24\,a - 5.09\,c \qquad a = -0^s.08$$
$$0 = -35.26 - 0.53\,\delta t - 5.09\,a + 76.90\,c \qquad c = +0^s.45$$

OGDEN, UTAH, OCTOBER 10, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α^2 Capricorni	29 53 38.98	− 0.55	+ 0.03	− 0.44	20 53 38.02	20 11 02.44	−42 35.58
W.	κ Cephei	55 42.13	+ 1.70	+ 0.18	− 1.95	55 42.06	13 06.72	35.34
W.	γ Cygni	21 00 17.33	− 0.03	+ 0.05	− 0.56	21 00 16.79	17 41.57	35.22
W.	π Capricorni	02 41.74	− 0.60	+ 0.02	− 0.45	02 40.71	20 05.20	35.51
W.	ϵ Delphini	09 46.60	− 0.34	+ 0.04	− 0.44	09 45.86	27 10.50	35.36
W.	Groombr. 3241	13 08.24	+ 1.11	+ 0.11	− 1.39	13 08.07	30 32.63	35.44
E.	α Cygni	19 42.25	+ 0.06	− 0.08	+ 0.60	19 42.83	37 07.52	35.31
E.	γ Delphini	23 22.95	− 0.30	− 0.05	+ 0.44	23 23.04	40 47.70	35.34
E.	μ Aquarii	28 25.80	− 0.52	− 0.04	+ 0.43	28 25.67	45 50.30	35.37
E.	12-year Cat. 1879.	35 47.27	+ 2.42	− 0.31	+ 2.48	35 51.86	53 16.45	35.41
E.	61 Cygni	43 49.23	+ 0.05	− 0.10	+ 0.54	43 49.72	21 01 14.28	35.44
E.	ζ Cygni	50 08.71	− 0.15	− 0.09	+ 0.49	50 08.96	07 33.67	−42 35.29
	Mean at $20^h\ 39^m$ local sidereal time							−42 35.38

NORMAL EQUATIONS.

$$0 = -\ 4.08 + 12.00\,\delta t - 4.28\,a - 0.53\,c \qquad \delta t = +0^s.12$$
$$0 = +19.56 - 4.28\,\delta t + 25.24\,a - 5.09\,c \qquad a = -0^s.66$$
$$0 = -36.24 - 0.53\,\delta t - 5.09\,a + 76.90\,c \qquad c = +0^s.43$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 11, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	γ Delphini	21 23 24.59	— 0.23	+ 0.24	— 0.44	21 23 24.16	20 40 47.68	—42 36.48
W.	u Aquarii	28 27.67	— 0.40	+ 0.19	— 0.43	28 27.03	45 50.28	36.75
W.	12-year Cat. 1879	35 52.15	+ 1.86	+ 1.35	— 2.46	35 52.90	53 16.34	36.56
W.	61 Cygni	43 50.88	+ 0.04	+ 0.39	— 0.54	43 50.77	21 01 14.26	36.51
W.	ζ Cygni	50 10.32	— 0.12	+ 0.35	— 0.49	50 10.06	07 33.65	36.41
W.	τ Cygni	52 21.62	— 0.04	+ 0.39	— 0.54	52 21.43	09 45.04	36.39
E.	α Cephei	58 09.00	+ 0.39	+ 0.40	+ 0.90	58 10.69	15 34.22	36.47
E.	β Aquarii	22 07 31.03	— 0.37	+ 0.13	+ 0.43	22 07 31.22	24 54.66	36.56
E.	β Cephei	09 36.30	+ 0.72	+ 0.50	+ 1.24	09 38.76	27 02.11	36.65
E.	ξ Aquarii	13 38.21	— 0.39	+ 0.11	+ 0.43	13 38.36	30 01.76	36.60
E.	ε Pegasi	20 35.23	— 0.27	+ 0.14	+ 0.43	20 35.53	37 59.10	36.43
E.	11 Cephei	22 38.82	+ 0.77	+ 0.45	+ 1.28	22 41.32	40 04.85	—42 36.47
	Mean at 21^h 10^m local sidereal time							—42 36.52

NORMAL EQUATIONS.

$$0 = +\ 6.91 + 12.00\,\delta t - 3.81\,a - 0.41\,c \qquad \delta t = -0^s.72$$
$$0 = +\ 2.81 - 3.81\,\delta t + 20.37\,a + 11.39\,c \qquad a = -0^s.51$$
$$0 = -22.29 - 0.41\,\delta t + 11.39\,a + 65.62\,c \qquad c = +0^s.42$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, SEPTEMBER 29, 1873.

Clamp.	Name of star.	T.	Aa.	bB.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	ν Cygni	12 45 32.01	0.00	+ 0.12	+ 0.24	12 45 32.37	20 52 28.10	+ 8 06 55.73
E.	61 Cygni (*pr.*)	54 18.58	— 0.16	+ 0.14	+ 0.23	54 18.79	21 01 14.48	55.69
E.	61 Cygni (*seq.*)	54 20.01	— 0.16	+ 0.14	+ 0.23	54 20.22	01 16.00	55.78
E.	ζ Cygni	13 00 38.50	— 0.60	+ 0.15	+ 0.21	13 00 38.26	07 33.85	55.59
E.	α Cephei	08 36.15	+ 2.11	+ 0.30	+ 0.38	08 38.94	15 34.65	55.72
W.	β Aquarii	18 01.14	— 2.00	+ 0.09	— 0.18	17 59.05	24 54.79	55.74
W.	ξ Aquarii	24 08.41	— 2.11	+ 0.09	— 0.18	24 06.21	30 01.88	55.67
W.	ε Pegasi	31 05.03	— 1.45	+ 0.11	— 0.18	31 03.51	37 59.24	55.73
W.	μ Capricorni	39 31.55	— 2.33	+ 0.07	— 0.19	39 29.10	46 24.90	55.80
W.	79 Draconis	44 19.06	+ 5.04	+ 0.44	— 0.61	44 23.93	51 19.58	55.65
W.	α Aquarii	52 24.23	— 1.84	+ 0.11	— 0.18	52 22.32	59 18.12	+ 8 06 55.80
	Mean at 21^h 30^m local sidereal time							+ 8 06 55.718

NORMAL EQUATIONS.

$$11.00\,\delta t + 1.28\,a - 1.35\,c = -\ 6.83 \qquad a = -2^s.743$$
$$1.28\,\delta t + 6.60\,a + 1.39\,c = -18.20 \qquad c = +0^s.180$$
$$-\ 1.35\,\delta t + 1.39\,a + 27.56\,c = +\ 1.51 \qquad \delta t = -0^s.281$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 1, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	ε Aquilæ	10 46 57.92	— 1.22	0.00	+ 0.15	10 46 56.85	18 53 52.88	+ 8 06 56.03
E.	ζ Aquilæ	52 40.95	— 1.27	0.00	+ 0.14	52 39.82	59 35.75	55.03
E.	π Sagittarii	55 21.04	— 2.57	+ 0.01	+ 0.15	55 18.63	19 02 14.55	55.92
E.	δ Draconis	11 05 31.81	+ 3.16	+ 0.07	+ 0.37	11 05 35.41	12 31.37	55.96
E.	δ Aquilæ	12 12.92	— 1.67	+ 0.03	+ 0.14	12 11.42	19 07.35	55.93
E.	α Vulpeculæ	16 31.28	— 0.84	+ 0.04	+ 0.15	16 30.65	23 26.70	56.07
W.	μ Aquilæ	20 00.38	— 1.51	+ 0.06	— 0.14	19 58.79	27 54.78	55.99
W.	κ Aquilæ	23 11.57	— 2.03	+ 0.05	— 0.14	23 09.45	30 05.37	55.92
W.	θ Cygni	26 06.64	+ 0.68	+ 0.11	— 0.22	26 07.21	33 03.17	55.96
W.	γ Aquilæ	33 20.49	— 1.40	+ 0.05	— 0.14	33 19.00	40 15.00	56.00
W.	α Aquilæ	37 42.54	— 1.46	+ 0.04	— 0.14	37 40.98	44 36.97	55.99
W.	ε Draconis	41 36.36	+ 3.83	+ 0.13	— 0.41	41 39.91	48 35.88	+ 8 06 55.97
	Mean at $19^h\ 00^m$ local sidereal time							+ 8 06 55.973

NORMAL EQUATIONS.

$$12.00\,\delta t + 2.33\,a - 0.67\,c = +5.28$$
$$2.33\,\delta t + 6.68\,a + 2.01\,c = -15.54$$
$$-0.67\,\delta t + 2.01\,a + 27.33\,c = -2.23$$

$$a = -2^s.70$$
$$c = +0^s.140$$
$$\delta t = +0^s.95$$

SALT LAKE CITY, UTAH, OCTOBER 1, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	α Cygni	12 30 11.59	+ 0.25	+ 0.07	— 0.15	12 30 11.76	20 37 07.74	+ 8 06 55.98
W.	ε Aquarii	33 56.62	— 2.21	+ 0.03	— 0.11	33 54.33	40 50.25	55.92
W.	μ Aquarii	38 56.75	— 2.18	+ 0.03	— 0.11	38 54.49	45 50.42	55.93
W.	ν Cygni	45 32.06	— 0.00	+ 0.04	— 0.14	45 31.96	52 28.06	56.10
E.	α Cephei	13 08 36.04	+ 2.16	+ 0.08	+ 0.23	13 08 38.51	21 15 34.57	56.06
E.	β Cephei	20 02.33	+ 4.00	+ 0.07	+ 0.31	20 06.71	27 02.62	55.91
E.	ξ Aquarii	24 07.93	— 2.16	+ 0.01	+ 0.11	24 05.89	31 01.86	55.97
E.	ε Pegasi	31 04.43	— 1.48	0.00	+ 0.11	31 03.06	37 59.22	+ 8 06 56.16
	Mean at $21^h\ 00^m$ local sidereal time							+ 8 06 56.004

NORMAL EQUATIONS.

$$8.00\,\delta t + 0.58\,a + 2.33\,c = -1.34$$
$$0.58\,\delta t + 4.74\,a - 5.96\,c = -13.91$$
$$2.33\,\delta t - 5.96\,a + 20.94\,c = +18.96$$

$$a = -2^s.80$$
$$c = +0^s.107$$
$$\delta t = +0^s.003$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 2, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	δ Draconis	11 05 32.44	+ 3.33	+ 0.18	— 0.35	11 05 35.60	19 12 31.31	+ 8 06 55.71
W.	δ Aquilæ	12 13.46	— 1.77	+ 0.06	— 0.13	12 11.62	19 07.33	55.71
W.	α Vulpeculæ	16 31.98	— 0.88	+ 0.08	— 0.15	16 31.03	23 26.67	55.64
W.	μ Aquilæ	21 00.72	— 1.60	+ 0.08	— 0.14	20 59.06	27 54.76	55.70
W.	κ Aquilæ	23 11.95	— 2.14	+ 0.06	— 0.14	23 09.73	30 05.35	55.60
W.	θ Cygni	26 06.72	+ 0.71	+ 0.14	— 0.21	26 07.36	33 03.14	55.78
E.	γ Aquilæ	33 20.44	— 1.48	+ 0.08	+ 0.14	33 19.18	40 14.99	55.81
E.	α Aquilæ	37 42.59	— 1.54	+ 0.07	+ 0.14	37 41.26	44 36.94	55.68
E.	ε Draconis	41 35.55	+ 4.05	+ 0.18	+ 0.39	41 40.17	48 35.82	55.65
E.	τ Aquilæ	51 03.61	— 1.60	+ 0.05	+ 0.15	51 02.21	57 57.97	55.76
E.	θ Aquilæ	57 53.11	— 1.91	+ 0.04	+ 0.13	57 51.37	20 04 47.04	+ 8 06 55.66
	Mean at 19h 30m local sidereal time							+ 8 06 55.70

NORMAL EQUATIONS.

$$
\begin{aligned}
11.00\,\delta t + 1.69\,a - 1.23\,c &= -\ 8.28 \\
1.69\,\delta t + 6.12\,a - 0.63\,c &= -18.06 \\
-\ 1.23\,\delta t - 0.63\,a + 26.26\,c &= +\ 5.68
\end{aligned}
\qquad
\begin{aligned}
a &= -2^s.854 \\
c &= +0^s.134 \\
\delta t &= -0^s.31
\end{aligned}
$$

SALT LAKE CITY, UTAH, OCTOBER 2, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	61 Cygni (*pr.*)	12 54 18.50	— 0.17	+ 0.06	+ 0.27	12 54 18.66	21 01 14.43	+ 8 06 55.77
E.	61 Cygni (*seq.*)	54 19.87	— 0.17	+ 0.06	+ 0.27	54 20.03	01 15.95	55.92
E.	ζ Cygni	13 00 38.54	— 0.62	+ 0.05	+ 0.24	13 00 28.21	07 33.80	55.59
E.	α Cephei	08 36.26	+ 2.16	+ 0.08	+ 0.45	08 38.95	15 34.55	55.60
E.	β Aquarii	18 00.97	— 2.05	+ 0.03	+ 0.21	17 59.16	24 54.76	55.60
W.	ξ Aquarii	24 08.51	— 2.16	+ 0.06	— 0.21	24 06.20	31 01.85	55.65
W.	ε Pegasi	31 05.08	— 1.49	+ 0.07	— 0.21	31 03.45	37 59.21	55.76
W.	μ Capricorni	39 31.75	— 2.39	+ 0.05	— 0.22	39 29.19	46 24.87	55.68
W.	79 Draconis	44 19.06	+ 5.17	+ 0.23	— 0.71	44 23.75	51 19.42	55.67
W.	α Aquarii	52 24.42	— 1.88	+ 0.06	— 0.21	52 22.39	59 18.10	+ 8 06 55.71
	Mean at 21h 30m local sidereal time							+ 8 06 55.695

NORMAL EQUATIONS.

$$
\begin{aligned}
10.00\,\delta t + 1.28\,a - 0.65\,c &= -\ 6.77 \\
1.28\,\delta t + 6.60\,a + 2.89\,c &= -18.31 \\
-\ 0.65\,\delta t + 2.89\,a + 25.90\,c &= -\ 2.47
\end{aligned}
\qquad
\begin{aligned}
a &= -2^s.805 \\
c &= +0^s.210 \\
\delta t &= -0^s.303
\end{aligned}
$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 3, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	π Sagittarii	10 55 22.10	− 2.60	+ 0.06	− 0.18	10 55 19.38	19 02 14.51	+ 8 06 55.13
W.	δ Draconis	11 05 33.16	+ 3.21	+ 0.23	− 0.44	05 36.16	12 31.25	55.09
W.	δ Aquilæ	12 14.00	− 1.70	+ 0.08	− 0.17	12 12.21	19 07.31	55.10
W.	α Vulpeculæ	16 32.45	− 0.85	+ 0.09	− 0.19	16 31.50	23 26.66	55.16
E.	μ Aquilæ	21 00.97	− 1.53	+ 0.06	+ 0.17	20 59.67	27 54.74	55.07
E.	κ Aquilæ	23 12.04	− 2.06	+ 0.05	+ 0.17	23 10.20	30 05.33	55.13
E.	θ Cygni	26 06.84	+ 0.69	+ 0.11	+ 0.26	26 07.90	33 03.04	55.14
E.	γ Aquilæ	33 21.03	− 1.42	+ 0.05	+ 0.17	33 19.83	40 14.97	55.14
E.	α Aquilæ	37 43.10	− 1.48	+ 0.05	+ 0.17	37 41.84	44 36.92	55.08
E.	ε Draconis	41 36.13	+ 3.89	+ 0.13	+ 0.50	41 40.65	48 35.75	+ 8 06 55.10
	Mean at 19ʰ 30ᵐ local sidereal time							+ 8 06 55.112

NORMAL EQUATIONS.

$$10.00\,\delta t + 1.41\,a + 2.74\,c = -12.25 \qquad a = -2^s.736$$
$$1.41\,\delta t + 6.26\,a - 1.06\,c = -18.57 \qquad c = +0^s.170$$
$$2.74\,\delta t - 1.06\,a + 25.19\,c = +4.73 \qquad \delta t = -0^s.888$$

SALT LAKE CITY, UTAH, OCTOBER 3, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	ε Pegasi	13 31 05.29	− 1.46	+ 0.02	+ 0.17	13 31 04.02	21 37 59.19	+ 8 06 55.17
E.	μ Capricorni	39 31.87	− 2.35	+ 0.04	+ 0.18	39 29.74	46 24.86	55.12
E.	79 Draconis	44 18.22	+ 5.08	+ 0.29	+ 0.58	44 24.17	51 19.37	55.20
E.	α Aquarii	52 24.54	− 1.85	+ 0.08	+ 0.17	52 22.94	59 18.09	55.15
W.	θ Aquarii	14 03 17.48	− 2.13	+ 0.06	− 0.17	14 03 15.24	22 10 10.47	55.23
W.	π Aquarii	11 56.59	− 1.77	+ 0.06	− 0.17	11 54.71	18 49.96	55.25
W.	η Aquarii	21 59.11	− 1.85	+ 0.05	− 0.17	21 57.14	28 52.34	55.20
W.	ζ Pegasi	28 16.53	− 1.44	+ 0.06	− 0.17	28 14.98	35 10.12	55.14
W.	ι Cephei	38 14.83	+ 2.79	+ 0.15	− 0.41	38 17.36	45 12.47	+ 8 06 55.11
	Mean at 22ʰ 00ᵐ local sidereal time							+ 8 06 55.173

NORMAL EQUATIONS.

$$9.00\,\delta t + 1.80\,a + 0.01\,c = -3.41 \qquad a = -2^s.755$$
$$1.80\,\delta t + 7.58\,a - 4.37\,c = -21.31 \qquad c = +0^s.170$$
$$0.01\,\delta t - 4.37\,a + 24.57\,c = +16.23 \qquad \delta t = +0^s.172$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 4, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	δ Draconis	11 05 33.29	+ 3.31	+ 0.19	— 0.54	11 05 36.25	19 12 31.19	+ 8 06 54.94
W.	δ Aquilæ	12 14.31	— 1.75	+ 0.06	— 0.21	12 12.41	19 07.30	54.89
W.	α Vulpeculæ	16 32.71	— 0.88	+ 0.08	— 0.23	16 31.68	23 26.64	54.96
W.	μ Aquilæ	21 01.58	— 1.58	+ 0.07	— 0.21	20 59.86	27 54.73	54.87
W.	κ Aquilæ	23 12.78	— 2.12	+ 0.06	— 0.21	23 10.51	30 05.32	54.81
W.	θ Cygni	26 07.64	+ 0.71	+ 0.14	— 0.32	26 08.17	33 03.02	54.84
W.	γ Aquilæ	33 21.59	— 1.47	+ 0.08	— 0.21	33 19.99	40 14.96	54.97
W.	α Aquilæ	37 43.65	— 1.53	+ 0.07	— 0.21	37 41.98	44 36.91	54.93
W.	ε Draconis	41 37.07	+ 4.02	+ 0.20	— 0.60	41 40.69	48 35.69	55.00
E.	ν Cygni	12 45 32.90	0.00	+ 0.10	+ 0.27	12 45 33.27	20 52 27.99	54.72
E.	61 Cygni (*pr.*)	54 19.20	— 0.17	+ 0.10	+ 0.26	54 19.39	21 01 14.40	55.01
E.	61 Cygni (*seq.*)	54 20.72	— 0.17	+ 0.10	+ 0.26	54 20.91	01 15.92	55.01
E.	ζ Cygni	13 00 39.27	— 0.62	+ 0.10	+ 0.24	13 00 38.99	07 33.77	54.78
E.	α Cephei	08 37.08	+ 2.18	+ 0.18	+ 0.44	08 39.88	15 34.48	54.60
E.	β Aquarii	18 01.65	— 2.07	+ 0.08	+ 0.21	18 59.87	24 54.73	54.86
E.	ξ Aquarii	24 08.94	— 2.18	+ 0.10	+ 0.21	24 07.07	31 01.83	54.76
E.	ε Pegasi	31 05.55	— 1.50	+ 0.13	+ 0.21	31 04.39	37 59.18	+ 8 06 54.79
	Mean at 20^h 00^m local sidereal time							+ 8 06 54.866

NORMAL EQUATIONS.

$$17.00\,\delta t + 2.06\,a - 3.04\,c = - 8.72 \qquad a = -2.^s829$$
$$2.06\,\delta t + 7.40\,a + 5.05\,c = -20.16 \qquad c = +0.^s205$$
$$3.04\,\delta t + 5.05\,a + 37.97\,c = - 6.91 \qquad \delta t = -0.^s137$$

SALT LAKE CITY, UTAH, OCTOBER 5, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	α Vulpeculæ	11 16 32.59	— 0.83	+ 0.12	+ 0.16	11 16 32.04	19 23 26.61	+ 8 06 54.57
E.	μ Aquilæ	21 01.66	— 1.50	+ 0.10	+ 0.15	21 00.41	27 54.71	54.30
E.	κ Aquilæ	23 12.59	— 2.01	+ 0.08	+ 0.15	23 10.81	30 05.30	54.49
E.	θ Cygni	26 07.36	+ 0.67	+ 0.17	+ 0.23	26 08.43	33 03.03	54.60
E.	γ Aquilæ	33 21.53	— 1.39	+ 0.09	+ 0.15	33 20.38	40 14.94	54.56
W.	α Aquilæ	37 43.83	— 1.45	+ 0.10	— 0.15	37 42.33	44 36.89	54.56
W.	ε Draconis	41 37.45	+ 3.81	+ 0.31	— 0.44	41 41.13	48 35.62	54.49
W.	τ Aquilæ	51 04.89	— 1.50	+ 0.11	— 0.15	51 03.35	57 57.92	54.57
W.	θ Aquilæ	57 54.34	— 1.80	+ 0.10	— 0.15	57 52.49	04 46.97	54.48
W.	α^2 Capricorni	12 04 10.23	— 2.22	+ 0.09	— 0.15	12 04 07.95	20 11 02.52	54.57
W.	β Capricorni	07 02.47	— 2.30	+ 0.10	— 0.15	07 00.12	13 54.62	+ 8 06 54.50
	Mean at 19^h 30^m local sidereal time							+ 8 06 74.517

NORMAL EQUATIONS.

$$11.00\,\delta t + 3.93\,a - 2.32\,c = -16.18 \qquad a = -2.^s68$$
$$3.93\,\delta t + 5.81\,a + 2.43\,c = -17.09 \qquad c = +0.^s149$$
$$-2.32\,\delta t + 2.43\,a + 20.40\,c = - 2.38 \qquad \delta t = -0.^s482$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 5, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	ν Cygni	12 45 33.40	— 0.00	+ 0.26	— 0.27	0 0 33.39	20 52 27.97	+ 8 06 54.58
W.	f¹ Cygni	48 37.35	+ 0.44	+ 0.29	— 0.30	37.78	55 31.99	54.21
W.	61 Cygni (*pr.*)	54 19.97	— 0.16	+ 0.25	— 0.26	19.80	21 01 14.38	54.58
W.	61 Cygni (*seq.*)	54 21.27	— 0.16	+ 0.25	— 0.26	21.10	01 15.90	54.80
E.	ζ Cygni	13 00 39.47	— 0.60	+ 0.27	+ 0.24	39.38	17 33.75	54.37
E.	α Cephei	08 36.84	+ 2.10	+ 0.48	+ 0.44	39.86	15 34.44	54.58
E.	β Aquarii	18 01.77	— 1.99	+ 0.18	+ 0.21	00.17	24 54.72	54.55
E.	ξ Aquarii	24 08.95	— 2.10	+ 0.19	+ 0.21	07.25	31 01.82	+ 8 06 54.57
	Mean at 13ʰ 00ᵐ local sidereal time							+ 8 06 54.531

NORMAL EQUATIONS.

$$8.00\,\delta t + 0.91\,a - 0.02\,c = -6.22 \qquad \delta t = -0.^s469$$
$$0.91\,\delta t + 1.78\,a + 0.22\,c = -5.26 \qquad a = -2.^s726$$
$$-0.02\,\delta t + 0.22\,a + 15.04\,c = +2.49 \qquad c = +0.^s205$$

DETROIT, MICHIGAN, SEPTEMBER 29, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	12 Ceti	0 29 13.08	+ 0.01	+ 0.33	+ 0.26	0 29 13.68	0 23 36.24	— 5 37.44
W.	α Cassiopeiæ	38 58.09	— 0.01	+ 0.85	+ 0.45	38 59.38	33 21.99	37.39
W.	β Ceti	42 52.69	+ 0.02	+ 0.25	+ 0.27	42 53.23	37 15.74	37.49
W.	ε Piscium	1 02 00.79	+ 0.01	+ 0.40	+ 0.26	1 02 01.46	56 23.93	37.53
E.	θ¹ Ceti	23 20.49	+ 0.01	+ 0.34	— 0.26	23 20.58	1 17 43.31	37.27
E.	η Piscium	30 21.37	+ 0.01	+ 0.48	— 0.27	30 21.59	24 44.04	37.55
E.	ο Piscium	44 21.43	+ 0.01	+ 0.44	— 0.26	44 21.62	38 44.10	— 5 37.52
	Mean at 1ʰ 00ᵐ local sidereal time							— 5 37.46

NORMAL EQUATIONS.

$$0 = -0.12 + 7.00\,\delta t + 3.64\,a - 1.77\,c \qquad \delta t = -0^s.06$$
$$0 = +0.24 + 3.64\,\delta t + 3.04\,a + 0.29\,c \qquad a = +0^s.02$$
$$0 = +2.31 - 1.77\,\delta t + 0.29\,a + 9.45\,c \qquad c = -0^s.26$$

Observations and reductions for time taken at receiving station—Continued.

DETROIT, MICHIGAN, SEPTEMBER 30, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	ε Delphini	20 32 48.36	+ 0.14	+ 0.46	+ 0.17	20 32 49.13	20 27 10.66	— 5 38.47
W.	γ^2 Delphini	46 25.66	+ 0.13	+ 0.49	+ 0.17	46 26.45	40 47.84	38.61
W.	μ Aquarii	51 28.07	+ 0.22	+ 0.33	+ 0.17	51 28.79	45 50.43	38.36
W.	32 Vulpeculæ	54 48.39	+ 0.08	+ 0.58	+ 0.19	54 49.24	49 10.72	38.52
W.	ζ Cygni	21 13 11.44	+ 0.07	+ 0.60	+ 0.19	21 13 12.30	21 07 33.83	38.47
E.	1 Draconis, L. C	24 26.65	+ 1.61	— 2.21	+ 1.18	24 27.23	18 48.93	38.30
E.	β Aquarii	30 32.76	+ 0.21	+ 0.38	— 0.17	30 33.18	24 54.78	38.40
E.	ξ Aquarii	36 40.03	+ 0.21	+ 0.36	— 0.17	36 40.43	31 01.87	38.56
E.	ε Pegasi	43 37.29	+ 0.15	+ 0.48	— 0.17	43 37.75	37 59.23	38.52
E.	μ Capricorni	52 02.86	+ 0.23	+ 0.32	— 0.17	52 03.24	46 24.89	38.35
E.	θ Pegasi	22 09 28.01	+ 0.17	+ 0.45	— 0.17	22 09 28.46	22 03 50.05	38.41
E.	θ Aquarii	15 48.60	+ 0.22	+ 0.35	— 0.17	15 49.00	10 10.50	38.50
E.	γ Aquarii	20 46.33	+ 0.19	+ 0.39	— 0.16	20 46.75	15 08.30	38.45
E.	π Aquarii	24 27.99	+ 0.18	+ 0.40	— 0.17	24 28.40	18 49.98	38.42
E.	226 Cephei	35 42.97	— 0.60	+ 1.78	— 0.67	35 43.48	30 05.36	38.12
E.	ζ Pegasi	40 48.34	+ 0.15	+ 0.46	— 0.17	40 48.78	35 10.14	38.64
E.	λ Aquarii	51 40.08	+ 0.22	+ 0.34	— 0.17	51 40.47	46 01.94	— 5 38.53
	Mean at $21^h 55^m$ local sidereal time							— 5 38.45

NORMAL EQUATIONS.

$$0 = -\ 0.76 + 17.00\,\delta t + 13.04\,a + \ 1.74\,c \qquad \delta t = -\,0^s.15$$
$$0 = -\,17.84 + 13.04\,\delta t + 45.45\,a - 45.52\,c \qquad a = +\,0^s.27$$
$$0 = +\,26.32 + \ 1.74\,\delta t - 45.52\,a + 82.26\,c \qquad c = -\,0^s.17$$

DETROIT, MICHIGAN, OCTOBER 1, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	θ Aquilæ	20 10 25.64	+ 0.10	+ 0.23	— 0.27	20 10 25.70	20 04 47.06	— 5 38.64
E.	α^2 Capricorni	16 41.15	+ 0.12	+ 0.20	— 0.28	16 41.19	11 02.58	38.61
E.	π Capricorni	25 43.90	+ 0.13	+ 0.19	— 0.29	25 43.93	20 05.34	38.59
E.	ε Delphini	32 49.39	+ 0.07	+ 0.35	— 0.28	32 49.53	27 10.64	38.89
E.	γ^2 Delphini	46 26.69	+ 0.07	+ 0.40	— 0.29	46 26.87	40 47.81	39.06
E	μ Aquarii	51 29.05	+ 0.11	+ 0.29	— 0.28	51 29.17	45 50.42	38.75
E.	32 Vulpeculæ	54 49.67	+ 0.04	+ 0.51	— 0.31	54 49.91	49 10.71	39.20
E.	ζ Cygni	21 13 12.75	+ 0.03	+ 0.61	— 0.32	21 13 13.07	21 07 33.82	39.25
W.	1 Pegasi	21 53.05	+ 0.06	+ 0.51	+ 0.29	21 53.91	16 14.96	38.95
W.	β Aquarii	30 32.93	+ 0.11	+ 0.35	+ 0.27	30 33.66	24 54.77	38.89
W.	ξ Aquarii	36 39.98	+ 0.11	+ 0.33	+ 0.28	36 40.70	31 01.86	38.84
W.	ε Pegasi	43 37.20	+ 0.08	+ 0.44	+ 0.28	43 38.00	37 59.22	38.78
W.	μ Capricorni	52 03.11	+ 0.12	+ 0.30	+ 0.28	52 03.81	46 24.83	38.93
W.	20 Pegasi	22 00 34.75	+ 0.07	+ 0.45	+ 0.28	22 00 35.55	54 56.49	39.06
W.	α Aquarii	05 56.26	+ 0.09	+ 0.37	+ 0.27	05 56.99	59 18.10	38.89
W.	θ Pegasi	09 28.27	+ 0.09	+ 0.41	+ 0.28	09 29.05	22 03 50.05	39.00
W.	θ Aquarii	15 48.61	+ 0.11	+ 0.32	+ 0.28	15 49.32	10 10.49	38.83
W.	γ Aquarii	20 46.54	+ 0.10	+ 0.36	+ 0.27	20 47.27	15 08.29	38.98
W.	π Aquarii	24 28.16	+ 0.09	+ 0.37	+ 0.28	24 28.90	18 49.97	38.93
W.	226 Cephei	35 41.58	— 0.31	+ 1.68	+ 1.10	35 44.05	30 05.32	38.73
W.	ζ Pegasi	40 48.38	+ 0.08	+ 0.41	+ 0.28	40 49.18	35 10.13	39.05
W.	λ Pegasi	46 05.57	+ 0.10	+ 0.53	+ 0.30	46 06.50	40 27.31	39.19
W.	λ Aquarii	51 40.12	+ 0.11	+ 0.34	+ 0.28	51 40.85	46 01.94	38.91
W.	α Pegasi	23 04 06.76	+ 0.07	+ 0.49	+ 0.28	23 04 07.60	58 28.67	— 5 38.93
	Mean at $21^h 55^m$ local sidereal time							— 5 38.91

NORMAL EQUATIONS.

$$0 = +\,2.73 + 24.00\,\delta t + 12.42\,a - 10.95\,c \qquad \delta t = -\,0^s.31$$
$$0 = +\,2.80 + 12.42\,\delta t + 14.79\,a + \ 3.63\,c \qquad a = +\,0^s.14$$
$$0 = +\,7.24 - 10.95\,\delta t + \ 3.63\,a + 40.71\,c \qquad c = -\,0^s.27$$

Observations and reductions for time taken at receiving station—Continued.

DETROIT, MICHIGAN, OCTOBER 9, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	α^2 Capricorni	20 16 20.48	+ 0.20	— 0.03	— 0.32	20 16 20.33	20 10 38.60	— 5 41.73
E.	ε Delphini	32 52.69	+ 0.12	+ 0.03	— 0.31	32 52.53	27 10.52	42.01
E.	α Cygni	42 50.30	— 0.01	+ 0.06	— 0.44	42 49.91	37 07.55	42.36
E.	μ Aquarii	51 32.38	+ 0.19	+ 0.03	— 0.32	51 32 28	45 50.31	41.97
E.	ν Cygni	58 10.62	+ 0.01	+ 0.09	— 0.41	58 10.31	52 27.89	42.42
E.	61 Cygni	21 06 56.92	+ 0.02	+ 0.10	— 0.39	21 06 56.65	21 01 14.30	42.35
W.	ξ Aquarii	36 43.44	+ 0.19	— 0.02	+ 0.31	36 43.92	31 01.78	42.14
W.	ε Pegasi	43 40.90	+ 0.13	— 0.03	+ 0.32	43 41.32	37 59.13	42.19
W.	μ Capricorni	52 06.49	+ 0.21	— 0.02	+ 0.32	52 07.00	46 24.80	42.20
W.	α Aquarii	22 04 59.83	+ 0.16	— 0.01	+ 0.31	22 05 00.29	59 18.03	42.26
W.	θ Aquarii	15 52.03	+ 0.19	— 0.01	+ 0.32	15 52.53	22 10 10.42	42.11
W.	γ Aquarii	20 50.01	+ 0.17	— 0.00	+ 0.31	20 50.49	15 08.24	42.25
W.	π Aquarii	24 31.63	+ 0.16	+ 0.01	+ 0.31	24 32.11	18 49.91	42.20
W.	η Aquarii	34 33.84	+ 0.16	+ 0.01	+ 0.31	34 34.32	28 52.30	42.02
W.	226 Cephei	35 46.14	— 0.53	+ 0.08	+ 1.24	35 46.93	30 04.93	42.00
W.	λ Pegasi	46 09.11	+ 0.16	+ 0.04	+ 0.33	46 09.64	40 27.26	42.38
W.	λ Aquarii	51 43.60	+ 0.19	+ 0.03	+ 0.32	51 44.14	46 01.90	42.24
W.	α Pegasi	23 04 10.38	+ 0.12	+ 0.05	+ 0.32	23 04 10.87	58 28.64	42.23
W.	θ Piscium	28 15.96	+ 0.14	+ 0.05	+ 0.31	28 16.46	23 22 34.17	42.29
W.	ι Piscium	39 09.62	+ 0.15	+ 0.06	+ 0.31	39 10.14	33 27.85	42.29
W.	ω Piscium	58 31.89	+ 0.14	+ 0.07	+ 0.31	58 32.41	52 50.16	42.25
W.	α Andromedæ	0 07 34.16	+ 0.06	+ 0.11	+ 0.35	0 07 34.68	0 01 52.26	— 5 42.42
	Mean at 21^h 55^m local sidereal time							— 5 42.20

NORMAL EQUATIONS.

$$0 = -1.81 + 22.00\,\delta t + 9.80\,a - 12.34\,a \qquad \delta t = -0^s.20$$
$$0 = -0.87 + 9.80\,\delta t + 13.06\,a + 1.01\,a \qquad a = +0^s.24$$
$$0 = +9.83 - 12.34\,\delta t + 1.01\,a + 40.38\,a \qquad c = -0^s.31$$

DETROIT, MICHIGAN, OCTOBER 10, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α^2 Capricorni	20 16 45.76	+ 0.24	0.00	+ 0.18	20 16 46.18	20 11 02.44	— 5 43.74
W.	π Capricorni	25 48.30	+ 0.26	+ 0.02	+ 0.18	25 48.76	20 05.20	43.56
W.	ε Delphini	32 53.89	+ 0.15	+ 0.07	+ 0.18	32 54.29	27 10.50	43.79
W.	α Cygni	42 50.83	— 0.01	+ 0.17	+ 0.24	42 51.23	37 07.55	43.68
W.	μ Aquarii	51 33.61	+ 0.22	+ 0.10	+ 0.18	51 34.11	45 50.30	43.81
W.	61 Cygni	21 06 57.66	+ 0.02	+ 0.15	+ 0.22	21 06 58.05	21 01 14.28	43.77
W.	ζ Cygni	13 17.04	+ 0.07	+ 0.08	+ 0.20	13 17.39	07 33.67	43.72
E.	β Aquarii	30 38.26	+ 0.21	+ 0.07	— 0.17	30 38.37	24 54.66	43.71
E.	ξ Aquarii	36 45.41	+ 0.22	+ 0.07	— 0.18	36 45.52	31 01.76	43.76
E.	ε Pegasi	43 42.72	+ 0.16	+ 0.09	— 0.17	43 42.80	37 59.11	43.69
E.	μ Capricorni	52 08.37	+ 0.24	+ 0.06	— 0.18	52 08.49	46 24.79	43.70
E.	α Aquarii	22 05 01.63	+ 0.19	+ 0.09	— 0.17	22 05 01.74	59 18.02	43.72
E.	η Aquarii	34 35.86	+ 0.19	+ 0.11	— 0.17	34 35.99	22 28 52.30	43.69
E.	λ Aquarii	51 45.45	+ 0.22	+ 0.10	— 0.18	51 45.59	46 01.89	43.70
E.	α Pegasi	23 04 12.33	+ 0.14	+ 0.16	— 0.18	23 04 12.45	58 28.63	— 5 43.82
	Mean at 23^h 25^m local sidereal time							— 5 43.72

NORMAL EQUATIONS.

$$0 = -0.64 + 15.00\,\delta t + 8.95\,a + 0.20\,c \qquad \delta t = -0^s.12$$
$$0 = -0\ 42 + 8.95\,\delta t + 6.55\,a + 2.20\,c \qquad a = +0^s.28$$
$$0 = +2.42 + 0.20\,\delta t + 2.20\,a + 17.41\,c \qquad c = -0^s.17$$

The following tables show the corrections and rates of the chronometers used at Salt Lake City and Ogden and of the clock used at Detroit:

CHRONOMETER AT OGDEN.—Negus, No. 1499.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
	h.	h. m. s.	s.
Sept. 29, 1873	20.6	— 0 42 32.18	— 0.008
Sept. 30, 1873	19.6	31.98	— 0.008
Oct. 1, 1873	20.1	31.79	0.000
Oct. 2, 1873	20.4	31.80	0.000
Oct. 3, 1873	19.9	31.92	+ 0.007
Oct. 4, 1873	20.4	32.12	+ 0.017
Oct. 5, 1873	19.7	32.68	+ 0.026
Oct. 7, 1873	3.2	34.06	+ 0.020
Oct. 8, 1873	20.7	34.28	+ 0.022
Oct. 9, 1873	20.7	35.00	+ 0.023
Oct. 10, 1873	20.7	35.38	+ 0.031
Oct. 11, 1873	21.2	— 0 42 36.52	....

CHRONOMETER AT SALT LAKE CITY.—Negus, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
	h.	h. m. s.	s.
Sept. 29, 1873	21.5	+ 8 06 55.72	— 0.011
Oct. 1, 1873	20.0	55.99	0.000
Oct. 2, 1873	20.5	55.70	+ 0.018
Oct. 3, 1873	20.7	55.14	+ 0.018
Oct. 4, 1873	20.0	54.87	+ 0.013
Oct. 5, 1873	20.2	+ 8 06 54.52	+ 0.014

CLOCK AT DETROIT.—Bond, No. 184.

Date.	Local sidereal time.	Correction of clock.	Hourly rate.
	h.	h. m. s.	s.
Sept. 29, 1873	0.9	— 0 05 37.46	+ 0.001
Sept. 30, 1873	21.9	38.45	+ 0.020
Oct. 1, 1873	21.9	38.91	+ 0.022
Oct. 9, 1873	21.9	42.20	+ 0.025
Oct. 10, 1873	23.4	— 0 05 43.72	+ 0.085

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
September 29, 1873:		h. m. s	h. m. s.	h. m. s.	h. m. s.	s.	s.
Salt Lake City	Salt Lake City	12 31 26.13	+ 8 06 55.71	20 38 21.84			
	Ogden	21 20 29.31	— 0 42 32.18	20 37 57.13	0 00 24.71		
Ogden	Salt Lake City	12 37 02.37	+ 8 06 55.71	20 43 58.08			
	Ogden	21 26 05.51	— 0 42 32.18	20 43 33.33	24.75	0.04	24.730
October 1, 1873:							
Salt Lake City	Salt Lake City	12 19 58.86	+ 8 06 55.99	20 26 54.85			
	Ogden	21 09 01.94	— 0 42 31.79	20 26 30.15	24.70		
Ogden	Salt Lake City	12 24 52.51	+ 8 06 55.99	20 31 48.50			
	Ogden	21 13 55.53	— 0 42 31.79	20 31 23.74	24.76	0.06	24.730
October 2, 1873:							
Salt Lake City	Salt Lake City	12 36 45.70	+ 8 06 55.69	20 43 41.39			
	Ogden	21 25 48.45	— 0 42 31.80	20 43 16.65	24.74		
Ogden	Salt Lake City	12 41 32.86	+ 8 06 55.69	20 48 28.55			
	Ogden	21 30 35.55	— 0 42 31.80	20 48 03.75	24.80	0.06	24.770
October 3, 1873:							
Salt Lake City	Salt Lake City	13 10 42.49	+ 8 06 55.13	21 17 37.62			
	Ogden	21 59 44.79	— 0 42 31.93	21 17 12.86	24.76		
Ogden	Salt Lake City	13 16 13.05	+ 8 06 55.13	21 23 08.18			
	Ogden	22 05 15.32	— 0 42 31.93	21 22 42.39	24.79	0.03	24.775
October 4, 1873:							
Salt Lake City	Salt Lake City	12 30 18.28	+ 8 06 54.86	20 37 13.14			
	Ogden	21 19 20.56	— 0 42 32.13	20 36 48.43	24.71		
Ogden	Salt Lake City	12 34 32.99	+ 8 06 54.86	20 41 27.85			
	Ogden	21 23 35.25	— 0 42 32.13	20 41 03.12	24.73	0.02	24.720
October 5, 1873:							
Ogden	Salt Lake City	12 28 33.04	+ 8 06 54.51	20 35 27.55			
	Ogden	21 17 35.50	— 0 42 32.71	20 35 02.79	24.76	0.01	
Salt Lake City	Salt Lake City	12 34 03.87	+ 8 06 54.51	20 40 58.38			
	Ogden	21 23 06.34	— 0 42 32.71	20 40 33.63	0 00 24.75		24.755

Ogden west of Salt Lake City.................... $0^h\ 00^m\ 24^s.747 \pm 0^s.006$

Final results of longitude—Continued.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
September 29, 1873:		h. m. s.	h. m. s.	h. m. s.	h. m. s.	s.	s.
Detroit	Detroit	23 53 22.00	— 0 05 37.46	23 47 44.54			
	Ogden	22 34 29.57	— 0 42 32.17	21 51 57.40	1 55 47.14		
Ogden	Detroit	23 58 29.01	— 0 05 37.46	23 52 51.55			
	Ogden	22 39 36.22	— 0 42 32.17	21 57 04.05	47.50	0.36	47.320
September 30, 1873:							
Detroit	Detroit	0 10 42.00	— 0 05 38.49	0 05 03.51			
	Ogden	22 51 48.35	— 0 42 31.96	22 09 16.39	47.12		
Ogden	Detroit	0 15 25.54	— 0 05 38.49	0 09 47.05			
	Ogden	22 56 31.56	— 0 42 31.96	22 13 59.60	47.45	0.33	47.285

Final results of longitude—Continued.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*s.*
October 1, 1873:							
Detroit..........	Detroit..........	23 51 32.00	— 0 05 38.95	23 45 53.05			
	Ogden	22 32 37.62	— 0 42 31.79	21 50 05.83	1 55 47.22		
Ogden..........	Detroit..........	23 56 13.24	— 0 05 38.95	23 50 34.29			
	Ogden	22 37 18.52	— 0 42 31.79	21 54 46.73	47.56	0.34	47.390
October 9, 1873:							
Ogden..........	Detroit..........	0 18 39.28	— 0 05 42.26	0 12 57.02			
	Ogden	22 59 44.37	— 0 42 35.04	22 17 09.33	47.69		
Detroit..........	Detroit..........	0 30 28.84	— 0 05 42.27	0 24 46.57			
	Ogden	23 11 34.23	— 0 42 35.04	22 48 59.19	47.38	0.31	47.535
October 10, 1873:							
Detroit..........	Detroit..........	23 46 02.00	— 0 05 43.75	23 40 18.25			
	Ogden	22 27 06.57	— 0 42 35.41	21 44 31.16	47.09		
Ogden..........	Detroit..........	23 53 31.28	— 0 05 43.75	23 47 47.53			
	Ogden	22 34 35.49	— 0 42 35.42	21 52 00.07	1 55 47.46	0.37	47.275

Ogden west of Detroit, approximate result..... $1^h 55^m 47^s.361$
Correction for personal equation................ $+ 0^s.110$

Ogden west of Detroit, final result .... $1^h 55^m 47^s.471 \pm 0^s.032$

Observations and computations for latitude.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
October 5...	7721	2 59.0	29.0	5.3		41 22 49.4	— 9 36.7	—3.0	41 13 09.7
	7731	2 42.0	29.0	5.3		22 54.2	— 9 42.0	—3.0	09.2
	7746	21 15.2	0.0	34.6					
	7824	7 29.6	15.9	19.9		16 20.9	— 3 08.6	—4.3	08.0
	Gr. 3779	20 88.8	15.8	20.2		23 23.9	—10 10.9	—4.4	08.6
	7843	1 22.5	12.3	23.8					
	7858	1 19.2	16.4	19.8		22 33.8	— 9 20.4	—4.9	08.5
	7880	9 86.6	16.3	19.8		18 04.9	— 4 50.9	—5.0	09.0
	7906	19 23.0	10.9	25.5					
	7932	8 75.0	22.8	13.5					
	7962	9 01.0	2.2	33.7		13 22.5	— 0 08.1	—6.1	08.4
	7972	6 05.6	19.5	15.0					
	7984	11 29.0	9.5	25.9		10 28.3	+ 2 42.6	—3.3	07.6
	7994	4 55.0	13.7	21.3					
	8023	12 70.2	13.2	21.0		17 26.5	— 4 13.3	—4.2	09.0
					Changed the inclination.				

Observations and computations for latitude—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 5...	8051	13 62.5	22.0	12.0					
	8104	4 13.3	15.3	18.3		41 08 12.0	+ 4 54.9	+1 9	41 13 08.8
	8118	8 38.9	17.9	15.9					
	8128	19 63.0	23.5	10.0		14 14.1	− 1 09.6	+4.2	08.7
	8153	0 88.0	13.3	20.2					
	8160	17 28.0	27.0	6.5		04 35.7	+ 8 29.5	+3.7	08.9
	8174	12 64.8	21.0	12.6					
	8188	6 48.7	18.9	14.6		09 53.6	+ 3 11.4	+3.5	08.5
	8211	5 06.3	20.3	13.2	Changed the inclination.				
	8231	13 12.0	21.8	11.8		17 14.0	− 4 10.3	+4.7	08.4
	8248	− 0 08.0	22.0	11.6					
	8273	17 66.4	16.8	17.2		22 16.5	− 9 11.3	+2.8	08.0
	8282	16 59.6	12.0	22.0					
	8324	1 17.0	24.3	9.9		21 06.4	− 7 59.3	+1.2	08.3
	6	11 57.3	12.2	21.0					
	42	4 11.0	32.3	0.2		16 54.7	− 3 51.9	+6.4	09.2
	105	12 91.0	12.7	19.3	Changed the inclination.				
	129	4 50.1	23.3	8.7		17 27.3	− 4 21.3	+2.2	08.2
	146	− 0 21.0	13.0	18.9					
	164	19 28.9	23.0	9.0		03 00.3	+10 05.5	+2.2	08.0
	201	12 64.0	15.2	17.0					
	224	5 49.0	13.5	19.0		16 53.0	− 3 42.2	−2.0	08.8
	250	0 88.0	14.6	18.0		18 44.5	− 5 35.1	−0.3	09.1
	255	11 66.8	17.4	15.2					
	264	13 02.0	12.8	20.0		12 27.7	+ 0 42.0	−1.4	08.3
	290	10 19.8	12.3	20.7					
	299	5 92.5	13.6	19.3		15 25.5	− 2 12.7	−3.9	08.9
	341	16 53.2	15.7	17.2					
	379	− 0 00.8	17.0	15.9		04 34.8	+ 8 33.8	−0.1	08.5
	393	0 10.3	16.9	16.0					
	408	17 20.6	18.0	14.7		04 16.2	+ 8 51.2	+1.2	08.6
	430	10 93.0	17.6	15.7					
	450	6 31.3	14.8	18.9		10 45.2	+ 2 23.4	−0.6	08.0
	454	3 26.5	16.5	17.3	Air very undulating.				
	468	14 58.0	16.9	17.3		19 00.4	− 5 51.6	−0.3	08.5
	487	13 87.6	19.7	14.9					
	516	4 73.0	13.3	22.0		17 53.8	− 4 44.2	−1.1	08.5
	533	7 05.0	20.4	15.0					
	564	10 52.1	9.1	26.0		14 59.5	− 1 47.8	−3.2	08.5

Observations and computations for latitude—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 5...	572	2 09.0	15.0	20.1	Duplex med.				
	588	16 13.2	16.2	18.8		41 20 27.5	− 7 16.4	−2.1	41 13 09.0
	600	2 60.0	10.9	24.3					
	629	15 32.7	23.0	12.0		06 33.7	+ 6 35.4	−0.7	08.4
	647	21 98.7	17.9	16.9		04 31.1	+ 8 38.9	−1.1	08.9
	658	5 28.6	14.7	19.7					
	666	8 13.6	17.9	16.3		11 40.4	+ 1 28.5	−0.9	08.0
	686	4 03.2	17.8	16.3		23 16.0	−10 06.2	−1.7	08.1
	702	23 55.0	13.0	20.8					
	712	− 1 00.4	19.0	14.7		25 52.8	−12 42.9	−1.0	08.9
	745	11 93.0	19.6	14.0					
	777	3 94.3	7.2	26.8		09 04.7	+ 4 08.1	−3.9	08.9
October 7...	8211	5 80.9	14.3	23.3	Cloudy before.				
	8231	13 54.2	15.6	22.8		17 14.4	− 4 00.3	−4.5	09.6
	8248	0 41.6	21.5	17.5					
	8273	17 86.1	5.0	34.4		22 16.9	− 9 02.0	−7.0	07.9
	8282	17 55.7	20.0	19.2					
	8324	2 35.4	7.6	32.0		21 06.9	− 7 52.3	−6.5	08.1
	6	12 38.0	13.5	25.6	Changed the inclination.				
	42	5 12.6	23.2	15.6		16 55.2	− 3 45.4	−1.2	08.6
	105	12 93.2	16.0	22.8					
	129	4 51.0	27.0	11.9		17 27.8	− 4 21.7	+2.3	08.4
	146	− 0 65.0	13.8	25.0					
	164	18 87.0	28.6	11.0		03 00.8	+10 06.4	+1.8	09.0
	201	13 39.0	14.8	24.0					
	224	6 09.2	27.5	11.4		16 53.5	− 3 46.7	+1.9	08.7
	250	0 51.2	28.6	10.3		18 45.0	− 5 35.8	−0.6	08.6
	255	11 32.4	9.3	29.7					
	264	12 55.0	33.3	6.0		12 28.2	+ 0 38.1	+1.9	08.2
	290	10 35.0	17.4	21.7					
	299	5 88.6	26.4	12.9		15 26.0	− 2 18.7	+2.5	09.8
	341	16 52.2	23.6	15.7					
	379	− 0 00.6	16.1	23.2		04 35.2	+ 8 33.5	+0.2	08.9
	393	0 13.2	17.0	22.3					
	408	17 31.3	20.3	19.0		04 16.6	+ 8 53.7	−1.1	09.2
	430	10 60.5	23.9	16.3					
	450	6 13.0	23.0	17.0		10 45.7	+ 2 19.1	+3.7	08.5
	454	2 96.0	27.2	12.8					
	468	14 32.0	13.0	27.0		19 00.8	− 5 52.8	+0.1	08.1

Observations and computations for latitude—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 7...	487	14 08.3	18.0	22.0					
	516	4 85.1	26.3	13.7		41 17 54.3	− 4 46.9	+2.4	41 13 09.8
	533	6 67.7	24.0	16.0					
	564	10 21.0	11.8	28.2		15 00.0	− 1 49.7	−2.3	08.0
	572	2 02.4	35.2	5.0	Duplex med.				
	588	16 20.7	6.6	33.7		20 27.9	− 7 20.6	+0.9	08.2
	600	2 56.1	20.2	20.2					
	629	15 21.5	22.0	18.8		06 34.2	+ 6 33.1	+0.9	08.2
	647	22 06.0	21.8	19.0		04 31.6	+ 8 35.9	+2.1	09.6
	658	5 45.5	22.9	18.0					
	666	8 24.3	20.2	20.3		11 40.9	+ 1 26.7	+1.3	08.9
	686	4 25.9	26.0	14.7		23 16.4	−10 07.8	−1.1	07.5
	702	23 82.8	12.9	28.0					
	712	− 0 78.5	28.9	12.0		25 53.2	−12 44.6	+0.5	09.1
	745	11 37.9	26.7	14.8		09 05.2	+ 4 04.7	−1.1	08.8
	750	9 16.4	27.0	14.5		10 13.5	+ 2 55.9	−0.9	08.5
	777	3 50.1	12.8	28.7					
October 8...	7731	3 13.7	17.0	18.0					
	7746	22 00.8	19.0	16.2		22 54.7	− 9 46.3	+0.5	08.9
	7765	15 86.0	19.4	15.7					
	7803	2 26.8	17.0	17.3		06 05.0	+ 7 02.3	+1.2	08.5
	7824	6 89.1	9.6	25.8		16 21.5	− 3 13.6	+0.9	08.8
	Gr. 3779	20 49.3	9.0	26.5		23 24.5	−10 16.2	+0.6	08.9
	7843	0 66.1	27.5	8.0					
	7880	9 08.8	23.6	12.2					
	7906	18 59.9	9.8	26.3		18 05.5	− 4 55.5	−1.4	08.6
	7932	8 65.2	19.9	16.0					
	7962	9 00.0	9.3	27.4		13 23.2	− 0 10.8	−3.9	08.5
	7972	5 49.4	15.9	21.0					
	7984	10 67.5	17.4	19.4		10 29.0	+ 2 40.9	−1.9	08.0
	7994	3 91.1	18.5	18.4					
	8023	12 14.0	12.3	25.0		17 27.1	− 4 15.6	−3.5	08.0
	8051	13 38.7	18.2	20.1					
	8104	3 68.6	9.8	28.5		08 12.6	+ 5 01.4	−5.7	08.3
	8118	8 58.6	17.1	21.3					
	8128	10 65.3	19.7	19.3		14 14.8	− 1 04.3	−1.1	09.4
	8153	0 66.5	12.0	27.0					
	8160	17 18.3	24.3	14.5		04 36.4	+ 8 33.2	−1.4	08.2
	8174	12 23.6	23.2	15.6					
	8188	5 89.2	9.7	29.3		09 54.2	+ 3 17.1	−3.3	08.0

Observations and computations for latitude—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
1873. October 8...	8211	5 25.2	21.0	18.0					
	8231	13 03.9	10.3	28.9		41 17 14.6	− 4 01.9	−4.3	41 13 08.4
	8248	0 93.7	24.9	14.8					
	8273	18 50.2	10.2	29.0		22 17.1	− 9 05.7	−2.4	09.0
	8282	16 08.9	22.0	17.3					
	8324	0 65.6	19.6	19.0		02 07.1	− 7 59.5	+1.4	09.0
	6	12 41.0	15.9	23.0					
	42	5 18.3	20.1	19.8		16 55.4	− 3 44.6	−1.9	08.9
	105	13 07.3	16.3	23.8					
	129	4 83.0	17.2	22.7		17 28.0	− 4 16.1	−3.6	08.3
	146	0 32.2	20.2	19.3					
	164	19 80.5	21.3	18.0		03 01.0	+10 05.3	+1.2	07.5
	201	12 85.0	15.1	24.3					
	224	5 60.0	23.4	16.0		16 53.7	− 3 45.2	−0.5	08.0
	250	1 18.1	23.0	16.3		18 45.2	− 5 39.9	+3.9	09.2
	255	12 12.0	23.3	16.0					
	264	13 35.8	17.9	21.8		12 28.4	+ 1 38.5	+0.9	07.8
	290	11 02.1	12.5	27.0					
	299	6 61.7	26.6	12.9		15 26.3	− 2 16.9	−0.2	09.2
	341	16 98.8	23.2	16.2					
	379	0 49.0	17.5	22.0		04 35.4	+ 8 32.6	+0.7	08.7
	393	0 09.7	16.5	23.0					
	408	17 25.0	20.0	19.3	Air undulating.	04 16.8	+ 8 53.0	−1.6	08.2
	430	11 21.0	19.0	20.3					
	450	6 69.5	25.7	13.6		10 45.9	+ 2 20.3	+3.0	09.2
	454	2 79.0	22.8	16.5					
	468	14 23.0	21.0	18.0		19 01.0	− 5 55.4	+2.6	08.2
	487	14 00.0	16.3	22.8					
	516	4 83.5	21.0	18.0		17 54.6	− 4 44.7	−1.0	08.9
	533	7 31.1	22.2	16.8					
	564	10 86.0	14.5	24.4		15 00.2	− 1 50.2	−1.2	08.8
	572	1 97.0	23.1	15.9					
	588	16 14.1	16.1	22.9		20 28.1	− 7 20.2	+0.1	08.0
	600	3 04.5	16.3	22.7					
	629	15 74.0	23.0	16.0		06 34.4	+ 6 34.4	+0.2	09.0
	647	22 01.2	21.7	17.3		04 31.8	+ 8 39.9	−1.8	09.9
	658	5 28.0	14.0	25.0					
	666	8 10.4	25.5	13.5		11 41.1	+ 1 27.8	+0.3	09.2

Observations and computations for latitude—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 8...	686	4 49.0	17.0	22.0		41 23 16.6	—10 08.4	+0.4	41 13 08.6
	702	24 07.2	22.7	16.3					
	712	— 0 55.0	17.4	21.6		25 53.4	—12 45.0	+0.6	09.0
	745	11 60.0	20.9	18.0		09 05.4	+ 4 04.6	—0.9	09.1
	750	9 39.9	21.0	17.9		10 13.7	+ 1 56.2	—0.9	09.0
	777	3 72.5	16.3	22.5					
October 9...	7994	4 83.8	21.2	15.3					
	8023	13 18.3	14.8	21.9		17 27.3	— 4 19.3	—0.3	07.7
	8051	13 27.1	17.1	19.8					
	8104	3 67.6	16.7	20.3		08 12.8	+ 4 58.1	—1.7	09.2
	8118	7 93.9	16.8	20.3					
	8128	10 01.5	17.3	19.8		14 15.0	— 1 04.5	—1.7	08.8
	8153	1 90.0	16.9	20.1					
	8160	18 28.4	25.5	11.0		04 36.6	+ 8 29.0	+3.1	08.7
	8174	12 95.2	19.7	17.0					
	8188	6 67.5	15.8	20.9		09 51.4	+ 3 15.0	—0.7	08.7
	8211	5 34.9	21.0	15.7					
	8231	13 21.0	12.0	24.7		17 14.9	— 4 04.2	—2.0	08.7
	8248	0 64.9	18.6	18.0					
	8273	18 35.1	19.6	17.3		22 17.3	— 9 10.0	+0.8	08.1
	8282	16 71.3	16.5	20.5					
	8324	1 32.0	18.7	18.6		21 07.4	— 7 58.2	—1.1	08.1
	6	12 76.1	15 3	21.6					
	42	5 47.0	19.3	17.6		16 55.6	— 3 46.6	—1.3	07.7
	105	13 23.2	16.3	20.4					
	120	4 82.0	24.0	12.8		17 28.1	— 4 21.4	+2.0	08.7
	146	0 18.9	14.7	22.1					
	164	19 66.5	24.3	12.3		03 01.2	+10 05.1	+1.3	07.6
	201	13 11.3	15.0	21.8					
	224	5 94.0	19.1	18.0		16 54.0	— 3 42.9	—1.6	09.5
	250	1 14.9	23.3	14.2		18 45.4	— 5 38.9	+2.6	09.1
	255	12 05.6	19.0	18.5					
	264	13 29.1	20.0	17.6		12 28.7	+ 1 38.4	+0.8	07.9
	290	10 52.1	15.9	21.7	Very faint.				
	299	6 12.3	19.2	18.0		15 26.5	— 2 16.7	—1.3	08.5
	341	17 33.5	20.1	17.2					
	379	0 70.9	9.8	27.8		04 35.6	+ 8 36.6	—4.2	08.0
	393	— 0 02.0	17.3	20.1					
	408	17 20.3	15.0	22.3	Very faint; hazy.	04 17.0	+ 8 55.1	—2.8	09.3

Observations and computations for latitude—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 9...	430	10 96.0	20.3	17.2					
	450	6 28.2	12.0	25.5		41 10 46.1	+ 2 25.4	−2.9	41 13 08.6
	454	3 60.0	18.8	18.8					
	468	14 97.3	20.2	17.3		19 01.2	− 5 53.4	+0.8	08.6
	487	14 21.9	16.3	21.4	Air undulat-				
	516	5 12.3	16.4	22.0	ing.	17 54.8	− 4 42.6	−3.0	09.2
	533	6 64.0	20.3	17.8					
	564	10 22.8	17.2	21.0		14 00.4	− 1 51.5	−0.4	08.5
	572	2 88.0	22.0	16.3	Duplex med.				
	588	17 09.0	20.0	18.5		20 28.4	− 7 21.5	+2.0	08.9
	600	3 06.0	15.1	23.7					
	629	15 83.6	18.6	20.3		06 34.6	+ 6 36.9	−2.8	08.7
	658	5 39.4	10.0	29.8					
	666	8 19.3	31.9	7.8		11 41.3	+ 1 27.0	+1.2	09.5
	686	3 95.9	29.7	9.8		23 16.8	−10 08.1	−0.4	08.3
	702	23 53.0	8.9	30.3					
	712	− 1 12.7	33.0	6.1		25 53.6	−12 46.1	+1.5	09.1
	745	11 75.0	22.6	16.4		09 05.6	+ 4 06.7	−3.0	09.3
	750	9 55.0	23.3	15.7		10 13.9	+ 1 58.3	−2.7	09.5
	777	3 81.2	10.8	28.0					
October 10..	7721	2 74.0	23.8	13.2					
	7746	21 29.0	2.8	34.4		22 50.4	− 9 36.3	−5.8	08.3
	7765	15 46.8	17.0	20.0					
	7803	1 62.7	9.8	27.7		06 05.3	+ 7 10.0	−5.8	09.5
	7824	7 11.9	21.9	15.3	Changed the inclination.	16 21.8	− 3 18.7	+5.1	08.2
	Gr. 3779	20 71.9	22.8	14.5		23 24.9	−10 21.3	+5.5	09.1
	7843	0 52.2	24.5	12.7					
	7880	9 46.4	19.6	17.5					
	7906	19 27.0	30.4	6.4		18 05.9	− 5 04.6	+7.2	08.5
	7932	8 87.7	27.0	9.9					
	7962	9 58.7	23.3	13.2		13 23.6	− 0 22.1	+7.5	09.0
	7972	6 16.4	25.3	11.4					
	7984	11 03.2	25.9	10.8		10 29.4	+ 2 31.2	+8.0	08.6
	7994	4 38.6	28.4	8.2					
	8023	12 93.2	20.0	16.7		17 27.5	− 4 25.5	+6.5	08.5
	8051	13 43.1	16.1	20.7					
	8104	4 05.2	26.3	10.3		08 13.0	+ 4 53.0	+3.1	09.1
	8118	7 73.0	23.4	13.3	Air undulat-ing.				
	8128	10 08.0	26.0	10.9		14 15.2	− 1 13.0	+6.9	09.1

Observations and computations for latitude—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 10..	8153	1 16.5	21.2	15.9					
	8160	17 53.0	24.0	13.0		41 04 36.8	+ 8 28.4	+4.5	41 13 09.7
	8174	12 82.0	17.3	19.5					
	8188	6 65.0	24.4	13.2		09 54.7	+ 3 11.7	+2.5	08.9
	8211	5 60.0	22.2	14.4					
	8231	13 61.8	19.8	16.6		17 15.1	— 4 09.1	+3.0	09.0
	8248	0 28.6	25.0	11.0					
	8273	18 14.2	20.3	15.8		22 17.6	— 9 14.8	+5.1	07.9
	8282	16 38.2	13.9	22.3					
	8324	0 97.0	20.3	15.5		21 07.6	— 7 58.8	—1.0	07.8
	6	12 41.9	16.3	20.9	Closed on account of undulation of air.				
	42	4 89.2	32.9	5.0		16 55.8	— 3 53.9	+6.4	08.3

Besides the preceding observations, some were made on the pairs 55, 63, and 68, on the 5th, 7th, 8th, 9th, and 10th of October. No. 55 seems to be wrong by 12″; No. 63 by 2″. The following are the observations made at these dates:

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ′	′ ″	″	° ′ ″
October 5...	55	2 55.6	23.0	9.8		41 22 44.6	— 9 32.8	+3.6	41 14 15.4
	63	7 23.0	23.3	9.0		20 14.8	— 7 07.6	+3.9	11.1
	68	20 99.2	16.1	16.2					
October 7...	55	1 85.6	22.0	17.0		22 45.1	— 9 34.0	+3.6	14.7
	63	6 51.5	22.1	16.8		20 15.3	— 7 09.2	+3.7	09.7
	68	20 33.0	23.3	15.3					
October 8...	55	1 51.6	23.7	16.2		22 45.3	— 9 27.9	—2.6	14.8
	63	6 16.3	24.3	15.8		20 15.5	— 7 03.5	—2.4	09.6
	68	19 79.4	11.4	28.6					
October 9...	55	1 48.7	20.0	17.0		22 45.5	— 9 28.0	—2.9	14.6
	63	6 14.1	21.0	16.0		20 15.7	— 7 03.5	—2.4	09.8
	68	19 77.0	11.7	25.3					

Observations and computations for latitude—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 10..	55	1 57.3	21.9	15.9		41 22 45.8	− 9 34.9	+3.9	41 14 14 8
	63	6 24.6	21.9	15.8		20 15.9	− 7 09.7	+4.0	10 2
	68	20 07.6	23.0	14.7					

Recapitulation.

The following table shows the daily means:

Date.	No. of observations.	Mean latitude.
1873.		° ′ ″
Oct. 5	36	41 13 08.58
Oct. 7	24	08.67
Oct. 8	36	08.64
Oct. 9	28	08.66
Oct. 10	16	08.72

Giving the last date the weight ½, the mean will be............41° 13′ 08″.647
The mean of all observations gives.............................41° 13′ 08″.645

Therefore the adopted latitude is..............................41° 13′ 08″.65 ± 0″.022

SEASON OF 1874.

Tabulation of stars used for determination of time at Ogden, Utah, and Washington, D. C. 1874.

Name of star.	OGDEN. October 15.	October 16.	October 17.	October 20.	October 29.	October 31.	WASHINGTON. October 15.	October 16.	October 20.	October 29.	October 31.
α Andromedæ	..	×	..	..	..	..	..	×	..	..	..
22 Andromedæ	..	×	..	..	..	..	..	..	..	..	..
γ Pegasi	..	×	..	..	..	..	×	..	..	..	..
Groombridge 29	..	×	..	..	..	..	..	..	..	..	..
ι Ceti	×	×	..	..	..	..	..	..	..	..	..
12 Ceti	×	×	..	×	..	..	..	..	..	..	..
ζ Cassiopeiæ	×	×	..	×	..	..	..	..	..	..	..
α Cassiopeiæ	×	×	..	×	..	..	..	..	..	..	..
β Ceti	..	..	..	..	..	..	×	×	..	..	..
21 Cassiopeiæ	×	×	..	×	..	..	..	..	..	..	..
Bradley 82	..	..	..	×	..	..	..	..	..	..	..
μ Andromedæ	×	×	..	×	×	..	..	..	..	..	..
ε Piscium	×	×	..	×	×	..	×	×	×	×	..
β Andromedæ	×	×	..	×	×	..	..	..	..	..	..
τ Piscium	×	×	..	×	×	..	..	..	..	..	..
υ Piscium	×	..	..	×	×	..	..	..	..	..	..
Polaris	..	..	..	..	..	..	×	×	×	×	..
θ^1 Ceti	×	..	..	×	×	..	×	×	×	×	..
38 Cassiopeiæ	×	..	..	×	×	..	..	..	..	..	..
η Piscium	..	..	..	×	×	..	×	×	..	×	..
υ Persei	..	..	..	..	×	..	..	..	..	..	..
φ Persei	..	..	..	..	×	..	..	..	..	..	..
ο Piscium	..	..	..	..	×	..	..	..	×	×	..
ε Cassiopeiæ	..	..	..	..	×	×	..	..	..	..	..
β Arietis	..	..	..	..	×	×	..	×	..	×	..
50 Cassiopeiæ	..	..	..	..	×	×	..	..	..	..	..
γ Andromedæ	..	..	..	..	×	×	..	..	..	..	..
α Arietis	..	..	..	..	×	×	..	..	×	×	..
ξ^1 Ceti	..	..	..	..	×	×	×	×	×	×	..
ι Cassiopeiæ	..	..	..	..	..	×	..	..	..	..	..
ξ^2 Ceti	..	..	..	..	..	×	..	..	..	..	..
δ Ceti	..	..	..	..	..	×	..	..	..	..	..
θ Persei	..	..	..	..	..	×	..	..	..	..	..
γ Ceti	..	..	..	..	..	..	×	..	×	..	..
μ Ceti	..	..	..	..	..	×	..	..	..	..	..
α Ceti	..	..	..	..	..	..	..	..	×	..	..
γ^2 Ursæ Minoris, S. P	..	..	..	..	..	..	..	..	..	..	×
η Tauri	..	..	..	..	..	..	..	..	..	..	×
ζ Persei	..	..	..	..	..	..	..	..	..	..	×
γ Tauri	..	..	..	..	..	..	..	..	..	..	×
ε Tauri	..	..	..	..	..	..	..	..	..	..	×
α Tauri	..	..	..	..	..	..	..	..	..	..	×
9 Camelopardalis	..	..	..	..	..	..	..	..	..	..	×
ι Aurigæ	..	..	..	..	..	..	..	..	..	..	×
11 Orionis	..	..	..	..	..	..	..	..	..	..	×

Name of star.	OGDEN. October 15.	October 16.	October 17.	October 20.	October 29.	October 31.	WASHINGTON. October 15.	October 16.	October 20.	October 29.	October 31.
ε Ursæ Minoris, S. P	..	..	..	..	..	..	..	..	..	..	×
β Orionis	..	..	..	..	..	..	..	..	..	..	×
α Lyræ	×	×	×	×	..	..	..	..	..	..	..
β Lyræ	×	×	×	×	..	..	..	..	..	..	..
σ Sagittarii	..	×	×	..	..	..	..	..	..	..	..
50 Draconis	×	..	..	..	..	..	..	..	..	..	..
γ Lyræ	×	×	×	×	..	..	..	..	..	..	..
ζ Aquilæ	×	×	×	×	..	..	..	..	..	..	..
ι Lyræ	×	×	×	×	..	..	..	..	..	..	..
d Sagittarii	×	×	×	×	..	..	..	..	..	..	..
δ Draconis	..	..	..	×	..	..	..	..	..	..	..
τ Draconis	×	×	×	×	..	..	..	..	..	..	..
β Cygni	×	×	×	×	..	..	..	..	..	..	..
κ Aquilæ	×	×	×	×	..	..	..	..	..	..	..
γ Aquilæ	×	×	×	×	..	..	..	..	..	..	..
α Aquilæ	×	×	×	×	..	..	..	..	..	..	..
ε Draconis	×	×	×	×	..	..	..	..	..	..	..
γ Sagittæ	×	×	×	×	..	..	..	..	..	..	..
τ Aquilæ	..	..	..	×	..	..	..	..	..	..	..
3 Ursæ Majoris, L. C	×	×	..	..	..	..	..	..	..	..	..
1 Pegasi	..	×	..	..	..	..	..	..	..	..	..
β Aquarii	..	×	..	..	..	..	..	..	..	..	..
β Cephei	×	×	..	..	..	..	..	..	..	..	..
ξ Aquarii	×	×	..	..	..	..	..	..	..	..	..
ε Pegasi	×	×	..	..	×	..	..	..	..	..	..
11 Cephei	×	×	..	..	..	..	..	..	..	..	..
μ Capricorni	×	×	..	..	×	..	..	..	..	..	..
79 Draconis	×	×	..	..	×	..	..	..	..	..	..
α Aquarii	×	×	..	..	×	..	..	..	..	..	..
ζ Cephei	×	×	..	..	×	..	..	..	..	..	..
θ Aquarii	×	×	..	..	×	..	..	..	..	..	..
γ Aquarii	×	×	..	..	×	..	..	..	..	..	..
π Aquarii	×	×	..	..	×	..	..	..	..	..	..
9 Draconis, L. C	×	×	..	..	×	..	..	..	..	..	..
226 Cephei	×	×	..	..	×	×	..	..	..	..	..
ζ Pegasi	×	..	..	..	×	×	..	..	..	..	..
η Pegasi	..	..	..	..	×	×	..	..	..	..	..
λ Pegasi	..	..	..	..	×	×	..	..	..	..	..
ι Cephei	..	..	..	..	..	×	..	..	..	..	..
α Pegasi	..	..	..	..	..	×	..	..	..	..	..
π Cephei	..	..	..	..	..	×	..	..	..	..	..
ο Cephei	..	..	..	..	..	×	..	..	..	..	..
υ Pegasi	..	..	..	..	..	×	..	..	..	..	..
λ Draconis, L. C	..	..	..	..	..	×	..	..	..	..	..

Observations and reductions for time taken at sending station.

OGDEN, UTAH, OCTOBER 15, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Lyræ	18 38 58.02	— 0.02	— 0.09	— 0.00	18 38 57.95	18 32 41.08	— 6 16.87
W.	β Lyræ	51 43.50	+ 0.04	— 0.08	— 0.01	51 43.45	45 26.62	16.83
W.	50 Draconis	56 40.70	— 0.57	— 0.19	— 0.02	56 39.92	50 22.86	17.06
W.	γ Lyræ	19 00 31.75	+ 0.05	— 0.06	— 0.00	19 00 31.74	54 14.89	16.85
W.	ζ Aquilæ	05 55.50	+ 0.12	— 0.05	— 0.01	05 55.56	59 38.50	17.66
W.	ι Lyræ	09 06.26	+ 0.03	— 0.05	+ 0.01	09 06.23	19 02 49.35	16.88
W.	d Sagittarii	16 34.68	+ 0.24	— 0.02	— 0.00	16 34.90	10 17.77	17.13
E.	τ Draconis	24 13.11	— 0.47	+ 0.15	+ 0.02	24 12.81	17 56.14	16.67
E.	β Cygni	31 56.40	+ 0.07	+ 0.05	+ 0.01	31 56.53	25 39.74	16.79
E.	κ Aquilæ	36 25.44	+ 0.20	+ 0.05	+ 0.00	36 25.69	30 08.68	17.01
E.	γ Aquilæ	46 34.71	+ 0.14	+ 0.09	+ 0.00	46 34.94	40 17.88	17.06
E.	α Aquilæ	50 56.71	+ 0.14	+ 0.10	+ 0.01	50 56.96	44 39.92	17.04
E.	ε Draconis	54 51.90	— 0.36	+ 0.38	+ 0.01	54 51.93	48 34.63	17.30
E.	γ Sagittæ	59 27.62	+ 0.10	+ 0.15	+ 0.01	59 27.88	53 10.87	17.01
E.	3 Urs. Majoris, L. C.	20 06 35.43	+ 0.68	— 0.14	0.02	20 06 35.95	20 00 19.03	— 6 16.92

NORMAL EQUATIONS.

$$0 = +0.94 + 15.00\,\delta t + 1.59\,a - 2.11\,c$$
$$0 = +5.06 + 1.59\,\delta t + 19.40\,a - 8.41\,c \qquad a = +0^s.260$$
$$0 = -1.99 - 2.11\,\delta t - 8.41\,a + 57.30\,c \qquad c = +0^s.005 \text{ for E.}$$

OGDEN, UTAH, OCTOBER 15, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	β Cephei	21 33 19.68	— 0.24	+ 0.18	0.00	21 33 19.62	21 27 02.52	— 6 17.10
E.	ξ Aquarii	37 21.97	+ 0.13	+ 0.04	0.00	37 22.14	31 05.21	16.93
E.	ε Pegasi	44 18.96	+ 0.09	+ 0.06	0.00	44 19.11	38 02.26	16.95
E.	11 Cephei	46 22.27	— 0.25	+ 0.21	0.00	46 22.23	40 05.36	16.87
E.	μ Capricorni	52 45.08	+ 0.14	+ 0.05	0.00	52 45.27	46 28.34	16.93
E.	79 Draconis	57 36.13	— 0.30	+ 0.26	0.00	57 36.09	51 19.18	16.91
E.	α Aquarii	22 05 38.16	+ 0.11	+ 0.07	0.00	22 05 38.34	59 21.34	17.00
W.	ζ Cephei	12 47.87	+ 0.06	0.00	0.00	12 47.93	22 06 30.95	16.98
W.	θ Aquarii	16 31.10	— 0.10	— 0.01	0.00	16 30.99	10 13.85	17.14
W.	γ Aquarii	21 28.87	— 0.08	— 0.03	0.00	21 28.76	15 11.58	17.18
W.	π Aquarii	25 10.40	— 0.08	— 0.05	0.00	25 10.27	18 53.21	17.06
W.	9 Draconis, L. C.	30 38.63	— 0.46	+ 0.18	0.00	30 38.35	24 21.58	16.77
W.	226 Cephei	35 22.08	+ 0.27	— 0.23	0.00	35 22.12	29 05.36	16.76
W.	ζ Pegasi	41 30.52	— 0.06	— 0.04	0.00	41 30.42	35 13.28	— 6 17.14

NORMAL EQUATIONS.

For E.: $0 = +0.01 + 7.00\,\delta t - 1.89\,a$
$0 = -1.52 + 1.89\,\delta t + 9.57\,a \qquad a = +0^s.167$

For W.: $0 = +0.48 + 7.00\,\delta t + 3.66\,a$
$0 = +2.59 + 3.66\,\delta t + 21.05\,a \qquad a = -0^s.122$

Adopted $c = 0^s.00$.

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 15, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	ι Ceti	0 19 21.14	— 0.07	— 0.01	— 0.02	0 19 21.04	0 13 03.63	— 6 17.41
W.	12 Ceti	29 57.01	— 0.06	— 0.01	— 0.02	29 56.92	23 39.64	17.28
W.	ζ Cassiopeiæ	36 18.20	+ 0.03	— 0.02	— 0.03	36 18.18	30 00.95	17.23
W.	α Cassiopeiæ	39 42.71	+ 0.04	— 0.01	— 0.03	39 42.71	33 25.56	17.15
W.	21 Cassiopeiæ	43 43.63	+ 0.18	0.00	— 0.07	43 43.74	37 26.57	17.17
W.	μ Andromedæ	56 06.37	— 0.01	0.00	— 0.03	56 06.33	49 48.90	17.43
E.	ε Piscium	1 02 44.65	— 0.05	+ 0.05	+ 0.02	1 02 44.67	56 27.43	17.24
E.	β Andromedæ	09 01.19	— 0.01	+ 0.07	+ 0.03	09 01.28	1 02 44.18	17.10
E.	τ Piscium	11 03.85	— 0.02	+ 0.06	+ 0.02	11 03.91	04 46.76	17.15
E.	υ Piscium	18 53.06	— 0.03	+ 0.04	+ 0.02	18 53.09	12 35.86	17.23
E.	θ¹ Ceti	24 04.23	— 0.07	+ 0.02	+ 0.02	24 04.20	17 46.75	17.45
E.	38 Cassiopeiæ	27 14.99	+ 0.12	+ 0.05	+ 0.05	27 15.21	20 57.95	— 6 17.26

NORMAL EQUATIONS.

$0 = + 0.08 + 12.00\,\delta t - 0.60\,a - 2.05\,c$ $\qquad a = -\,0^s.092$
$0 = + 0.67 - 0.60\,\delta t + 8.48\,a + 5.41\,c$ $\qquad c = +\,0^s.019$
$0 = - 0.25 - 2.05\,\delta t + 5.41\,a + 37.65\,c$

OGDEN, UTAH, OCTOBER 16, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	α Lyræ	18 38 43.03	+ 0.02	+ 0.19	+ 0.10	18 38 43.34	18 32 41.06	— 6 02.28
E.	β Lyræ	51 28.63	+ 0.06	+ 0.18	+ 0.10	51 28.97	45 26.60	02.37
E.	σ Sagittarii	53 31.09	+ 0.34	+ 0.06	+ 0.09	53 31.58	47 29.16	02.42
E.	γ Lyræ	19 00 16.87	+ 0.06	+ 0.18	+ 0.10	19 00 17.21	54 14.85	02.36
E.	ζ Aquilæ	05 40.57	+ 0.16	+ 0.15	+ 0.08	05 40.96	59 38.49	02.47
E.	ι Lyræ	08 51.31	+ 0.03	+ 0.20	+ 0.10	08 51.64	19 02 49.34	02.30
E.	d Sagittarii	16 19.79	+ 0.30	+ 0.09	+ 0.08	16 20.26	10 17.76	02.50
W.	τ Draconis	23 59.73	— 0.60	— 0.17	— 0.28	23 58.68	17 56.06	02.62
W.	β Cygni	31 41.90	+ 0.09	— 0.06	— 0.09	31 41.84	25 39.72	02.12
W.	κ Aquilæ	36 10.95	+ 0.25	— 0.01	— 0.08	36 11.11	30 08.67	02.44
W.	γ Aquilæ	46 20.09	+ 0.17	0.00	— 0.08	46 20.18	40 17.87	02.31
W.	α Aquilæ	50 42.15	+ 0.18	+ 0.02	— 0.08	50 42.27	44 39.91	02.36
W.	ε Draconis	54 37.49	— 0.46	+ 0.11	— 0.23	54 36.91	48 34.57	02.34
W.	γ Sagittæ	59 13.12	+ 0.13	+ 0.05	— 0.08	59 13.22	53 10.87	02.35
W.	3 Urs. Majoris, L. C.	20 06 20.57	+ 0.86	— 0.04	+ 0.22	20 06 21.61	20 00 19.11	— 6 02.50

NORMAL EQUATIONS.

$0 = + 1.20 + 15.00\,\delta t + 4.82\,a - 0.74\,c$ $\qquad a = +\,0^s.330$
$0 = - 5.73 + 4.82\,\delta t + 15.62\,a + 18.22\,c$ $\qquad c = +\,0^s.080$
$0 = - 9.58 - 0.74\,\delta t + 18.22\,a + 43.01\,c$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 16, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	1 Pegasi	21 22 20.05	+ 0.02	+ 0.06	− 0.05	21 22 20.08	21 16 17.74	− 6 02.34
W.	β Aquarii	31 00.63	+ 0.04	+ 0.03	− 0.05	31 00.65	24 58.06	02.59
W.	β Cephei	33 05.40	− 0.07	+ 0.05	− 0.15	33 05.23	27 02.46	02.77
W.	ξ Aquarii	37 07.62	+ 0.04	0.00	− 0.05	37 07.61	31 05.20	02.41
W.	ε Pegasi	44 04.66	+ 0.03	− 0.02	− 0.05	44 04.62	38 02.25	02.37
W.	11 Cephei	46 08.24	− 0.07	− 0.08	− 0.15	46 07.94	40 05.30	02.64
W.	μ Capricorni	52 30.98	+ 0.04	− 0.03	− 0.05	52 30.94	46 28.33	02.61
W.	79 Draconis	57 22.14	− 0.09	− 0.14	− 0.17	57 21.74	51 19.12	02.62
E.	α Aquarii	22 05 23.84	+ 0.03	+ 0.09	+ 0.05	22 05 24.01	59 21.33	02.68
E.	ζ Cephei	12 33.28	− 0.03	+ 0.21	+ 0.09	12 33.55	22 06 30.92	02.63
E.	θ Aquarii	16 16.34	+ 0.04	+ 0.07	+ 0.05	16 16.50	10 13.84	02.66
E.	γ Aquarii	21 14.20	+ 0.03	+ 0.08	+ 0.05	21 14.36	15 11.57	02.79
E.	π Aquarii	24 55.70	+ 0.03	+ 0.08	+ 0.05	24 55.86	18 53.20	02.66
E.	9 Draconis, L. C	30 24.57	+ 0.19	− 0.20	− 0.21	30 24.35	24 21.66	02.69
E.	226 Cephei	26 07.43	− 0.11	+ 0.33	+ 0.20	26 07.85	20 05.30	− 6 02.55

NORMAL EQUATIONS.

$$0 = +0.33 + 15.00\,\delta t + 2.39\,a - 8.87\,c \qquad\qquad$$
$$0 = -0.99 + 2.39\,\delta t + 31.06\,a - 11.49\,c \qquad a = +0^s.051$$
$$0 = -3.30 - 8.87\,\delta t - 11.49\,a + 76.52\,c \qquad c = +0^s.051$$

OGDEN, UTAH, OCTOBER 16, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	α Andromedæ	0 07 57.79	+ 0.19	+ 0.23	+ 0.01	0 07 58.22	0 01 55.56	− 6 02.66
E.	22 Andromedæ	09 51.91	− 0.07	+ 0.30	+ 0.02	09 52.16	03 49.71	02.45
E.	γ Pegasi	12 50.09	+ 0.35	+ 0.19	+ 0.01	12 50.64	06 47.92	02.72
E.	Groombridge 29	15 15.09	− 1.80	+ 0.72	+ 0.05	15 14.06	09 11.24	02.82
E.	ι Ceti	19 05.66	+ 0.59	+ 0.13	+ 0.01	19 06.39	13 03.63	02.76
E.	12 Ceti	29 41.66	+ 0.54	+ 0.14	+ 0.01	29 42.35	23 39.64	02.71
E.	ζ Cassiopeiæ	36 03.58	− 0.26	+ 0.32	+ 0.02	36 03.66	30 00.95	02.71
W.	α Cassiopeiæ	39 28.30	− 0.34	+ 0.09	− 0.02	39 28.03	33 25.56	02.47
W.	21 Cassiopeiæ	43 30.70	− 1.51	+ 0.12	− 0.04	43 29.27	37 26.57	02.70
W.	μ Andromedæ	55 51.77	+ 0.06	+ 0.05	− 0.02	55 51.86	49 48.89	02.97
W.	ε Piscium	1 02 29.88	+ 0.43	+ 0.03	− 0.01	1 02 30.33	56 27.43	02.90
W.	β Andromedæ	08 46.85	+ 0.10	+ 0.04	− 0.01	08 46.98	1 02 44.18	02.80
W.	τ Piscium	10 49.27	+ 0.18	+ 0.02	− 0.01	10 49.46	04 46.76	− 6 02.70

NORMAL EQUATIONS.

$$0 = +1.83 + 13.00\,\delta t - 2.07\,a + 1.36\,c \qquad\qquad$$
$$0 = -9.00 - 2.07\,\delta t + 12.02\,a - 1.40\,c \qquad a = +0^s.746$$
$$0 = +0.50 + 1.36\,\delta t - 1.40\,a + 49.22\,c \qquad c = +0^s.012$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 17, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Lyræ	18 38 45.16	+ 0.11	+ 0.11	— 0.16	18 38 45.22	18 32 41.04	— 6 04.18
W.	β Lyræ	51 30.54	+ 0.31	+ 0.10	— 0.14	51 30.81	45 26.58	04.23
W.	σ Sagittarii	53 31.74	+ 1.88	+ 0.03	— 0.13	53 33.52	47 29.14	04.38
W.	γ Lyræ	19 00 18.76	+ 0.33	+ 0.10	— 0.14	19 00 19.05	54 14.84	04.21
W.	ζ Aquilæ	05 42.08	+ 0.87	+ 0.07	— 0.13	05 42.89	59 38.47	04.42
W.	ι Lyræ	08 53.40	+ 0.20	+ 0.10	— 0.15	08 53.55	19 02 49.32	04.23
W.	d Sagittarii	16 20.48	+ 1.68	+ 0.04	— 0.13	16 22.07	10 17.74	04.33
E.	τ Draconis	24 02.62	— 3.32	+ 0.52	+ 0.42	24 00.24	17 55.97	04.27
E.	β Cygni	31 42.93	+ 0.49	+ 0.19	+ 0.14	31 43.75	25 39.70	04.05
E.	κ Aquilæ	36 11.33	+ 1.38	+ 0.12	+ 0.12	36 12.95	30 08.65	04.30
E.	γ Aquilæ	46 20.90	+ 0.95	+ 0.13	+ 0.12	46 22.10	40 17.85	04.25
E.	α Aquilæ	50 42.90	+ 0.98	+ 0.13	+ 0.12	50 44.13	44 39.89	04.24
E.	ε Draconis	54 40.70	— 2.56	+ 0.38	+ 0.35	54 38.87	48 34.50	04.37
E.	γ Sagittæ	59 14.08	+ 0.73	+ 0.15	+ 0.13	59 15.09	53 10.85	— 6 04.24

NORMAL EQUATIONS.

$$0 = -\ 3.55 + 14.00\,\delta t + 2.22\,a + 3.49\,c$$
$$0 = -\ 14.66 + 2.22\,\delta t + 8.86\,a - 11.02\,c \qquad a = +\ 1^{s}.822$$
$$0 = +\ 16.02 + 3.49\,\delta t - 11.02\,a + 35.34\,c \qquad c = +\ 0^{s}.121$$

OGDEN, UTAH, OCTOBER 20, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	α Lyræ	18 38 49.06	+ 0.10	+ 0.13	+ 0.28	18 38 49.57	18 32 40.97	— 6 08.60
E.	β Lyræ	51 34.61	+ 0.29	+ 0.09	+ 0.26	51 35.25	45 26.51	08.74
E.	γ Lyræ	19 00 22.73	+ 0.31	+ 0.07	+ 0.25	19 00 23.36	54 14.79	08.57
E.	ζ Aquilæ	05 46.03	+ 0.83	+ 0.04	+ 0.22	05 47.12	59 38.42	08.70
E.	ι Lyræ	08 57.37	+ 0.19	+ 0.02	+ 0.26	08 57.84	19 02 49.24	08.60
E.	d Sagittarii	16 24.47	+ 1.58	— 0.01	+ 0.23	16 26.27	10 17.69	08.58
E.	δ Draconis	18 40.32	— 1.97	— 0.12	+ 0.56	18 38.79	12 30.18	08.61
E.	τ Draconis	24 07.03	— 3.13	— 0.15	+ 0.74	24 04.49	17 55.73	08.76
W.	β Cygni	31 48.09	+ 0.47	— 0.14	— 0.24	31 48.18	25 39.64	08.54
W.	κ Aquilæ	36 16.43	+ 1.21	— 0.09	— 0.22	36 17.33	30 08.60	08.73
W.	γ Aquilæ	46 25.94	+ 0.89	— 0.12	— 0.22	46 26.49	40 17.80	08.69
W.	α Aquilæ	50 47.96	+ 0.93	— 0.13	— 0.22	50 48.54	44 39.84	08.70
W.	ε Draconis	54 46.36	— 2.41	— 0.41	— 0.62	54 42.92	48 34.29	08.63
W.	γ Sagittarii	59 19.10	+ 0.69	— 0.17	— 0.23	59 19.39	53 10.79	08.60
W.	τ Aquilæ	20 04 08.94	+ 0.98	— 0.13	— 0.22	20 04 09.57	57 00.88	— 6 08.69

NORMAL EQUATIONS.

$$0 = +\ 3.45 + 15.00\,\delta t + 0.61\,a + 3.88\,c$$
$$0 = -\ 14.70 + 0.61\,\delta t + 9.44\,a - 6.22\,c \qquad a = +\ 1^{s}.721$$
$$0 = +\ 3.12 + 3.88\,\delta t - 6.22\,a + 41.94\,c \qquad c = +\ 0^{s}.214$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 20, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	12 Ceti	0 26 47.73	+ 1.24	— 0.15	— 0.21	0 26 48.61	8 20 39.67	— 6 08.94
W.	ζ Cassiopeiæ	36 11.10	— 0.60	— 0.33	— 0.34	36 09.83	30 00.96	08.87
W.	α Cassiopeiæ	39 35.96	— 0.77	— 0.36	— 0.36	39 34.47	33 25.55	08.92
W.	21 Cassiopeiæ	43 40.78	— 3.47	— 0.65	— 0.75	43 35.91	37 26.52	09.39
W.	Bradley 82	49 21.23	— 1.46	— 0.42	— 0.46	49 18.89	43 09.56	09.33
W.	μ Andromedæ	55 58.43	+ 0.14	— 0.25	— 0.26	55 58.06	49 48.90	09.16
W.	ε Piscium	1 02 35.88	+ 0.98	— 0.27	— 0.20	1 02 36.49	56 27.44	09.05
W.	β Andromedæ	08 53.40	+ 0.22	— 0.24	— 0.25	08 53.13	1 02 44.18	08.95
W.	τ Piscium	10 55.68	+ 0.41	— 0.23	— 0.23	10 55.63	04 46.76	08.87
E.	υ Piscium	18 44.42	+ 0.48	— 0.03	+ 0.23	18 45.10	12 35.86	09.24
E.	θ¹ Ceti	23 54.75	+ 1.34	— 0.02	+ 0.21	23 56.28	17 46.78	09.50
E.	32 Cassiopeiæ	28 08.73	— 2.36	— 0.13	+ 0.58	28 06.82	21 57.98	08.84
E.	η Piscium	30 56.19	+ 0.79	— 0.06	+ 0.21	30 57.13	24 47.70	— 6 09.43

NORMAL EQUATIONS.

$$0 = + \ 6.38 + 13.00\,\delta t - 1.78\,a - \ 9.00\,c$$
$$0 = - 16.65 - \ 1.78\,\delta t + 8.79\,a + \ 6.57\,c \qquad a = + 1^s.720$$
$$0 = - 21.01 - \ 9.00\,\delta t + 6.57\,a + 42.75\,c \qquad c = + 0^s.203$$

OGDEN, UTAH, OCTOBER 29, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	α Pegasi	21 44 24.07	+ 0.34	— 0.05	+ 0.15	21 44 24.51	21 38 02.08	— 6 22.43
E.	μ Capricorni	52 50.05	+ 0.54	— 0.03	+ 0.15	52 50.71	46 28.16	22.55
E.	79 Draconis	57 42.26	— 1.16	— 0.23	+ 0.50	57 41.37	51 18.29	23.08
E.	α Aquarii	22 05 43.42	+ 0.43	— 0.06	+ 0.14	22 05 43.93	59 21.19	22.74
E.	ζ Cephei	12 53.40	— 0.33	— 0.19	+ 0.27	12 53.15	22 06 30.54	22.61
E.	θ Aquarii	16 35.88	+ 0.50	— 0.07	+ 0.15	16 36.46	10 13.70	22.76
E.	γ Aquarii	21 33.73	+ 0.43	— 0.09	+ 0.14	21 34.21	15 11.43	22.78
E.	π Aquarii	25 15.34	+ 0.41	— 0.09	+ 0.14	25 15.80	18 53.07	22.73
E.	9 Draconis, L. C.	30 43.41	+ 2.40	+ 0.28	— 0.61	30 45.48	24 22.80	22.68
E.	226 Cephei	36 28.12	— 1.41	— 0.46	+ 0.58	36 26.83	30 04.44	22.39
W.	ζ Pegasi	41 36.25	+ 0.33	— 0.17	— 0.15	41 36.26	35 13.14	23.12
W.	η Pegasi	43 31.16	+ 0.15	— 0.22	— 0.17	43 30.92	37 08.17	22.75
W.	λ Pegasi	46 53.23	+ 0.21	— 0.20	— 0.15	46 53.09	40 30.16	— 6 22.93

NORMAL EQUATIONS.

$$0 = - \ 0.93 + 13.00\,\delta t + \ 4.46\,a + \ 7.92\,c$$
$$0 = - 11.35 + \ 4.46\,\delta t + 25.98\,a - 28.96\,c \qquad a = + 0^s.638$$
$$0 = + 11.81 + \ 7.92\,\delta t - 28.96\,a + 59.16\,c \qquad c = + 0^s.144$$

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 29, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	μ Andromedæ	0 56 12.21	0.00	— 0.25	— 0.22	0 56 11.74	0 49 48.92	— 6 22.82
W.	ε Piscium	1 02 50.57	— 0.03	— 0.16	— 0.17	1 02 50.21	56 27.46	22.75
W.	β Andromedæ	09 07.26	0.00	— 0.24	— 0.21	09 06.81	1 02 44.22	22.59
W.	τ Piscium	11 09.81	— 0.01	— 0.22	— 0.20	11 09.38	04 46.80	22.58
W.	υ Piscium	18 59.03	— 0.01	— 0.19	— 0.19	18 58.64	12 35.91	22.73
W.	θ¹ Ceti	24 10.05	— 0.04	— 0.10	— 0.17	24 09.74	17 46.81	22.93
W.	38 Cassiopeiæ	28 21.66	+ 0.06	— 0.40	— 0.49	28 20.83	21 58.01	22.82
W.	η Piscium	31 10.97	— 0.02	— 0.14	— 0.18	31 10.63	24 47.75	22.88
W.	υ Persei	36 42.87	+ 0.01	— 0.22	— 0.26	36 42.40	30 19.64	22.76
W.	φ Persei	42 13.41	+ 0.01	— 0.24	— 0.27	42 12.91	35 50.22	22.69
W.	ο Piscium	45 10.89	— 0.02	— 0.14	— 0.17	45 10.56	38 47.81	22.75
E.	ε Cassiopeiæ	51 48.13	+ 0.04	— 0.16	+ 0.38	51 48.39	45 25.65	22.74
E.	β Arietis	54 06.94	— 0.02	— 0.08	+ 0.18	54 07.02	47 44.26	22.76
E.	50 Cassiopeiæ	59 11.14	+ 0.07	— 0.25	+ 0.55	59 11.51	52 48.70	22.81
E.	γ Andromedæ	2 02 36.47	0.00	— 0.14	+ 0.23	2 02 36.56	56 13.89	22.67
E.	α Arietis	06 30.37	— 0.01	— 0.10	+ 0.18	06 30.44	2 00 07.81	22.63
E.	ξ¹ Ceti	12 45.46	— 0.02	— 0.09	+ 0.17	12 45.52	06 22.64	— 6 22.88

NORMAL EQUATIONS.

$$0 = -1.68 + 17.00\,\delta t + 0.10\,a - 4.86\,c$$
$$0 = +1.08 + 0.10\,\delta t + 7.46\,a - 4.42\,c \qquad a = -0^s.045$$
$$0 = -6.86 - 4.86\,\delta t - 4.42\,a + 42.97\,c \qquad c = +0^s.172$$

OGDEN, UTAH, OCTOBER 31, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	226 Cephei	22 36 28.93	+ 0.43	— 0.43	— 0.64	22 36 28.29	22 30 04.30	— 6 23.99
W.	ζ Pegasi	41 38.06	— 0.10	— 0.11	— 0.16	41 37.69	35 13.12	24.57
W.	η Pegasi	43 33.04	— 0.04	— 0.14	— 0.18	43 32.68	37 08.14	24.54
W.	λ Pegasi	46 54.96	— 0.06	— 0.14	— 0.17	46 54.59	40 30.14	24.45
W.	ι Cephei	51 38.61	+ 0.18	— 0.29	— 0.38	51 38.12	45 13.70	24.42
E.	α Pegasi	23 04 56.72	— 0.70	— 0.05	+ 0.16	23 04 56.13	58 31.71	24.42
E.	π Cephei	10 16.58	+ 3.12	— 0.19	+ 0.60	10 20.11	23 03 55.77	24.34
E.	ο Cephei	19 52.73	+ 1.72	— 0.19	+ 0.41	19 54.67	13 29.97	24.70
E.	υ Pegasi	25 33.13	— 0.52	— 0.09	+ 0.17	25 32.69	19 08.17	24.52
E.	λ Draconis, L. C.	30 24.30	— 4.07	+ 0.09	— 0.46	30 19.86	23 55.39	— 6 24.47

NORMAL EQUATIONS.

For W.: $0 = -2.94 + 5.00\,\delta t - 2.12\,a$
$0 = +2.29 - 2.12\,\delta t + 6.29\,a \qquad a = -0^s.194$

For E.: $0 = -1.00 + 5.00\,\delta t + 0.30\,a$
$0 = +19.99 + 0.30\,\delta t + 13.48\,a \qquad a = -1^s.492$

Adopted $c = +0.158$ for E.

Observations and reductions for time taken at sending station—Continued.

OGDEN, UTAH, OCTOBER 31, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	ε Cassiopeiæ......	1 51 48.86	+ 1.16	— 0.20	+ 0.35	1 51 50.17	1 45 25.66	— 6 24.51
E.	β Arietis	54 09.25	— 0.54	— 0.10	+ 0.17	54 08.78	47 44.27	24.51
E.	50 Cassiopeiæ......	59 10.91	+ 2.30	— 0.22	+ 0.51	59 13.50	52 48.71	24.79
E.	γ Andromedæ	2 02 38.33	+ 0.01	— 0.08	+ 0.21	2 02 38.47	56 13.90	24.57
E.	α Arietis	06 32.72	— 0.47	— 0.05	+ 0.17	06 32.37	2 00 07.83	24.54
E.	ξ¹ Ceti	12 47.97	— 0.78	— 0.04	+ 0.16	12 47.31	06 22.66	24.65
W.	ι Cassiopeiæ......	25 11.92	+ 1.55	— 0.57	— 0.40	25 12.50	18 47.90	24.60
W.	ξ² Ceti	27 56.85	— 0.78	— 0.21	— 0.16	27 55.70	21 30.98	24.72
W.	δ Ceti	39 30.93	— 0.93	— 0.19	— 0.16	39 29.65	33 04.86	24.79
W.	θ Persei	42 05.14	+ 0.28	— 0.38	— 0.24	42 04.80	35 40.29	24.51
W.	μ Ceti	44 37.06	— 0.75	— 0.22	— 0.16	44 35.93	38 11.30	— 6 24.63

NORMAL EQUATIONS.

$$0 = -\ 2.38 + 11.00\,\delta t - 0.76\,a + \ 2.81\,c$$
$$0 = +\ 9.44 - \ 0.76\,\delta t + 6.15\,a - \ 4.38\,c \qquad a = -1^{s}.413$$
$$0 = -11.48 + \ 2.81\,\delta t - 4.38\,a + 32.07\,c \qquad c = +0^{s}.158$$

NOTE.—The instrument had to be removed from its pier every day to allow the carpenter to work in the observing-room.

Observations and reductions for time taken at receiving station.

NAVAL OBSERVATORY, WASHINGTON, D. C.

Date.	Star.	Observed place.	Aa.	Bb.	Cc.	Instrumental corrections.	Corrected transit.	Adopted right ascension.	Observed clock-corrections.	v.
1874.		*h. m. s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	
Oct. 15	γ Pegasi	0 07 38.52	— 0.47	— 0.44	— 0.01	— 0.92	37.60	47.92	—49.68	—0.02
	β Ceti	38 10.13	— 0.97	— 0.27	— 0.01	— 1.25	08.88	19.19	.69	—0.01
	ε Piscium.....	0 57 18.10	— 0.58	— 0.40	— 0.01	— 0.99	17.11	27.44	.67	+0.02
	Polaris......	1 13 50.50	+35.13	—13.08	— 0.42	+21.63	12.13	22.36	....	......
	θ¹ Ceti	18 37.61	— 0.82	— 0.32	— 0.01	— 1.15	36.46	46.77	.69	+0.02
	η Piscium.....	1 25 38.32	— 0.46	— 0.44	— 0.01	— 0.91	37.41	47.74	.67	+0.04
	ξ¹ Ceti	2 07 13.26	— 0.56	— 0.41	— 0.01	— 0.98	12.28	22.54	.74	0.00
	γ Ceti	2 37 40.33	— 0.64	— 0.38	— 0.01	— 1.03	39.30	49.52	—49.78	—0.02
Oct. 16	α Andromedæ.	0 02 46.33	— 0.23	— 0.50	— 0.01	— 0.74	45.59	55.58	—50.01	+0.01
	β Ceti	38 10.42	— 0.97	— 0.25	— 0.01	— 1.23	09.19	19.19	.00	+0.02
	ε Piscium.....	0 57 18.48	— 0.58	— 0.39	— 0.01	— 0.98	17.50	27.45	.05	—0.04
	Polaris......	1 13 50.00	+35.13	—12.26	— 0.42	+22.45	12.45	22.39	....	......
	θ¹ Ceti	18 37.92	— 0.82	— 0.31	— 0.01	— 1.14	36.78	46.78	—50.00	0.00
	η Piscium.....	25 38.64	— 0.46	— 0.42	— 0.01	— 0.89	37.75	47.75	—50.00	0.00
	β Arietis	1 48 34.97	— 0.37	— 0.45	— 0.01	— 0.83	34.14	44.17	—49.97	+0.02
	ξ¹ Ceti	2 07 13.47	— 0.56	— 0.39	— 0.01	— 0.96	12.51	22.55	—49.96	+0.02

Observations and reductions for time taken at receiving station—Continued.

NAVAL OBSERVATORY, WASHINGTON, D. C.

Date.	Star.	Observed place.	Aa.	Bb.	Cc.	Instrumental corrections.	Corrected transit.	Adopted right ascension.	Observed clock-corrections.	v.
1874.		h. m. s.	s.	s.	s.	s.	s.	s.	s.	
Oct. 20	ε Piscium.....	0 57 19.66	— 0.56	— 0.39	— 0.02	— 0.97	18.69	27.46	—51.23	+0.01
	Polaris......	1 13 52.82	+33.84	—12.54	— 0.85	+20.45	13.27	22.00	....	......
	θ¹ Ceti	18 39.21	— 0.79	— 0.31	— 0.02	— 1.12	38.09	46.80	.29	—0.05
	ο Piscium.....	1 39 39.89	— 0.54	— 0.40	— 0.02	— 0.96	38.93	47.73	.20	+0.04
	α Arietis	2 00 59.77	— 0.32	— 0.48	— 0.02	— 0.82	58.95	07.73	.22	+0.02
	ξ¹ Ceti	07 14.81	— 0.54	— 0.40	— 0.02	— 0.96	13.85	22.59	.26	—0.02
	γ Ceti	37 41.84	— 0.62	— 0.37	— 0.02	— 1.01	40.83	49.58	.25	—0.01
	α Ceti	2 56 37.10	— 0.61	— 0.38	— 0.02	— 1.01	36.09	44.86	—51.23	+0.01
Oct. 29	ε Piscium.....	0 57 21.52	— 0.56	— 0.42	— 0.11	— 1.09	20.43	27.48	—52.95	+0.03
	Polaris......	1 13 58.10	+34.16	—13.37	— 4.64	+16.15	14.25	21.42	....	......
	θ¹ Ceti	18 41.13	— 0.79	— 0.33	— 0.11	— 1.23	39.90	46.83	—53.07	—0.08
	η Piscium.....	25 41.87	— 0.45	— 0.46	— 0.11	— 1.02	40.85	47.82	—53.03	—0.03
	ο Piscium.....	39 41.82	— 0.54	— 0.43	— 0.11	— 1.08	40.74	47.79	—52.95	+0.06
	β Arietis......	1 48 38.22	— 0.36	— 0.49	— 0.12	— 0.97	37.25	44.29	—52.96	+0.05
	α Arietis......	2 01 01.80	— 0.32	— 0.51	— 0.12	— 0.95	00.85	07.83	—53.02	0.00
	ξ¹ Ceti	2 07 16.86	— 0.55	— 0.43	— 0.11	— 1.09	15.77	22.69	—53.08	—0.05
Oct. 31	γ²·Ur. Min., S.P.	3 21 49.73	— 3.19	+ 0.46	— 0.03	— 2.76	46.97	53.37	....	......
	η Tauri.......	40 57.57	— 0.30	— 0.41	+ 0.01	— 0.70	56.87	03.40	—53.47	+0.01
	ζ Persei	3 47 10.70	— 0.16	— 0.45	+ 0.01	— 0.60	10.10	16.65	.45	+0.03
	γ Tauri.......	4 13 35.17	— 0.43	— 0.37	+ 0.01	— 0.79	34.38	40.91	.47	+0.01
	ε Tauri.......	22 13.42	— 0.38	— 0.39	+ 0.01	— 0.76	12.66	19.11	.55	—0.07
	α Tauri.......	29 39.24	— 0.42	— 0.38	+ 0.01	— 0.79	38.45	44.94	.51	—0.03
	9 Camelop	42 31.67	+ 1.15	— 0.86	+ 0.02	+ 0.31	31.98	38.51	....	......
	ι Aurigæ	49 45.22	— 0.13	— 0.46	+ 0.01	— 0.58	44.64	51.16	.48	0.00
	11 Orionis.....	58 19.80	— 0.43	— 0.37	+ 0.01	— 0.79	19.01	25.55	.46	+0.02
	ε Ur. Min., S.P.	4 59 44.67	— 6.59	+ 1.49	— 0.07	— 5.17	39.50	46.04	....	......
	β Orionis.....	5 09 26.47	— 0.77	— 0.27	+ 0.01	— 1.03	25.44	31.97	—53.47	+0.01

The following tables show the corrections and rates of the chronometers used at Ogden and of the clock at the Naval Observatory, Washington, D. C.:

CHRONOMETER AT OGDEN.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1874.	h.	h. m. s.	s.
Oct. 15	23.40	— 0 06· 17.120	+ 0.0533

CHRONOMETER AT OGDEN.—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of clock.	Adopted hourly rate.
1874.	h.	h. m. s.	s.
Oct. 16	23.23	— 0 06 02.660	+ 0.0891
Oct. 17	19.20	04.260	+ 0.0917
Oct. 20	22.08	08.883	+ 0.0634
Oct. 29	23.81	22.742	+ 0.0367
Oct. 31	00.58	— 0 06 24.530	+ 0.0367

CLOCK AT WASHINGTON.—KESSELS.

Date.	Local sidereal time.	Correction of clock.	Adopted hourly rate.
1874.	h. m.	s. s.	s.
Oct. 15	1 40	— 49.717 ± 0.006	— 0.040
Oct. 16	1 40	— 49.986 ± 0.006	+ 0.026
Oct. 20	1 50	— 51.240 ± 0.008	+ 0.004
Oct. 29	2 00	— 53.025 ± 0.013	— 0.042
Oct. 31	3 30	— 53.480 ± 0.008	— 0.003

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
Oct. 15, 1874:		h. m. s.	h. m. s.	h. m. s	h. m. s.	s.	h. m. s.
Washington	Ogden	23 24 10.829	— 0 06 17.115	23 17 53.714			
	Washington	1 38 30.526	— 0 00 49.719	1 37 40.807	2 19 47.093		
Ogden	Ogden	23 45 10.526	— 0 06 17.132	23 38 53.394			
	Washington	1 59 30.700	— 0 00 49.710	1 58 40.990	47.596	0.503	2 19 47.345
Oct. 16, 1874:							
Ogden	Ogden	23 23 09.199	— 0 06 02.664	23 17 06.535			
	Washington	1 37 44.204	— 0 00 49.985	1 36 54.219	47.684		
Washington	Ogden	23 47 02.271	— 0 06 02.695	23 40 59.575			
	Washington	2 01 36.707	— 0 00 49.995	2 00 36.712	47.137	0.547	47.410
Oct. 20, 1874:							
Ogden	Ogden	23 36 26.592	— 0 06 08.973	23 20 17.619			
	Washington	1 50 56.541	— 0 00 51.240	1 50 05.301	47.682		
Washington	Ogden	0 06 01.137	— 0 06 09.003	23 59 52.134			
	Washington	2 20 30.526	— 0 00 51.242	2 19 39.284	47.150	0.532	47.416
Oct. 29, 1874:							
Washington	Ogden	0 25 18.561	— 0 06 22.760	0 18 55.801			
	Washington	2 39 36.161	— 0 00 53.000	2 38 43.161	47.360		
Ogden	Ogden	0 32 31.852	— 0 06 22.765	0 26 09.087			
	Washington	2 46 49.998	— 0 00 52.993	2 45 57.005	47.918	0.558	47.639
Oct. 31, 1874:							
Washington	Ogden	1 17 19.526	— 0 06 24.552	1 10 54.974			
	Washington	3 31 36.159	— 0 00 53.480	3 30 42.679	47.705		
Ogden	Ogden	1 24 09.350	— 0 06 24.556	1 17 44.794			
	Washington	3 38 25.464	— 0 00 53.480	3 37 31.984	2 19 47.190	0.515	2 19 47.448

Ogden west of Washington	$2^h\ 19^m\ 47^s.452$
Reduction to center of dome	$+\ 0^s.040$
Ogden west of Washington, final value	$2^h\ 19^m\ 47^s.492$

Observations and computations for latitude.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
1874. September 28.	6470	10 43.5	30.0	20.0					
	6534	28 98.0	25.0	26.0		41 03 30.3	+ 9 35.4	+2.5	41 13 08.2
	6553	18 99.0	22.0	30.0					
	6659	13 26.0	38.0	15.0		10 07.7	+ 2 57.8	+4.1	09.6
	6698	29 15.0	23.0	30.0					
	6721	8 69.0	34.0	19.0		02 33.4	+10 36.8	+2.2	12.4
	6777	24 83.0	20.0	34.0					
	6799	17 55.0	39.0	13.0		09 22.1	+ 3 45.9	+3.3	11.3
	6830	18 17.0	39.0	14.0					
	6851	22 31.0	20.0	34.0		10 58.2	+ 2 08.4	+3.0	09.6
	6915	30 10.5	18.0	35.0					
	6962	8 84.5	43.0	11.0		02 07.0	+10 59.6	+4.1	10.7
	6986	26 16.5	31.0	23.0					
	7041	11 25.5	29.0	25.0		05 21.3	+ 7 42.6	+3.3	07.2
	7073	23 87.0	27.0	27.0					
	7112	16 28.5	33.0	22.0		09 12.1	+ 3 55.4	+3.0	10.5
	7194	26 29.0	30.0	26.0					
	Gr. 3311	12 13.0	28.0	27.0		05 48.3	+ 7 19.3	+1.4	09.0
	7290	9 20.0	25.1	30.0					
	7320	25 76.0	34.0	22.0		04 33.0	+ 8 33.8	+1.9	08.7
	7336	27 49.0	30.0	26.0		03 41.2	+ 9 27.4	−0.3	08.3
	7462	18 19.0	19.0	38.0					
	7480	25 75.8	50.0	7.0		16 58.5	− 3 55.4	+6.6	09.7
	7521	15 69.0	34.0	23.0					
	7544	22 89.0	27.0	30.0		16 49.8	− 3 43.4	+2.2	08.6
	7824	22 59.0	26.0	30.0					
	7843	15 73.0	38.0	18.0		16 38.5	− 3 33.4	+4.4	09.5
	7917	29 77.0	23.0	33.0					
	7932	7 92.0	41.0	17.0		01 44.4	+11 17.9	+3.8	06.1
	7972	15 63.3	23.0	36.0					
	7984	20 02.5	50.0	9.0		10 46.9	+ 2 16.2	+7.7	10.8
	α Pegasi.	33 56.5	27.0	31.0					
	ο Cephei.	5 98.0	42.0	16.0		40 58 48.3	+14 15.9	+6.0	10.2
September 29.	6553	20 35.5	22.0	28.0					
	6659	14 50.0	27.0	24.0		41 10 07.7	+ 3 01.6	−0.8	08.5
	6698	29 61.5	17.0	34.0					
	6721	9 05.3	31.0	21.0		02 33.5	+10 37.9	−1.9	09.5
	6777	23 46.5	27.0	25.0					
	6799	16 13.8	23.0	28.0		09 22.2	+ 3 47.3	−1.0	08.5

Observations and computations—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
September 29.	6830	16 75.0	23.0	28.0					
	6851	20 93.5	29.0	22.0		41 10 58.3	+ 2 09.8	+0.5	41 13 08.6
	6915	29 93.5	29.0	22.0					
	6962	8 60.3	22.0	22.0		02 07.1	+11 01.8	0.0	08.9
	6986	27 36.5	26.0	26.0					
	7041	12 40.3	28.0	24.0		05 21.4	+ 7 44.1	+1.1	06.6
	7073	22 68.0	23.0	29.0					
	7112	15 06.5	30.0	23.0		09 12.3	+ 3 56.3	+0.3	08.9
	7194	26 38.0	24.0	29.0					
	Gr. 3311	12 72.5	29.0	24.0		05 48.4	+ 7 19.2	0.0	07.6
	7290	7 04.0	20.0	33.0					
	7320	23 61.5	33.0	20.0		04 33.2	+ 8 34.3	0.0	07.5
	7336	25 31.0	......	......		03 41.4	+ 9 26.8	0.0	08.2
	7398	24 06.5	29.0	25.0					
	7402	15 67.0	20.0	34.0		08 49.7	+ 4 20.5	—2.8	07.4
	7462	18 46.5	24.0	30.0					
	R. C. 5252	19 46.5	29.0	26.0		13 38.5	— 0 31.1	—0.8	06.6
	7521	15 91.8	36.0	19.0					
	7544	23 02.0	18.0	37.0		16 50.0	— 0 40.7	—0.6	08.7
	7602	20 56.0	31.0	25.0					
	7681	19 72.0	20.0	35.0		12 46.6	+ 0 26.1	—2.5	10.2
	7824	22 88.0	30.0	26.0					
	7843	16 14.0	24.0	32.0		16 38.7	— 0 29.4	—1.1	08.2
	7917	29 48.5	24.0	32.0		05 35.1	+ 7 31.8	—1.1	05.8
	7932	13 88.0	25.0	31.0		13 40.8	— 0 32.8	—0.5	07.5
	7962	14 92.5	30.0	26.0					
	7972	17 11.3	25.0	31.0					
	7984	21 70.5	27.0	28.0		10 47.1	+ 2 22.6	—1.9	07.8
	7994	15 80.5	32.0	23.0					
	8023	24 71.0	20.0	35.0		17 45.7	— 4 36.4	—1.6	07.7
	α Pegasi.	33 35.0	47.0	8.0					
	o Cephei.	5 51.0	2.0	53.0		40 58 48.5	+14 23.8	—3.3	09.0
September 30.	7521	15 61.5	37.0	18.0					
	7544	22 73.0	15.0	40.0		41 16 50.1	— 3 40.8	—1.6	07.7
	7602	19 37.0	23.0	33.0					
	7681	18 63.0	30.0	25.0		12 46.9	+ 0 23.0	—1.4	08.5
	7765	25 60.8	34.0	26.0					
	7803	12 51.0	22.0	38.0		06 22.0	+ 6 46.3	—2.2	06.1

Observations and computations—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
September 30.	7824	21 59.5	17.0	38.0					
	7843	14 77.0	39.0	15.0		41 16 38.9	− 3 31.7	+0.8	41 13 08.0
	7917	29 48.5	24.0	32.0		05 35.6	+ 7 31.8	−1.1	06.3
	7932	13 88.0	25.0	31.0		13 41.5	− 0 32.5	−0.6	08.4
	7962	14 92.5	30.0	26.0					
	7972	16 29.0	23.0	33.0					
	7984	20 92.0	26.0	30.0		10 47.3	+ 2 23.6	−3.8	07.1
	α Pegasi.	33 36.5	34.0	22.0					
	o Cephei.	5 63.5	20.0	36.0		40 58 48.8	+14 20.6	−1.1	08.3
October 2.....	7290	7 13.5	20.0	26.0					
	7320	23 69.0	29.0	27.0		41 04 33.6	+ 8 33.6	+1.7	08.9
	7336	25 35.0	......	......		03 41.7	+ 9 25.1	+1.7	08.5
	7398	23 77.0	26.0	30.0					
	7402	15 42.0	30.0	26.0		08 50.2	+ 4 19.1	0.0	09.3
	7462	17 56.5	26.0	31.0					
	R. C. 5252	18 57.0	32.0	25.0		13 39.0	− 0 31.2	+0.6	08.4
	7521	18 71.0	34.0	23.0					
	7544	25 90.0	25.0	32.0		16 50.5	− 3 43.1	+1.1	08.5
	7602	19 54.3	50.0	8.0					
	7681	18 85.0	9.0	49.0		12 47.2	+ 0 21.5	+0.5	09.2
	7765	26 12.8	27.0	30.0					
	7803	13 11.0	33.0	25.0		06 22.3	+ 6 44.0	+1.4	07.7
	7824	21 92.0	29.0	29.0					
	7843	15 08.0	31.0	26.0		16 39.3	− 3 32.2	+1.4	08.5
	7917	27 83.0	30.0	27.0		05 36.0	+ 7 32.5	−1.1	07.4
	7932	12 15.8	33.0	24.0		13 41.8	− 0 33.8	+0.5	08.5
	7962	13 24.5	25.0	32.0					
	7972	16 71.8	20.0	36.0					
	7984	21 19.5	39.0	17.0		10 47.8	+ 2 18.9	+1.9	08.6
	7994	16 17.0	34.0	23.0					
	8023	24 75.0	3.0	54.0		17 46.1	− 4 26.2	−10.0	09.9
	α Pegasi.	33 48.0	40.0	16.0					
	o Cephei.	5 80.0	16.0	40.0		40 58 49.2	+14 18.8	0.0	08.0
October 5.....	7073	22 51.2	29.0	16.0					
	7112	14 97.0	19.0	26.0		41 09 13.0	+ 3 54.0	+1.7	08.7
	7194	26 60.5	18.0	28.0					
	Gr. 3311	12 87.0	30.0	16.0		05 49.2	+ 7 18.6	+1.1	08.9
	7290	6 17.0	20.0	26.0					
	7320	22 75.0	26.0	20.0		04 34.1	+ 8 34.4	0.0	08.5
	7336	24 41.5	......	......		03 42.0	+ 9 26.0	0.0	08.0

Observations and computations—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 5.....	7398	24 88.0	22.0	26.0					
	7402	16 55.0	23.0	25.0		41 08 50.6	+ 4 18.5	−1.7	41 13 07.4
	7462	18 22.0	16.0	32.0					
	R. C. 5252	19 27.5	36.0	13.0		13 39.5	− 0 32.8	+1.9	08.6
	7521	18 56.3	26.0	23.0					
	7544	25 80.0	25.0	23.0		16 51.0	− 3 44.5	+1.4	07.9
	7602	20 27.2	30.0	18.0					
	7681	19 70.2	27.0	21.0		12 47.8	+ 0 17.7	+5.0	10.5
	7765	26 86.0	9.0	39.0					
	7803	13 85.5	45.0	4.0		06 23.0	+ 6 43.5	+3.0	09.5
	7824	22 38.5	21.0	28.0					
	7843	15 46.5	34.0	15.0		16 40.0	− 3 34.7	+3.3	08.6
	7917	28 84.5	......	......		05 36.8	+ 7 29.3	+4.4	10.5
	7932	13 20.0	33.0	16.0		13 42.5	− 0 36.1	+4.4	10.8
	7962	14 36.3	24.0	25.0					
	7972	16 90.5	17.0	32.0					
	7984	21 38.2	34.0	15.0		10 48.5	+ 2 18.9	+1.1	08.5
	7994	15 50.2	28.0	20.0					
	8023	24 48.5	23.0	26.0		17 46.8	− 0 39.1	+1.4	09.1
	α Pegasi.	33 78.5	29.0	20.0					
	ο Cephei.	6 23.8	26.0	23.0		40 58 49.8	+14 14.7	+3.3	07.8
October 13....	6698	9 25.5	29.0	21.0					
	6721	29 64.5	27.0	23.0		41 02 34.1	+10 32.6	+3.3	10.0
	6777	15 23.0	24.0	28.0					
	6799	22 45.3	31.0	20.0		09 23.0	+ 3 44.0	+1.9	08.9
	6830	21 84.7	31.0	20.0					
	6851	17 74.0	25.0	27.0		10 59.0	+ 2 07.6	+2.3	08.9
	6915	8 27.2	28.0	24.0					
	6962	29 52.0	27.0	25.0		02 08.2	+10 59.2	+1.5	08.9
	6986	14 75.0	14.0	37.0		05 22.6	+ 7 42.3	+4.7	09.6
	7022	7 68.8	14.0	37.0		01 43.7	+11 21.5	+4.7	09.9
	7041	29 65.2	46.0	6.0					
	7073	15 68.0	32.0	20.0					
	7112	23 22.7	22.0	31.0		09 13.7	+ 3 54.2	+0.8	08.7
	7194	12 23.3	21.0	31.0					
	Gr. 3311	26 33.5	34.0	19.0		05 50.0	+ 7 17.5	+1.4	08.9
	7290	31 46.5	1 .0	36.0					
	7320	14 93.5	36.0	18.0		04 35.0	+ 8 32.9	−0.3	07.6
	7336	13 27.0	......	....		03 43.2	+ 9 24.5	−0.3	07.4

Observations and computations—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 13....	7398	13 73.5	24.0	29.0					
	7402	22 04.3	29.0	25.0		41 08 51.7	+ 4 17.8	—0.3	41 13 09.2
	7462	20 75.8	26.0	28.0					
	7480	13 33.0	26.0	29.0		17 00.9	— 3 50.5	—1.4	09.0
	7521	19 43.0	22.0	33.0					
	7544	12 15.2	35.0	19.0		16 52.3	— 3 45.8	+1.4	07.9
	7602	18 00.2	28.0	27.0					
	7681	18 69.0	26.0	29.0		12 49.1	+ 0 21.4	—0.5	10.0
	7765	11 83.5	18.0	37.0					
	7803	24 84.0	36.0	19.0		06 24.5	+ 6 43.5	—0.5	07.5
	7824	16 12.7	37.0	18.0					
	7843	22 93.8	15.0	40.0		16 41.5	— 3 31.3	—1.7	08.5
	7917	9 45.0	15.0	39.0		05 38.3	+ 7 29.9	—1.4	06.8
	7932	25 06.8	......	......		13 44.0	— 0 34.6	—1.4	08.0
	7962	23 95.5	37.0	18.0					
	7972	21 00.5	27.0	28.0					
	7984	16 62.0	32.0	23.0		10 50.1	+ 2 16.0	+2.2	08.3
	7994	22 83.0	21.0	34.0					
	8023	13 73.5	37.0	18.0		17 48.5	— 4 42.2	+1.7	08.0
	α Pegasi.	5 47.0	17.0	38.0					
	ο Cephei	33 08.8	36.0	19.0		40 58 51.4	+14 16.9	—1.1	07.2
October 14	6553	15 08.0	22.0	27.0					
	6659	20 85.7	31.0	20.0		41 10 08.0	+ 2 58.6	+1.7	08.3
	6698	7 48.2	28.0	23.0					
	6721	27 84.7	30.0	20.0		02 34.1	+10 31.9	+4.1	10.1
	6777	15 07.5	21.0	31.0					
	6799	22 32.0	34.0	18.0		09 23.0	+ 3 44.7	+1.6	09.3
	6830	21 70.0	33.0	19.0					
	6851	17 58.3	22.0	31.0		10 59.1	+ 2 07.7	+1.4	08.2
	6915	7 71.0	24.0	28.0					
	6962	28 89.0	35.0	18.0		02 08.3	+10 57.1	+3.6	09.0
	6986	15 21.2	19.0	34.0		05 22.7	+ 7 44.0	+1.1	07.8
	7022	8 16.5	19.0	34.0		01 43.8	+11 22.8	+1.1	07.7
	7041	30 17.0	36.0	17.0					
	7073	15 40.2	16.0	38.0					
	7112	21 90.8	39.0	14.0		09 13.8	+ 3 52.9	+0.8	07.5
	7194	12 55.0	18.0	36.0					
	Gr. 3311	26 60.3	36.0	18.0		05 50.2	+ 7 16.0	0.0	06.2

Observations and computations—Continued.

OGDEN, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 14....	7290	31 72.2	27.0	28.0					
	7320	15 21.8	29.0	27.0		41 04 35.1	+ 8 32.1	+0.3	41 13 07.5
	7336	13 53.0	......	......		03 43.4	+ 9 24.4	+0.3	08.1
	7398	13 67.2	20.0	34.0					
	7402	21 95.2	33.0	20.0		08 51.9	+ 4 16.9	−0.8	08.0
	7462	20 89.0	24.0	32.0					
	7480	13 39.5	32.0	23.0		17 01.1	− 3 53.2	+0.3	08.2
	R. C. 5252	19 79.0	......	......		13 40.8	− 0 34.2	+0.3	06.9
	7521	18 91.5	22.0	33.0					
	7544	11 74.5	28.0	27.0		16 52.5	− 3 43.1	−2.8	06.6
	7602	18 26.2	16.0	40.0					
	7681	18 90.3	39.0	17.0		12 49.3	+ 0 19.9	−0.5	08.7
	7765	11 53.5	30.0	27.0					
	7803	24 57.0	23.0	33.0		06 24.7	+ 6 44.5	−1.9	07.3
	7824	15 44.0	37.0	20.0					
	7843	22 28.0	17.0	40.0		16 41.7	− 0 32.5	−1.6	07.6
	7917	9 20.0	00.0	00.0		05 38.5	+ 7 31.5	−0.3	09.7
	7932	24 88.0	20.0	38.0		13 44.2	− 0 35.0	−0.3	08.9
	7962	23 75.2	37.0	20.0					
	7972	21 30.0	42.0	11.0					
	7984	16 94.0	14.0	39.0		10 50.3	+ 2 15.2	+1.7	07.2
	7994	23 35.0	24.0	34.0					
	8023	14 35.5	32.0	25.0		17 48.8	− 4 39.1	−0.8	08.9
	α Pegasi	4 35.2	12.0	45.0					
	ο Cephei.	31 94.7	42.0	15.0		40 58 51.6	+14 16.2	−1.6	41 13 06.2

Mean latitude obtained in 1874...... .... 41° 13′ 08″.47
Mean latitude obtained in 1873........................... 41° 13′ 08″.65

Adopted for final use .... 41° 13′ 08″.56

DISCUSSION OF FINAL LONGITUDES OF OGDEN OBSERVATORY.

		h.	m.	s.	s.
1873—1.	Ogden west of Salt Lake City	0	00	24.747	± 0.006
	Salt Lake west of Washington Naval Observatory (official information from the United States Coast Survey)	2	19	22.740	
	Ogden west of Washington Naval Observatory	2	19	47.487	
	Washington west of Greenwich	5	08	12.120	
	Ogden west of Greenwich	7	27	59.607	
1873—2.	Ogden west of Detroit, Mich	1	55	47.471	± 0.032
	Detroit west of Washington (from Report of Chief of Engineers, 1871)	0	24	00.120	
	Ogden west of Washington	2	19	47.591	
	Ogden west of Greenwich	7	27	59.711	
1874—3.	Ogden west of Washington	2	19	47.492	± 0.034
	Ogden west of Greenwich	7	27	59.612	

The probable error of these three results is determined so that the connected station is taken as correct, and the probable error in longitude in reference to Greenwich or Washington is assumed to be zero. Calling the probable errors respectively ε_1, ε_2, and ε_3, the probable error of the adopted mean result will be

$$\varepsilon_r = \pm\sqrt{\frac{\varepsilon_1^2 + \varepsilon_2^2 + \varepsilon_3^2}{3}},$$

and therefore $= \pm\, 0.027$

Ogden Observatory, east pier of the transit-room, west of the dome of the United States Naval Observatory, Washington, D. C.,

$2^h\ 19^m\ 47^s.523 \pm 0^s.027.$

ASTRONOMICAL CO-ORDINATES OF STATION IN ASTRONOMICAL OBSERVATORY, OGDEN, UTAH.

	h. m. s.	s.		° ′ ″	″	
Longitude..	7 27 59.643	± 0.027	or	111 59 54.64	± 0.40	west from Greenwich.
	2 19 47.523		or	34 56 52.84		west from U. S. Naval Observatory, Washington, D. C.
Latitude ...				41 13 08.56	± 0.03	north.

55.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY JOHN H. CLARK AND E. P. AUSTIN IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF STATION AT BEAVER, UTAH.

SEASON OF 1872.

COMPUTATIONS BY

JOHN H. CLARK, Dr. F. KAMPF, and WM. A. ROGERS.

BEAVER, UTAH.

GEOGRAPHICAL POSITION OF STATION.

Longitude, ...	112° 38′ 35″.90 ± 0″.26 west from Greenwich.
	35° 35′ 34″.10 west from U. S. Naval Observatory, Washington, D. C.
Latitude, ...	38° 16′ 23″.28 ± 0″.06 north.

Barometric altitude of observatory above sea-level, 5915.6 feet.

This station was situated in the main plaza of the town, a short distance east of the church, which is used by religious societies other than the Mormon, and between this building and the main street running from north to south. The town of Beaver is laid out on a bench or tongue of land which inclines to the south, and is bounded by North Creek and the dry bed of Beaver Creek, whose water is turned from its course for purposes of irrigation before it reaches the settlement. Directly northward, no mountains are visible; in that direction, however, the valley, if such it may be called, is much broken. On the west is a chain of mountains which has the same general direction as the Beaver Range on the east. In the south, the broken character of the general country is fully maintained.

METEOROLOGICAL CONDITIONS.

While at Beaver, a succession of storms, which, preceded by heavy winds, commenced about the middle of August, came up from the south, sometimes bringing torrents of rain, and interfering much with the astronomical operations. By the time any given storm had passed beyond Beaver, leaving weather fit for observations, it had reached Salt Lake City, interrupting the observer there, so that, out of 21 nights, there were only 10 that could be used in common for time and signal exchanges. Observations for clock-error were made on August 10, 11, 12, 13, 14, 15, 16, and September 2, 3, 4, 5, 6, 7, and it took all of that time to succeed in making three exchanges. The nights of August 18, 19, 20, 21, 23, 24, 25, 27, 30, were given to the determination of latitude; on a majority of these, there were only partial observations, in consequence of interruption from rain and clouds.

OBSERVATORY—PARTY—TELEGRAPH.

A simple wall-tent constituted the observatory. John H. Clark was principal astronomical observer, and was assisted by W. W. Marryatt. An hourly meteorological record was kept by F. R. Simonton and C. Herbert. The telegraph-line employed was the Deseret of Utah. The operator was Robert, son of Bishop Farthingham, of the Mormon Church.

INSTRUMENTS.

The observations were made with the zenith meridian instrument, Würdemann, No. 16. Its focal length was 26 inches; its aperture, $1\frac{3}{4}$ inches. It was mounted on a block of wood 7 feet in length, which was planted in the ground to a depth of 4 feet. The Negus chronometer No. 1499 was used.

CONNECTIONS—COMPUTERS

The longitude was obtained by the exchange of arbitrary signals with Brigham Young's observatory at Salt Lake City, where E. P. Austin was observer. These exchanges, which were received and sent by sound, were made on three different nights. They consisted of 42 signals in a series, 21 being transmitted each way every night. The observations for longitude were computed by John H. Clark and Dr. F. Kampf; those for latitude were reduced by Wm. A. Rogers and by Dr. Kampf.

INSTRUMENTAL VALUES.

One division of the striding-level had the value of $1''.14$. For each division of the zenith-telescope level there was a value of $1''.44$. One revolution of the zenith-micrometer was equal to $81''.00$. The telegraphic circuit was upward of 200 miles in length. There was a battery at Beaver where the line branched. There was no attempt to use a register or chronograph here, and the signals were obtained by taking the chronometer to the telegraph office.

Tabulation of stars used for determination of time at Beaver and Salt Lake City, Utah, 1872.

Name of star.	Beaver. August 13.	Beaver. August 15.	Beaver. September 6.	Salt Lake City. August 13.	Salt Lake City. August 15.	Salt Lake City. September 6.
α Scorpii	×	....	....	....	....	....
ζ Ophiuchi	×	×	....	....	....	....
η Herculis	×	×	....	....	....	....
κ Ophiuchi	×	×	....	....	....	....
d Herculis	×	×	....	....	....	....
ε Ursæ Minoris	....	....	....	....	×	....
α Herculis	×	×	....	....	×	....
44 Ophiuchi	×	×	....	....	....	....
β Draconis	×	×	....	....	....	....
α Ophiuchi	....	....	....	×	×	....
ω Draconis	×	×	....	×	×	....
μ Herculis	....	....	....	×	....	....
ψ Draconis	×	×	....	....	×	....
γ Draconis	×	×	....	×	×	....
γ^2 Sagittarii	×	×	....	....	....	....
μ^1 Sagittarii	×	×	....	×	×	....
η Serpentis	....	×	....	....	×	....
1 Aquilæ	....	×	....	....	....	....
α Lyræ	....	×	....	....	....	×
β Lyræ	....	×	....	....	....	×
50 Draconis	....	×	....	....	....	×
ζ Aquilæ	....	....	....	....	....	×

Name of star.	Beaver. August 13.	Beaver. August 15.	Beaver. September 6.	Salt Lake City. August 13.	Salt Lake City. August 15.	Salt Lake City. September 6.
d Sagittari	....	....	....	....	....	×
δ Draconis	....	....	....	....	....	×
τ Draconis	....	....	×	....	....	....
δ Aquilæ	....	....	....	....	....	×
κ Aquilæ	....	....	×	....	....	×
γ Aquilæ	×	....	×	....	....	×
α Aquilæ	×	....	×	....	....	....
ε Draconis	×	....	×	....	....	×
τ Aquilæ	×	....	×	....	....	×
θ Aquilæ	....	....	....	×	....	....
α^2 Capricorni	....	×	×	×	....	....
κ Cephei	....	....	....	....	×	....
π Capricorni	×	×	×	×	×	×
ε Delphini	×	×	....	....	×	....
Groombridge 3241	....	....	....	×	....	....
α Cygni	×	×	×	×	×	....
μ Aquarii	....	×	....	×	×	....
μ Capricorni	....	....	....	....	....	×
79 Draconis	....	....	....	....	....	×
ν Cygni	....	×	....	....	....	....
α Aquarii	.	....	....	....	....	×
θ Aquarii	....	....	....	....	....	×

Observations and reductions for time taken at sending station.

BEAVER, UTAH, AUGUST 13, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	α Scorpii	18 44 17.79	+ 1.54	− 0.12	− 0.42	18 44 18.79	16 22 35.30	−2 22 43.49
W.	ζ Ophiuchi	52 51.54	+ 1.15	− 0.37	− 0.39	52 51.93	30 08.19	43.74
W.	η Herculis	19 01 16.70	− 0.03	− 0.10	− 0.50	19 01 16.07	38 31.82	44.25
W.	κ Ophiuchi	14 21.93	+ 0.74	0.00	− 0.39	14 22.28	51 38.03	44.25
W.	d Herculis	19 38.82	+ 0.15	+ 0.09	− 0.46	19 38.60	56 54.13	44.47
W.	α Herculis	31 33.94	+ 0.64	+ 0.16	− 0.40	31 34.34	17 08 50.22	44.12
W.	44 Ophiuchi	41 18.17	+ 1.47	+ 0.13	− 0.41	41 19.36	18 35.15	44.21
W.	β Draconis	50 19.50	− 0.59	+ 0.03	− 0.62	50 18.32	27 34.08	44.24
W.	ω Draconis	20 00 31.35	− 2.16	+ 0.02	− 1.06	20 00 28.15	37 44.20	43.95
W.	ψ Draconis	07 03.30	− 2.77	0.00	− 1.25	06 59.28	44 15.36	43.92
W.	γ Draconis	16 25.08	− 0.55	+ 0.28	− 0.60	16 24.21	53 39.96	44.25
W.	γ^2 Sagittarii	20 20.44	+ 1.64	+ 0.15	− 0.44	20 21.79	57 37.38	44.41
W.	μ^1 Sagittarii	28 52.12	+ 1.38	+ 0.16	− 0.41	28 53.25	18 06 08.60	−2 22 44.65
								−2 22 44.15

NORMAL EQUATIONS.

$$+13.00\,\delta t - 1.73\,a = +1.20 \qquad \delta t = -0^s.15$$
$$-1.73\,\delta t + 10.55\,a = -15.83 \qquad a = -1^s.52$$

Adopted error of collimation (from previous observations), $c = +0^s.38$.

Observations and reductions for time taken at sending station—Continued.

BEAVER, UTAH, AUGUST 13, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	γ Aquilæ	22 02 56.78	+ 0.12	+ 0.42	— 0.39	22 02 56.93	19 40 12.54	—2 22 44.39
W.	α Aquilæ	07 18.87	+ 0.08	+ 0.45	— 0.39	07 19.01	44 34.39	44.62
W.	ε Draconis	11 26.19	+ 0.20	— 1.33	— 1.11	11 24.95	48 38.76	45.19
W.	τ Aquilæ	20 39.90	+ 0.04	+ 0.46	— 0.39	20 40.01	57 55.36	44.65
W.	π Capricorni	42 46.20	— 0.04	+ 0.77	— 0.40	42 46.53	20 20 02.02	44.51
W.	ε Delphini	49 52.66	— 0.10	+ 0.42	— 0.39	49 52.59	27 08.00	44.59
W.	α Cygni	59 51.63	— 0.21	— 0.15	— 0.54	59 50.73	37 06.38	—2 22 44.35
								—2 22 44.61

NORMAL EQUATIONS.

$$+7.00\,\delta t - 1.19\,a = -3.24 \qquad \delta t = -0^s.61$$
$$-1.19\,\delta t + 4.33\,a = -3.08 \qquad a = -0^s.88$$

Adopted $c = +0^s.38$.

BEAVER, UTAH, AUGUST 15, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	ζ Ophiuchi	18 52 53.36	+ 1.56	— 0.14	— 0.46	18 52 54.32	16 30 08.17	—2 22 46.15
W.	η Herculis	19 01 19.34	— 0.04	— 0.39	— 0.59	19 01 18.32	38 31.78	46.54
W.	κ Ophiuchi	13 24.15	+ 1.00	— 0.30	— 0.46	13 24.39	50 38.00	46.39
W.	d Herculis	19 41.44	+ 0.20	— 0.38	— 0.54	19 40.72	56 54.09	46.63
W.	α Herculis	31 36.44	+ 0.86	— 0.38	— 0.47	31 36.45	17 08 50.18	46.27
W.	44 Ophiuchi	41 19.74	+ 1.99	— 0.15	— 0.49	41 21.09	18 35.13	45.96
W.	β Draconis	50 22.29	— 0.80	— 0.64	— 0.73	50 20.12	27 33.99	46.13
W.	ω Draconis	20 00 35.27	— 2.91	— 1.05	— 1.26	20 00 30.05	37 44.07	45.98
W.	ψ_1 Draconis	07 07.68	— 3.73	— 0.92	— 1.48	07 01.55	44 15.25	46.30
W.	γ Draconis	16 28.02	— 0.74	— 0.38	— 0.72	16 26.18	53 39.92	46.26
W.	γ^2 Sagittarii	20 21.84	+ 2.21	— 0.05	— 0.52	20 23.48	57 37.36	46.12
W.	μ^1 Sagittarii	28 53.80	+ 1.87	— 0.14	— 0.48	28 55.05	18 06 08.59	46.46
W.	η Serpentis	37 28.69	+ 1.35	— 0.22	— 0.45	37 29.37	14 43.03	46.34
W.	1 Aquilæ	51 02.08	+ 1.52	— 0.28	— 0.46	51 02.86	28 16.46	46.40
W.	α Lyræ	55 25.46	— 0.04	— 0.85	— 0.59	55 23.98	32 38.12	45.86
W.	β Lyræ	21 08 10.18	+ 0.21	— 0.75	— 0.53	21 08 09.11	45 23.11	46.00
W.	50 Draconis	13 27.47	— 4.78	— 2.00	— 1.79	13 18.90	18 50 32.48	—2 22 46.42
								—2 22 46.26

NORMAL EQUATIONS.

$$+17.00\,\delta t + 0.13\,a = -4.42 \qquad \delta t = -0^s.26$$
$$+0.13\,\delta t + 15.98\,a = -32.78 \qquad a = -2^s.05$$

c derived from 50 Draconis, clamp E. and W., to be $= +0^s.45$.

Observations and reductions for time taken at sending station—Continued.

BEAVER, UTAH, AUGUST 15, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	α^2 Capricorni	22 33 44.49	+ 1.09	— 0.05	— 0.47	22 33 45.06	20 10 59.41	—2 22 45.65
W.	π Capricorni	42 46.86	+ 1.21	— 0.05	— 0.48	42 47.54	20 02.02	45.52
W.	ϵ Delphini	49 53.96	+ 1.05	— 0.09	— 0.46	49 54.46	27 08.00	46.46
W.	α Cygni	59 53.66	— 0.23	+ 0.06	— 0.63	59 52.86	37 06.41	46.45
W.	μ Aquarii	23 08 32.38	+ 1.03	+ 0.07	— 0.46	23 08 33.02	45 47.23	45.79
W.	ν Cygni	15 13.52	— 0.07	+ 0.20	— 0.59	15 13.06	20 52 26.36	—2 22 46.70
								—2 22 46.09

NORMAL EQUATIONS.

$$+6.00\,\delta t - 3.00\,a = +3.51 \qquad \delta t = -0^s.09$$
$$-3.00\,\delta t + 2.89\,a = -4.20 \qquad a = -1^s.36$$

c adopted $= +0^s.45$.

BEAVER, UTAH, SEPTEMBER 6, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	τ Draconis	21 41 06.14	— 0.39	— 1.13	— 1.04	21 41 03.58	19 18 01.86	—2 23 01.72
W.	κ Aquilæ	53 04.47	+ 0.15	— 0.28	— 0.31	53 04.03	30 02.27	01.76
W.	γ Aquilæ	22 03 14.78	+ 0.10	— 0.27	— 0.31	22 03 14.30	40 12.35	01.95
W.	α Aquilæ	07 36.65	+ 0.10	— 0.26	— 0.31	07 36.18	44 34.21	01.97
W.	ϵ Draconis	10 41.75	— 0.31	— 0.58	— 0.88	10 39.98	47 37.75	02.23
W.	τ Aquilæ	21 57.62	+ 0.10	— 0.38	— 0.31	21 57.03	58 55.21	01.82
W.	α^2 Capricorni	34 01.69	+ 0.16	— 0.13	— 0.31	34 01.41	20 10 59.32	02.09
W.	π Capricorni	43 04.21	+ 0.18	— 0.12	— 0.32	43 03.95	20 01.95	02.00
W.	α Cygni	22 00 08.92	— 0.03	— 0.28	— 0.42	22 00 08.19	20 37 06.18	—2 23 02.01
								—2 23 01.95

NORMAL EQUATIONS.

$$+9.00\,\delta t - 0.25\,a = +0.51 \qquad \delta t = +0^s.05$$
$$-0.25\,\delta t + 9.16\,a = -1.85 \qquad a = -0^s.20$$

c adopted $= +0^s.30$.

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, AUGUST 13, 1872.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	α Ophiuchi	17 29 50.46	− 0.01	+ 0.07	− 0.02	17 29 50.50	17 29 01.24	−0 00 49.26
E.	ω Draconis..........	38 33.72	+ 0.04	+ 0.20	− 0.06	38 33.90	37 44.21	49.69
E.	μ Herculis.........	42 17.98	− 0.01	+ 0.05	− 0.02	42 18.00	41 28.61	49.39
E.	γ Draconis	54 29.32	+ 0.01	+ 0.03	− 0.03	54 29.33	53 39.97	49.36
E.	μ^1 Sagittarii.......	18 06 58.16	− 0.03	0.00	− 0.02	18 06 58.11	18 06 08.61	49.50
W.	θ Aquilæ	20 05 33.50	− 0.02	0.00	+ 0.02	20 05 33.50	20 05 44.24	49.26
W.	α^2 Capricorni	11 48.94	− 0.02	− 0.01	+ 0.02	11 48.93	10 59.42	49.51
W.	π Capricorni	20 51.60	− 0.03	0.00	+ 0.02	20 51.59	20 02.03	49.56
W.	Groombr. 3241...	31 25.24	+ 0.05	+ 0.11	+ 0.08	31 25.48	30 36.13	49.35
W.	α Cygni	38 55.90	0.00	+ 0.13	+ 0.03	38 56.06	38 06.42	49.64
W.	μ Aquarii..........	20 46 36.74	− 0.02	+ 0.01	+ 0.02	20 46 36.75	20 45 47.24	−0 00 49.51
								−0 00 49.45

NORMAL EQUATIONS.

$$0 = -0.02 + 11.00\,\delta t + 1.47\,a - 1.15\,c \qquad \delta t = 0^s.00$$
$$0 = +0.26 + 1.47\,\delta t + 8.40\,a + 0.06\,c \qquad a = -0^s.031$$
$$0 = +0.74 - 1.15\,\delta t + 0.06\,a + 30.45\,c \qquad c = -0^s.024$$

SALT LAKE CITY, AUGUST 15, 1872.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	ε Ursæ Minoris....	17 00 04.60	− 0.07	+ 0.11	+ 0.13	17 00 04.77	16 59 12.25	−0 00 52.52
E.	α Herculis	09 42.58	+ 0.01	+ 0.04	+ 0.02	09 42.65	17 08 50.18	52.47
E.	α Ophiuchi	29 53.64	0.00	+ 0.01	+ 0.02	29 53.67	29 01.18	52.49
E.	ω Draconis.........	38 36.56	− 0.02	+ 0.05	+ 0.05	38 36.64	37 44.10	52.54
W.	ψ Draconis.........	45 07.80	− 0.02	+ 0.11	− 0.05	45 07.84	44 15.25	52.59
W.	γ Draconis.........	54 32.32	0.00	+ 0.03	− 0.03	54 32.32	53 39.91	52.41
W.	μ^1 Sagittarii	18 07 01.00	+ 0.01	+ 0.01	− 0.02	18 07 01.00	18 06 08.59	52.41
W.	η Serpentis	15 35.58	− 0.01	0.00	− 0.01	15 35.58	14 43.03	52.55
E.	κ Cephei	20 14 05.97	− 0.04	+ 0.18	+ 0.08	20 14 06.19	20 13 13.71	52.48
E.	π Capricorni	20 54.58	+ 0.01	+ 0.00	+ 0.02	20 54.61	20 02.03	52.58
E.	ε Delphini	28 00.58	0.00	+ 0.02	+ 0.01	28 00.61	27 08.01	52.60
E.	α Cygni	37 58.74	0.00	+ 0.07	+ 0.01	37 58.82	37 06.41	52.41
E.	μ Aquarii..........	20 46 39.72	+ 0.01	+ 0.03	+ 0.02	20 46 39.78	20 45 47.24	−0 00 52.54
								−0 00 52.51

NORMAL EQUATIONS

$$0 = -0.06 + 13.00\,\delta t - 6.26\,a + 14.34\,c \qquad \delta t = -0^s.01$$
$$0 = +0.14 - 6.26\,\delta t + 39.66\,a - 44.90\,c \qquad a = +0^s.014$$
$$0 = -1.01 + 14.34\,\delta t - 44.90\,a + 106.12\,c \qquad c = +0^s.017$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, SEPTEMBER 6, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	α Lyræ	18 34 05.80	0.00	− 0.01	+ 0.18	18 34 05.97	18 33 37.69	−0 01 28.28
W.	β Lyræ	46 50.94	0.00	0.00	+ 0.17	46 51.11	46 22.75	28.36
W.	50 Draconis	51 58.70	− 0.05	+ 0.10	+ 0.55	51 59.30	51 30.79	28.51
W.	β Aquilæ	19 01 01.44	+ 0.01	+ 0.01	+ 0.14	19 01 01.60	19 00 33.24	28.36
W.	d Sagittarii	11 39.00	+ 0.02	0.00	+ 0.15	11 39.17	11 10.77	28.40
W.	δ Draconis	14 00.81	− 0.02	− 0.05	+ 0.36	14 01.10	13 32.85	28.25
E.	δ Aquilæ	20 33.04	+ 0.01	0.00	− 0.13	20 32.92	20 04.50	28.42
E.	κ Aquilæ	31 30.96	+ 0.01	− 0.03	− 0.14	31 30.80	31 02.27	28.53
E.	γ Aquilæ	41 40.82	+ 0.01	0.00	− 0.14	41 40.69	41 12.35	28.34
E.	ε Draconis	50 06.60	− 0.03	+ 0.10	− 0.36	50 06.31	49 37.75	28.56
E.	τ Aquilæ	59 23.66	+ 0.01	+ 0.01	− 0.13	59 23.55	58 55.21	28.34
E.	π Capricorni	20 21 30.38	+ 0.02	0.00	− 0.15	20 21 30.25	20 21 01.95	28.30
W.	μ Capricorni	21 47 50.02	+ 0.02	− 0.04	+ 0.14	21 47 50.14	21 47 21.49	28.65
W.	79 Draconis	52 48.06	− 0.03	+ 0.03	+ 0.48	52 48.54	52 20.14	28.40
W.	α Aquarii	22 00 43.15	+ 0.01	0.00	+ 0.14	22 00 43.30	22 00 14.93	28.37
W.	θ Aquarii	11 35.53	+ 0.02	0.00	+ 0.14	11 35.69	11 07.17	−0 01 28.52
								−0 01 28.41

NORMAL EQUATIONS.

$$0 = -1.22 + 16.00\,\delta t + 1.04\,a - 9.93\,c \qquad \delta t = -0^s.01$$
$$0 = +1.31 + 1.04\,\delta t + 15.37\,a + 11.74\,c \qquad a = +0^s.022$$
$$0 = +7.47 - 9.93\,\delta t + 11.74\,a + 56.21\,c \qquad c = -0^s.139$$

The following tables show the corrections and rates of the chronometers used at Beaver and Salt Lake City:

CHRONOMETER AT BEAVER.—NEGUS, No. 1499.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1872.	*h.*	*h. m. s.*	*s.*
Aug. 13	18.50	− 2 22 44.35	+ 0.058
Aug. 15	18.50	46.19	+ 0.025
Sept. 6	20.00	01.94	+ 0.010

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1872.	*h.*	*m. s.*	*s.*
Aug. 13	20.00	− 0 49.45	+ 0.067
Aug. 15	20.00	52.51	+ 0.066
Sept. 6	20.00	28.41	+ 0.068

On August 13 and 15, the mean-time chronometer Barraud, No. 22961, was used at Salt Lake City for exchanges. The following comparisons were made with Negus, No. 1511:

1872.		h. m. s.	h. m. s.	h. m. s.	h. m. s.
Aug. 13	Barraud...	11 44 02.5	11 49 59.5	10 13 05.0	10 16 12.5
	Negus.....	19 44 48.0	19 50 46.0	18 13 35.0	18 16 43.0
Aug. 15	Barraud...	10 09 52.5	10 12 49.0	11 56 30.0	11 59 29.5
	Negus.....	18 18 34.0	18 21 31.0	20 05 30.0	18 08 30.0

From these comparisons, the corrections and rates for Barraud, 22961, are derived as follows:

Date.	Time of Barraud.	Correction of Barraud.	Hourly rate.
1872.	h.	h. m. s.	s.
Aug. 13	11.7836	+ 7 59 56.57	— 10.165
Aug. 15	11.9666	+ 8 08 07.73	— 10.340

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
August 13, 1872:		h. m. s.	h. m. s.	h. m. s.	h. m. s.	s.	s.
Salt Lake City	Salt Lake City.	11 06 25.48	+ 7 59 49.69	19 06 15.17			
	Beaver	21 25 59.98	— 2 22 44.38	19 03 15.60	0 02 59.57		
Beaver	Salt Lake City.	11 12 59.22	+ 7 59 50.81	19 12 50.03			
	Beaver	21 32 34.97	— 2 22 44.39	19 09 50.58	59.45	....	59.510
August 15, 1872:							
Salt Lake City	Salt Lake City.	11 36 35.62	+ 8 08 04.04	19 44 39.66			
	Beaver	22 04 26.35	— 2 22 46.22	19 41 40.13	59.54		
Beaver	Salt Lake City.	11 43 21.43	+ 8 08 05.21	19 51 26.64			
	Beaver	22 11 13.39	— 2 22 46.22	19 48 27.17	59.47	....	59.505
September 6, 1872:							
Salt Lake City	Salt Lake City.	21 16 06.46	— 0 01 28.49	21 14 37.97			
	Beaver	23 34 40.32	— 2 23 01.95	21 11 38.37	59.60		
Beaver	Salt Lake City.	21 22 41.09	— 0 01 28.50	21 21 13.59			
	Beaver	23 41 14.97	— 2 23 01.95	21 18 13.02	0 02 59.57	....	59.585

Beaver west of Salt Lake City	$0^h\ 02^m\ 59^s.533 \pm 0^s.017$
Salt Lake City west of Greenwich	$7^h\ 27^m\ 34^s.86$
Beaver west of Greenwich	$7^h\ 30^m\ 34^s.393 \pm 0^s.017$
Beaver west of Greenwich	$112^\circ\ 38'\ 35''.90 \pm 0''.26$

Observations and computations for latitude.

BEAVER, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 20 ..	5847	15 28.0	27.0	19.0		38 12 22.2	+ 3 58.4	+2.8	38 16 23.4
	5886	22 47.0	28.0	18.0		07 31.3	+ 8.49.0	+3.5	23.8
	5929	10 38.0	24.0	24.0	Must be 9t.				
	5962	4 59.0	12.0	35.0	Must be 5t.	28 25.6	—12 06.8	+4.2	23.0
	5990	23 57.5	42.0	7.0					
	6033	19 81.0	20.0	27.0		14 34.7	+ 1 47.1	+1.7	23.5
	6052	17 16.0	31.0	19.0					
	6073	2 74.5	24.0	25.0	Must be 1t.	26 43.2	—10 22.9	+3.5	23.8
	6395	21 80.0	35.0	16.0	Must be 20t.				
	6438	14 33.0	24.0	26.0		20 40.6	— 4 21.5	+5.9	25.0
	6475	12 39.5	27.0	25.0					
	6491	23 22.5	34.0	16.0		19 00.4	+ 7 17.6	+7.0	25.0
	ε Drac.	23 39.5	14.0	18.0					
	τ Aquilæ	9 10.8	20.0	12.0		25 57.9	— 9 37.3	+1.4	22.0
	7083	17 61.0	15.0	18.0					
	7131	13 92.0	23.0	11.0		18 48.9	— 2 29.1	+3.2	23.0
	7132	16 13.0	......	......		17 20.2	— 0 59.8	+3.2	23.6
	7164	13 57.0	11.0	22.0					
	7171	19 75.5	27.0	6.0		20 28.7	— 4 09.9	+3.5	22.3
	7204	3 44.0	22.0	11.0	Must be 2t.				
	7241	26 02.8	13.0	21.0		32 16.0	—15 53.2	+1.0	23.8
	7256	22 55.0	11.0	23.0					
	7274	10 73.5	23.0	10.0		08 27.4	+ 7 57.4	+0.4	25.2
	7313	15 91.0	8.0	23.0					
	7385	17 45.0	27.0	5.0		15 19.6	+ 1 02.2	+2.4	24.2
	7505	10 42.0	15.0	17.0	Must be 9t.				
	7524	16 67.3	15.0	17.0		21 16.9	— 4 53.1	—1.4	22.4
August 21 ..	5962	4 80.0	26.0	22.0					
	5990	22 75.3	27.0	21.0		28 25.7	—12 05.5	+3.5	23.7
	6052	18 77.0	27.0	20.0					
	6073	3 35.3	28.0	20.0		26 43.3	—10 23.0	+5.3	25.6
	6218	23 35.5	17.0	32.0					
	6235	8 41.5	38.0	11.0	Rev. wrong.	27 03.2	—10 44.1	+4.2	23.3
	6355	19 84.0	14.0	26.0					
	6365	. 3 17.5	24.0	16.0		27 39.4	—11 13.4	—1.4	24.6
	6395	18 84.0	16.0	22.0					
	6438	12 40.0	26.0	14.0		20 40.7	— 4 20.2	+1.4	21.9
	6475	10 07.3	17.0	22.0					
	6491	21 05.5	23.0	16.0		38 09 00.6	+ 7 23.8	+0.7	38 16 25.1

Observations and computations—Continued.

BEAVER, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 21 ..	τ Drac.	2 77.5	......	......					
	δ Aquilæ	27 87.5	......	......	No level.	37 59 30.9	+17 54.3	—2.5	38 16 22.7
	6674	15 48.5	25.0	16.0		38 14 12.6	+ 2 14.8	—2.8	24.6
	6676	11 00.0	......	......		17 10.2	— 0 46.5	—2.8	20.9
	6687	12 15.0	13.0	29.0					
	6730	22 19.0	......	......		23 40.7	— 7 19.2	+1.0	22.5
	6734	20 98.0	26.0	16.0		22 52.1	— 6 30.3	+1.0	22.8
	6762	12 32.0	17.0	24.0	Rev. wrong.				
August 23 ..	5886	22 36.3	21.0	27.0					
	5929	9 14.0	20.0	26.0		07 31.6	+ 8 54.3	—4.2	21.7
	5962	4 37.0	32.0	14.0					
	5990	22 16.0	9.0	37.5		28 26.0	—11 58.9	—3.7	23.4
	6033	24 34.8	27.0	20.0					
	6052	21 58.0	16.0	30.5		14 34.9	+ 1 51.9	—2.7	24.1
	6674	16 69.5	31.0	16.0	Cloudy.				
	6687	13 38.3	7.0	40.0		14 12.9	+ 2 13.8	—6.3	20.4
	6734	20 93.8	18.0	29.0					
	6762	11 12.3	35.0	11.0		22 52.5	— 6 36.6	+4.6	20.5
	6813	13 73.0	18.0	29.0					
	6860	15 02.0	36.0	10.0		15 28.5	+ 0 52.1	+5.3	25.9
	6879	3 59.0	27.0	19.0					
	6895	29 83.0	24.0	23.0	Rev. wrong.	34 43.2	—18 20.8	+3.1	25.5
	7083	17 41.0	19.0	29.5					
	7131	13 61.5	40.0	9.0		18 49.7	— 2 33.3	+7.2	23.6
	7132	15 77.0	......	......		17 21.0	— 1 06.3	+7.2	21.9
	7204	5 83.5	27.0	21.0					
	7241	29 63.5	31.0	18.0		32 16.7	—16 01.7	+6.6	21.6
	7256	24 04.5	33.5	14.5					
	7274	12 37.0	22.0	27.0		08 28.2	+ 7 51.8	+4.9	24.9
	7313	15 04.0	16.0	34.0					
	7385	16 51.5	41.0	7.0		15 20.4	+ 0 59.6	+5.6	25.6
	7444	12 65.5	25.0	14.0					
	7448	21 43.3	28.0	12.0		22 07.3	— 5 54.7	+9.5	22.1
	7505	10 76.5	32.0	7.0					
	7524	18 20.5	17.0	23.0		21 17.9	— 5 00.6	+5.2	22.5
	7555	18 41.0	17.0	22.5					
	7585	14 36.5	31.0	9.0	Must be 13t.	19 41.1	— 3 23.9	+5.8	23.0
	7733	19 33.0	20.0	21.0					
	7754	19 91.0	26.0	15.0		16 45.2	— 0 23.4	+3.5	38 16 25.3

Observations and computations—Continued.

BEAVER, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 23 ..	7778	13 35.5	9.0	32.0		38 18 23.6	− 2 04.2	+2.8	38 16 22.2
	7782	21 18.0	......	......		23 40.7	− 7 20.5	+2.8	23.0
	7807	10 28.0	36.0	5.0					
August 24 ..	6395	18 49.0	29.0	25.0					
	6438	12 09.5	26.0	28.0		20 41.2	− 4 18.4	+0.7	23.5
	6475	11 99.0	34.5	19.0					
	6491	22 94.5	21.0	32.5		38 09 01.2	+ 7 22.7	+1.4	25.3
	τ Drac.	2 63.8	33.0	21.0					
	δ Aquilæ	27 67.0	19.0	36.0		37 59 31.5	+16 51.5	−1.7	21.3
	6674	17 04.5	28.0	24.0		38 14 13.1	+ 2 11.8	−3.5	21.4
	6676	12 64.8	......	......		17 10.8	− 0 45.9	−3.5	21.4
	6687	13 78.3	19.0	33.0					
	6730	20 48.5	20.0	32.0		23 41.3	− 7 16.2	−1.8	23.3
	6734	19 27.3	......	......		22 52.7	− 6 27.3	−1.7	23.7
	6762	9 69.0	29.0	22.0					
	6806	12 35.5	17.5	22.0					
	6849	12 54.8	21.0	18.0		16 17.8	+ 0 07.8	−0.5	25.1
	6879	2 49.0	10.0	28.0					
	6895	29 77.0	30.0	9.0		34 43.4	−18 22.4	+1.0	22.0
	7164	11 51.0	23.0	16.0					
	7171	17 56.8	12.0	27.0		20 29.7	− 4 04.8	−2.8	22.1
	7204	5 00.3	23.0	15.0					
	7241	28 62.0	14.0	25.0		32 17.0	−15 54.4	−1.0	21.6
	7256	23 44.6	20.5	18.0					
	7274	11 59.5	13.0	26.5		08 28.4	+ 7 58.9	−3.9	23.4
	7313	15 02.5	15.0	24.0					
	7385	16 57.0	23.0	17.0		15 20.7	+ 1 02.4	−1.0	22.1
	7444	13 35.5	14.0	24.0					
	7448	21 82.0	23.0	16.0		22 08.2	− 5 42.1	−1.1	25.0
	7505	11 55.0	22.0	17.0					
	7524	18 77.0	13.0	26.0		21 18.1	− 4 51.8	−2.8	23.5
	7555	17 80.5	19.0	19.0					
	7585	12 93.0	18.0	19.5		19 41.4	− 3 17.0	−0.5	23.9
	7754	13 98.0	19.0	19.0		12 20.0	+ 4 07.5	−4.0	23.5
	7778	23 00.0	......	......		18 23.9	− 1 57.0	−4.0	22.9
	7782	30 85.5	......	......		23 41.0	− 7 14.4	−4.0	22.6
	7799	17 15.8	......	......		14 28.1	+ 1 59.1	−4.0	23.2
	7807	20 10.5	14.0	25.5					
August 25 ..	6475	9 98.5	31.0	17.0					
	6491	20 98.5	11.0	35.0		38 09 01.3	+ 7 24.5	−3.5	38 16 22.3

Observations and computations—Continued.

BEAVER, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
August 25 ..	τ Drac.	2 63.6	31.0	15.0					
	δ Aquilæ	27 76.3	8.0	39.0		37 59 31.6	+16 55.4	−5.2	38 16 21.8
	6734	20 31.0	32.0	16.0					
	6762	10 72.0	10.0	36.0		38 22 52.9	− 6 27.5	−3.5	21.9
	6806	13 70.8	......	......		16 18.0	+ 0 08.5	−3.9	22.6
	6813	13 91.8	26.0	21.0		15 28.9	+ 0 59.6	−3.9	24.6
	6849	13 91.0	16.0	32.0					
	6860	15 39.3	......	......					
	6879	3 06.8	34.0	18.0					
	6895	30 14.0	10.0	42.0		34 43.6	−18 13.9	−5.6	24.1
	7083	18 88.5	24.0	17.0					
	7131	15 35.0	9.0	31.0		18 50.2	− 2 22.8	−5.2	22.2
	7204	7 60.3	24.0	17.0					
	7241	31 05.5	7.0	34.5		32 17.3	−15 47.7	−7.2	22.4
	7256	24 66.8	1.0	41.0					
	7274	12 82.3	37.0	4.5	Cloudy.	08 28.7	+ 7 58.7	−2.8	24.6
August 27..	6395	21 35.5	34.0	24.0					
	6438	14 84.0	32.0	26.0		20 41.6	− 4 23.3	+5.6	23.9
	6475	11 56.5	43.0	16.0					
	6491	22 26.0	29.0	28.0	Cloudy	09 01.7	+ 7 12.2	+9.8	23.7
August 30..	5886	24 16.6	26.0	28.0					
	5929	11 06.0	32.0	22.0		07 32.1	+ 8 49.6	+2.8	24.5
	5962	2 81.8	29.0	26.0					
	5990	20 75.5	29.0	25.0		28 26.5	−12 04.8	+2.8	24.5
	6033	24 08.5	23.0	32.0					
	6052	21 34.0	26.0	29.0		14 35.5	+ 1 50.9	−4.2	22.2
	6109	10 45.8	29.0	27.0					
	6147	32 05.5	28.0	26.0		01 50.2	+14 32.7	+1.4	24.3
	6218	23 91.0	32.0	24.0					
	6235	8 00.0	26.0	29.0		27 04.4	−10 42.9	+1.8	23.3
	6395	19 02.0	29.0	27.0					
	6438	12 56.8	29.0	27.0		20 42.1	− 4 20.7	+1.4	22.8
	6475	15 43.0	32.0	33.0					
	6491	26 49.3	14.0	41.0		38 09 02.1	+ 7 27.1	−6.3	22.9
	τ Drac.	2 17.0	14.0	30.0					
	δ Aquilæ	27 08.5	35.0	8.5		37 59 32.4	+16 46.8	+3.7	22.9
	6674	16 69.0	......	......		38 14 14.1	+ 2 05.9	+2.9	22.9
	6676	12 27.0	26.0	18.0		17 11.7	− 0 52.7	+2.9	38 16 21.9
	6687	13 57.5	21.0	22.0					

Observations and computations—Continued.

BEAVER, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 30..	6734	21 19.5	30.0	15.0					
	6762	11 46.0	17.0	27.0		38 22 53.9	− 6 33.4	+1.8	38 16 22.3
	6806	12 70.0	......	......		16 18.9	+ 0 02.0	+1.4	22.3
	6813	12 92.5	15.0	29.0		15 29.9	+ 0 53.3	+1.4	24.6
	6849	12 75.0	31.0	13.0					
	6860	14 24.5	......	......					
	7083	17 82.5	34.5	10.5					
	7131	14 12.8	16.0	32.0		18 51.3	− 2 29.4	+2.8	24.7
	7132	16 27.8	......	......		17 22.6	− 1 02.5	+2.8	22.9
	7164	12 17.0	8.0	38.0					
	7171	18 31.3	38.0	8.0		20 31.2	− 4 08.2	0.0	23.0
	7204	4 42.0	27.0	19.0					
	7241	28 00.0	17.0	29.0		32 18.5	−15 52.9	−1.4	24.2
	7256	20 19.0	15.0	30.0					
	7274	8 46.5	30.0	16.0		08 29.9	+ 7 53.8	−0.3	23.4
	7313	14 36.8	9.0	38.0					
	7385	15 87.0	39.0	7.0	Cloudy.	38 15 22.7	+ 1 00.7	+1.0	38 16 24.4

Recapitulation.

The following table contains the daily means:

Date.	No. of observations.	Mean latitude.
1872.		° ′ ″
Aug. 20	15	38 16 23.60
Aug. 21	11	23.52
Aug. 23	18	23.18
Aug. 24	20	23.04
Aug. 25, Aug. 27	11	23.10
Aug. 30	19	23.37

The mean of all observations gives .... 38° 16′ 23″.27
Giving every mean the same weight, the final result will be..... 38° 16′ 23″.30

Adopted for the use of this office.. 38° 16′ 23″.28 ± 0″.06

ASTRONOMICAL CO-ORDINATES OF STATION AT BEAVER, UTAH.

Longitude .... 112° 38′ 35″.90 ± 0″.26 west from Greenwich.
35° 35′ 34″.10 west from United States Naval Observatory, Washington, D. C.

Latitude .... 38° 16′ 23″.28 + 0″.06 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,

1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY W. W. MARYATT AND E. P. AUSTIN IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF STATION AT PIOCHE, NEVADA.

SEASON OF 1872.

COMPUTATIONS BY

W. W. MARYATT, DR. F. KAMPF, AND WM. A. ROGERS.

PIOCHE, NEVADA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, ...	114° 26′ 18″.27 ± 1″.12	west from Greenwich.
	37° 23′ 16″.47	west from U. S. Naval Observatory at Washington, D. C.
Latitude, ...	37° 55′ 26″.07 ± 0″.07	north.

Barometric altitude of observatory above sea-level, 5942.3 feet.

The astronomical station is 120 feet to the left of the road leading from Pioche to Bullionville. Its distance from the church on the corner of Cedar and Meadow Valley streets is 3,050 feet in a line whose direction is southwest by west. About 1,250 feet from this church, on the summit of the divide, where it is crossed by Meadow Valley street, and near the Gold Hill Mine, there stands a very conspicuous telegraph-pole; the astronomical monument is situated 1,060 feet south and 1,470 feet east of this.

The city lies on the northeastern declivity of hills which form a spur of the Ely Mountains. The surrounding country slopes gradually down to the plains in the same direction.

OBSERVATORY—INSTRUMENTS—MISCELLANEOUS.

A description of the instruments used, with the values pertaining to them, will be found in the report on Beaver, which precedes this. Much general information on this station, including a description of the observatory and methods of observation, is given by Mr. Maryatt, on page 46 of the Progress Report of 1872.

This was the first of the series of stations occupied in 1872 by the late Wm. W. Maryatt, who died in 1873, at Bozeman, Montana. This gentleman took the greatest care to secure results as satisfactory as possible, as will be seen from the observations made.

CONNECTIONS—OBSERVERS—COMPUTERS.

In this, as in all other work of this year, the connected station was Salt Lake City, at which point E. P. Austin was observer. The chronograph was used in the exchange of signals; the observations for time were taken by eye and ear.

The Deseret Telegraph Line was used as a route of transmission. The length of circuit was about 300 miles. Signals were sent by the local battery at Pioche. No repeaters intervened.

Time-exchanges were made September 25, 27, 28, 30, and October 2; observations for latitude on October 4, 5, 6, 7, 10, and 11. The reduction of observations for time taken by Mr. Maryatt was accomplished by himself in the office; those of Mr. Austin were reduced by Dr. Kampf. The latitude-observations were reduced in 1873 by Wm. A. Rogers, and revised by Dr. F. Kampf, who also prepared the report.

Tabulation of stars used for determination of time at Pioche, Nevada, and Salt Lake City, Utah, 1872.

	PIOCHE.					SALT LAKE CITY.						PIOCHE.					SALT LAKE CITY.				
	September 25.	September 27.	September 28.	September 30.	October 2.	September 25.	September 27.	September 28.	September 30.	October 2.		September 25.	September 27.	September 28.	September 30.	October 2.	September 25.	September 27.	September 28.	September 30.	October 2.
α Andromedæ	×	×	×	×	×	..	..	..	..	..	ε Delphini	..	..	×	..	×	..	..	×	..	×
γ Pegasi	×	..	×	×	×	..	..	..	..	..	Groombridge 3241	×	×	..	..	..	..	..	×	..	×
21 Cassiopeiæ	×	×	×	..	×	..	..	..	..	..	α Cygni	×	×	×	×	×	..	..	×	..	..
ε Piscium	×	×	×	×	×	..	..	..	..	..	μ Aquarii	×	×	×	×	..	..	..	×	..	..
38 Cassiopeiæ	×	×	..	×	×	..	..	..	..	..	61 Cygni	×	×	×	×	×	×	..	×	..	..
o Piscium	..	..	..	×	×	..	..	..	..	..	ζ Cygni	..	×	..	×	..	×	..	..	..	..
β Arietis	..	..	..	×	×	..	..	..	..	..	α Cephei	..	..	..	..	..	×	..	..	×	..
50 Cassiopeiæ	..	..	..	..	×	..	..	..	..	..	1 Pegasi	×	×	×	×	×	..	..	..	..	..
α Arietis	..	..	..	..	×	..	..	..	..	..	β Aquarii	..	..	..	..	..	×	..	..	×	..
ζ Aquilæ	..	..	..	..	..	..	×	..	×	..	β Cephei	×	..	×	×	..	..	..	..	..	..
d Sagittarii	..	..	..	..	..	×	×	..	×	..	ξ Aquarii	..	..	..	..	..	×	..	..	×	×
δ Draconis	×	..	..	..	..	..	×	..	×	..	ε Pegasi	×	..	..	..	..	..	×	..	..	×
τ Draconis	..	..	..	..	..	..	×	..	×	..	11 Cephei	..	..	..	..	×	×	..	..	×	..
δ Aquilæ	×	..	..	..	..	×	..	..	..	..	μ Capricorni	..	..	×	×	..	..	×	..	..	..
κ Aquilæ	×	×	..	..	..	×	×	..	×	×	79 Draconis	..	..	..	..	..	..	..	..	..	×
γ Aquilæ	×	×	..	×	..	×	×	×	×	×	α Aquarii	..	..	..	×	×	..	..	..	..	..
α Aquilæ	..	..	..	..	..	×	×	×	×	×	π Aquarii	..	..	×	..	..	..	..	..	..	×
ε Draconis	×	×	×	×	×	..	×	×	×	×	o Cephei	..	..	..	×	..	..	..	..	..	..
τ Aquilæ	..	×	×	×	..	×	×	×	×	×	Groombridge 4163	..	..	×	..	×	..	..	..	..	..
κ Cephei	..	×	..	..	..	×	×	×	×	×	ω Piscium	..	×	..	×	..	..	..	..	..	..
π Capricorni	×	..	..	×	×	..	..	×	..	×											

Observations and reductions for time taken at sending station.

PIOCHE, NEVADA, SEPTEMBER 25, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	δ Draconis	21 42 56.05	− 0.57	+ 0.15	0.00	21 42 55.63	19 12 31.80	−2 30 23.83
W.	δ Aquilæ	49 27.18	+ 0.26	+ 0.05	0.00	49 27.49	19 04.22	23.27
W.	κ Aquilæ	22 00 24.98	+ 0.32	+ 0.05	0.00	22 00 25.35	30 02.01	23.34
W.	γ Aquilæ	10 35.65	+ 0.21	+ 0.06	0.00	10 35.92	40 12.07	23.85
W.	ε Draconis	19 01.15	− 0.69	+ 0.16	0.00	19 00.62	49 36.65	23.97
E.	π Capricorni	50 25.01	+ 0.39	+ 0.04	0.00	50 25.44	20 20 01.73	23.71
E.	Groombr. 3241	23 00 58.38	− 0.82	+ 0.17	0.00	23 00 57.73	30 34.17	23.56
E.	α Cygni	07 29.64	− 0.07	+ 0.09	0.00	07 29.66	37 05.81	23.85
E.	μ Aquarii	16 10.61	+ 0.34	+ 0.04	0.00	16 10.99	46 47.02	23.97
E.	61 Cygni	31 35.62	0.00	+ 0.08	0.00	31 35.70	21 01 11.80	23.90
E.	1 Pegasi	46 35.74	+ 0.15	+ 0.07	0.00	46 35.96	16 12.11	23.85
E.	β Cephei	57 26.45	− 0.69	+ 0.16	0.00	57 25.92	27 02.40	23.52
E.	ε Pegasi	0 08 19.80	+ 0.22	+ 0.06	0.00	0 08 20.08	21 38 56.16	−2 30 23.92

NORMAL EQUATIONS.

$$0 = +1.39 + 13.00\,\delta t - 2.17\,a - 4.45\,c \qquad c = 0^{s}.00$$
$$0 = -5.75 - 2.17\,\delta t + 12.64\,a + 2.17\,c \qquad a = +0^{s}.45$$
$$0 = -0.62 - 4.45\,\delta t + 2.17\,a + 45.36\,c$$

Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, SEPTEMBER 25, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	α Andromedæ	2 32 12.82	+ 0.08	− 0.42	+ 0.08	2 32 12.56	0 01 49.03	−2 30 23.53
W.	γ Pegasi	37 05.23	+ 0.17	− 0.27	+ 0.06	37 05.19	06 41.29	23.90
W.	21 Cassiopeiæ	3 07 44.52	− 0.88	− 0.86	+ 0.22	3 07 43.00	37 19.23	23.77
E.	ε Piscium	26 44.11	+ 0.20	− 0.25	− 0.06	26 44.00	56 20.60	23.40
E.	38 Cassiopeiæ	3 52 13.68	− 0.60	− 0.70	− 0.17	3 52 12.21	1 21 48.90	−2 30 23.31

NORMAL EQUATIONS.

$$0 = +0.69 + 5.00\,\delta t - 2.59\,a$$
$$0 = -2.82 - 2.59\,\delta t + 7.53\,a \qquad a = +0^{s}.40$$

Adopted $c = -0^{s}.06$ for E.

PIOCHE, NEVADA, SEPTEMBER 27, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	κ Aquilæ	22 00 23.93	− 0.10	+ 0.04	− 0.06	22 00 23.81	19 30 01.98	−2 30 21.83
E.	γ Aquilæ	10 33.87	− 0.07	+ 0.05	− 0.06	10 33.79	40 12.04	21.75
E.	ε Draconis	18 58.26	+ 0.21	+ 0.12	− 0.17	18 58.42	48 36.51	21.91
E.	τ Aquilæ	28 16.98	− 0.07	+ 0.04	− 0.06	28 16.89	57 54.93	21.96
E.	κ Cephei	43 31.77	+ 0.40	+ 0.18	− 0.26	43 32.09	20 13 10.45	21.64
W.	Groombr. 3241	23 00 56.52	− 0.29	− 0.17	+ 0.18	23 00 56.24	29 34.03	22.21
W.	α Cygni	07 27.84	− 0.03	− 0.08	+ 0.08	07 27.81	39 05.76	22.05
W.	μ Aquarii	16 09.15	+ 0.12	− 0.04	+ 0.06	16 09.29	45 47.00	22.29
W.	61 Cygni	31 33.80	0.00	− 0.08	+ 0.07	31 33.79	21 01 11.77	22.02
W.	ζ Cygni	37 53.28	+ 0.03	− 0.07	+ 0.07	37 53.31	07 31.24	22.07
W.	1 Pegasi	23 46 33.99	+ 0.05	− 0.06	+ 0.06	23 46 34.04	21 10 12.09	−2 30 21.95

NORMAL EQUATIONS.

For E.: $0 = -0.10 + 5.00\,\delta t - 2.73\,a$
$$0 = +1.46 - 2.73\,\delta t + 11.73\,a \qquad a = -0^{s}.14$$

For W.: $0 = +1.92 + 6.00\,\delta t - 0.75\,a$
$$0 = -0.88 - 0.75\,\delta t + 4.07\,a \qquad a = +0^{s}.16$$

Adopted $c = -0^{s}.06$ for E.

Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, SEPTEMBER 27, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	ω Piscium	2 23 08.96	+ 0.06	+ 0.02	— 0.06	2 23 08.98	23 52 46.88	—2 30 22.10
E.	α Andromedæ	32 11.10	+ 0.02	+ 0.02	— 0.07	32 11.07	0 01 49.04	22.03
E.	21 Cassiopeiæ	3 07 41.73	— 0.24	+ 0.06	— 0.22	3 07 41.33	0 37 19.25	22.08
W.	ε Piscium	26 42.91	— 0.12	+ 0.02	+ 0.06	26 42.87	0 56 20.62	22.25
W.	38 Cassiopeiæ	3 52 10.62	+ 0.36	+ 0.05	+ 0.17	3 52 11.20	1 21 48.96	—2 30 22.24

NORMAL EQUATIONS.

For E.: $0 = +0.37 + 3.00\,\delta t - 1.47\,a$
$0 = -0.68 - 1.47\,\delta t + 5.11\,a$ $\qquad a = +0^s.11$

For W.: $0 = +0.25 + 2.00\,\delta t - 0.99\,a$
$0 = +0.36 - 0.99\,\delta t + 2.55\,a$ $\qquad a = -0^s.24$

Adopted $c = -0^s.06$ for E.

PIOCHE, NEVADA, SEPTEMBER 28, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	ε Draconis	22 18 58.80	— 0.66	— 0.12	0.00	22 18 58.02	19 48 36.45	—2 30 21.57
W.	τ Aquilæ	28 16.35	+ 0.22	— 0.04	0.00	28 16.53	57 54.93	21.61
W.	ε Delphini	57 29.01	+ 0.20	— 0.04	0.00	57 29.17	20 29 07.65	21.52
W.	α Cygni	23 07 27.19	— 0.07	— 0.07	0.00	23 07 27.05	37 05.74	21.31
W.	μ Aquarii	16 08.34	+ 0.32	— 0.03	0.00	16 08.63	45 46.99	21.64
E.	61 Cygni	31 33.30	0.00	— 0.06	0.00	31 33.24	21 01 11.75	21.49
E.	1 Pegasi	46 33.40	+ 0.14	— 0.05	0.00	46 33.49	16 12.08	21.41
E.	β Cephei	57 24.68	— 0.66	— 0.12	0.00	57 23.90	27 02.26	21.64
E.	μ Capricorni	0 16 42.63	+ 0.35	— 0.03	0.00	0 16 42.95	46 21.38	21.57
E.	π Aquarii	49 08.16	+ 0.26	— 0.04	0.00	49 08.38	22 18 46.73	—2 30 21.65

NORMAL EQUATIONS.

$0 = +1.60 + 10.00\,\delta t + 0.21\,a$
$0 = -2.94 + 0.21\,\delta t + 6.98\,a$ $\qquad a = +0^s.40$

Adopted $c = 0^s.00$.

Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, SEPTEMBER 28, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	Groombr. 4163 ...	2 19 65.10	— 1.04	— 0.12	0.00	2 19 03.94	23 48 42.40	—2 30 21.54
E.	α Andromedæ	32 10.66	+ 0.09	— 0.04	0.00	32 10.71	0 01 49.04	21.67
E.	γ Pegasi	37 02.90	+ 0.20	— 0.04	0.00	37 03.06	06 41.31	21.75
W.	21 Cassiopeiæ	3 07 42.40	— 1.09	— 0.12	0.00	3 07 41.19	37 19.26	21.93
W.	ε Piscium	26 42.12	+ 0.26	— 0.03	0.00	26 42.35	56 20.62	—2 30 21.73

NORMAL EQUATIONS.

$0 = + 2.70 + 5.00\,\delta t - 3.15\,a$

$0 = - 5.55 - 3.15\,\delta t + 9.59\,a \qquad a = + 0^{s}.50$

Adopted $c = 0^{s}.00$.

PIOCHE, NEVADA, SEPTEMBER 30, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	γ Aquilæ	22 10 31.45	+ 0.61	0.00	0.00	22 10 32.06	19 40 11.99	—2 30 20.07
W.	ε Draconis	18 58.65	— 1.98	0.00	0.00	18 56.67	48 36.71	19.96
W.	τ Aquilæ...........	28 14.33	+ 0.67	0.00	0.00	28 15.00	57 54.88	20.12
W.	π Capricorni	50 20.57	+ 1.13	0.00	0.00	50 21.70	20 20 01.66	20.04
W.	α Cygni............	23 07 26.16	— 0.22	0.00	0.00	23 07 25.94	37 05.69	20.25
W.	μ Aquarii	16 06.18	+ 0.96	0.00	0.00	16 07.14	45 46.96	20.18
E.	61 Cygni............	31 31.88	0.00	0.00	0.00	31 31.88	21 01 11.72	20.16
E.	ζ Cygni............	37 51.24	+ 0.21	0.00	0.00	37 51.45	07 31.19	20.26
E.	1 Pegasi	46 31.82	+ 0.44	0.00	0.00	46 32.26	16 12.05	20.21
E.	β Cephei	57 24.50	— 1.99	0.00	0.00	57 22.51	27 02.18	20.33
E.	μ Capricorni.......	0 16 40.46	+ 1.05	0.00	0.00	0 16 41.51	46 21.37	20.14
E.	α Aquarii	29 34.31	+ 0.81	0.00	0.00	29 35.12	21 59 14.83	—2 30 20.29

NORMAL EQUATIONS.

$0 = - 3.28 + 12.00\,\delta t + 1.29\,a$

$0 = - 10.26 + 1.29\,\delta t - 7.82\,a \qquad a = + 1^{s}.29$

Adopted $c = 0^{s}.00$

Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, SEPTEMBER 30, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	o Cephei	1 43 48.61	− 1.63	0.00	0.00	1 43 46.98	23 13 26.16	−2 30 20.82
E.	ω Piscium	2 23 06.61	+ 0.68	0.00	0.00	2 23 07.29	52 46.89	20.40
E.	α Andromedæ	32 09.16	+ 0.24	0.00	0.00	32 09.40	0 01 49.05	20.35
E.	γ Pegasi	37 01.06	+ 0.53	0.00	0.00	37 01.59	03 41.31	20.28
W.	ε Piscium	3 26 40.20	+ 0.61	0.00	0.00	3 26 40.86	56 20.64	20.22
W.	38 Cassiopeiæ	52 10.93	− 1.93	0.00	0.00	52 09.00	1 21 49.04	19.96
W.	o Piscium	4 09 00.27	+ 0.63	0.00	0.00	4 09 00.90	38 40.78	20.12
W.	β Arietis	17 56.73	+ 0.41	0.00	0.00	17 57.14	47 36.93	−2 30 20.21

NORMAL EQUATIONS.

$$0 = +1.00 + 8.00\,\delta t - 0.32\,a$$
$$0 = -6.48 - 0.32\,\delta t + 5.03\,a \qquad a = +1^{s}.28$$

Adopted $c = 0^{s}.00$.

PIOCHE, NEVADA, OCTOBER 2, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	ε Draconis	22 18 54.09	+ 1.26	− 0.06	0.00	22 18 55.29	19 48 36.20	−2 30 19.09
W.	π Capricorni	50 21.15	− 0.72	− 0.01	0.00	50 20.42	30 01.63	18.79
W.	ε Delphini	57 26.75	− 0.38	− 0.02	0.00	57 26.35	27 07.59	18.76
W.	α Cygni	23 07 24.80	+ 0.14	− 0.03	0.00	23 07 24.91	20 37 05.64	19.27
E.	61 Cygni	31 30.80	0.00	− 0.03	0.00	31 30.77	21 01 11.68	19.09
E.	1 Pegasi	46 31.26	0.00	− 0.02	0.00	46 31.24	10 12.02	19.22
E.	11 Cephei	0 10 22.39	− 1.34	− 0.06	0.00	0 10 23.67	40 04.71	18.96
E.	α Aquarii	29 34.81	+ 0.51	− 0.02	0.00	29 34.28	59 14.81	−2 30 19.47

NORMAL EQUATIONS.

$$0 = -1.00 + 8.00\,\delta t + 1.05\,a$$
$$0 = -5.43 + 1.05\,\delta t + 6.62\,a \qquad a = +0^{s}.82$$

Adopted $c = 0^{s}.00$.

Observations and reductions for time taken at sending station—Continued.

PIOCHE, NEVADA, OCTOBER 2, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	Groombr. 4163 ...	2 18 59.51	+ 2.06	— 0.22	0.00	2 19 01.35	23 38 42.35	—2 30 19.00
E.	σ Andromedæ	32 08.53	— 0.18	— 0.09	0.00	32 08.26	0 01 49.05	19.21
E.	γ Pegasi	37 01.19	— 0.41	— 0.07	0.00	37 00.71	06 41.32	19.39
E.	21 Cassiopeiæ	3 07 36.50	+ 2.18	— 0.23	0.00	3 07 38.45	37 19.29	19.16
W.	ε Piscium..........	26 40.64	— 0.51	— 0.08	0.00	26 40.05	56 20.66	19.39
W.	38 Cassiopeiæ	52 07.16	+ 1.49	— 0.19	0.00	50 08.46	1 19 49.07	19.39
W.	o Piscium..........	4 09 00.63	— 0.49	— 0.07	0.00	4 09 00.07	38 40.80	19.27
W.	β Arietis............	17 56.64	— 0.32	— 0.08	0.00	17 56.24	47 36.95	19.29
W.	50 Cassiopeiæ	22 55.93	+ 1.76	— 0.20	0.00	22 57.49	52 38.13	19.36
W.	α Arietis...........	4 30 20.09	— 0.28	— 0.09	0.00	4 30 19.72	2 00 00.33	—2 30 19.39

NORMAL EQUATIONS.

$$0 = -\ 3.43 + 10.00\,\delta t + 5.34\,a$$
$$0 = -15.01 + 5.34\,\delta t + 16.19\,a \qquad a = +0^{s}.99$$

Adopted $c = 0^{s}.00$.

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, SEPTEMBER 25, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	d Sagittarii	19 12 06.46	— 0.38	— 0.02	0.00	19 12 06.06	19 10 10.48	— 1 55.58
E.	δ Aquilæ............	21 00.06	— 0.26	— 0.02	0.00	20 59.78	19 04.22	55.56
E.	κ Aquilæ............	31 58.16	— 0.31	— 0.01	0.00	31 57.84	30 02.01	55.83
W.	γ Aquilæ............	42 08.12	— 0.22	+ 0.02	0.00	42 07.92	40 12.07	55.85
W.	α Aquilæ............	46 29.76	— 0.22	+ 0.02	0.00	46 29.56	44 33.97	55.59
W.	τ Aquilæ............	59 50.84	— 0.23	+ 0.03	0.00	59 50.64	57 54.96	55.68
W.	κ Cephei	20 15 05.00	+ 1.13	+ 0.23	0.00	20 15 06.36	20 13 10.64	55.72
E.	61 Cygni............	21 03 07.34	— 0.02	+ 0.07	0.00	21 03 07.39	21 01 11.80	55.59
E.	ζ Cygni............	09 27.30	— 0.09	+ 0.10	0.00	09 27.31	07 31.27	56.04
E.	α Cephei	17 28.90	+ 0.32	+ 0.24	0.00	17 29.46	15 33.49	55.97
E.	β Aquarii	26 47.48	— 0.30	+ 0.07	0.00	26 47.25	24 51.44	55.81
E.	ξ Aquarii	32 54.58	— 0.32	+ 0.06	0.00	32 54.32	30 58.50	55.82
E.	11 Cephei	21 41 59.74	+ 0.63	+ 0.18	0.00	42 00.55	40 05.04	— 1 55.51

NORMAL EQUATIONS.

$$0 = -0.68 + 13.00\,\delta t + 0.70\,a$$
$$0 = +5.79 + 0.70\,\delta t + 14.04\,a \qquad a = -0^{s}.416$$

Adopted $c = 0^{s}.00$.

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 27, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	ζ Aquilæ	19 01 31.66	− 0.07	− 0.05	0.00	19 01 31.54	18 59 32.89	− 1 58.65
E.	*d* Sagittarii	12 09.08	− 0.14	− 0.02	0.00	12 08.92	10 10.47	58.45
E.	δ Draconis	14 30.18	+ 0.18	− 0.04	0.00	14 30.32	12 31.70	58.62
E.	τ Draconis	19 59.00	+ 0.29	− 0.03	0.00	19 59.26	18 00.45	58.81
E.	κ Aquilæ	32 00.96	− 0.12	− 0.05	0.00	32 00.79	30 01.98	58.81
W.	γ Aquilæ	42 10.86	− 0.08	− 0.04	0.00	42 10.74	40 12.04	58.70
W.	α Aquilæ	46 32.70	− 0.08	− 0.03	0.00	46 32.59	44 33.92	58.67
W.	ε Draconis	50 35.14	+ 0.22	− 0.05	0.00	50 35.31	48 36.64	58.67
W.	τ Aquilæ	59 53.70	− 0.09	− 0.02	0.00	59 53.59	57 54.93	58.66
W.	κ Cephei	20 15 08.75	+ 0.43	− 0.07	0.00	20 15 09.11	20 13 10.48	58.63
E.	ε Pegasi	21 39 54.96	− 0.08	− 0.01	0.00	21 39 54.87	21 37 56.16	58.71
E.	μ Capricorni	48 20.36	− 0.13	0.00	0.00	48 20.23	46 21.39	− 1 58.84

NORMAL EQUATIONS.

$$0 = -1.11 + 12.00\,\delta t - 2.01\,a$$
$$0 = +2.90 - 2.01\,\delta t + 17.61\,a \qquad a = -0^{s}.157$$

Adopted $c = 0^{s}.00$

SALT LAKE CITY, UTAH, SEPTEMBER 28, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	γ Aquilæ	19 42 11.96	− 0.11	− 0.04	0.00	19 42 11.81	19 40 12.02	− 1 59.79
W.	α Aquilæ	46 33.70	− 0.11	− 0.02	0.00	46 33.57	44 33.90	59.67
W.	ε Draconis	50 35.96	+ 0.29	0.00	0.00	50 36.25	48 36.46	59.79
W.	τ Aquilæ	59 54.72	− 0.11	+ 0.01	0.00	59 54.62	57 54.91	59.71
W.	κ Cephei	20 15 09.28	+ 0.56	+ 0.18	0.00	20 15 10.02	20 13 10.36	59.66
E.	π Capricorni	22 01.67	− 0.19	− 0.03	0.00	22 01.45	20 01.69	59.76
E.	ε Delphini	29 07.70	− 0.10	− 0.04	0.00	29 07.56	27 07.65	59.91
E.	Groombr. 3241	32 33.65	+ 0.35	− 0.06	0.00	32 33.94	30 33.98	59.96
E.	α Cygni	39 05.44	+ 0.02	0.00	0.00	39 05.46	37 05.74	59.72
E.	μ Aquarii	47 46.92	− 0.16	− 0.01	0.00	47 46.75	45 46.99	59.76
E.	61 Cygni	21 03 11.70	− 0.01	− 0.04	0.00	21 53 11.65	21 01 11.75	− 1 59.90

NORMAL EQUATIONS.

$$0 = -1.70 + 11.00\,\delta t - 2.04\,a$$
$$0 = +3.27 - 2.04\,\delta t + 14.81\,a \qquad a = -0^{s}.205$$

Adopted $c = 0^{s}.00$.

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 30, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	ζ Aquilæ	19 01 35.22	— 0.07	— 0.07	0.00	19 01 35.08	18 59 32.84	— 2 02.24
W.	*d* Sagittarii	12 12.94	— 0.14	— 0.04	0.00	12 12.76	19 10 10.23	02.53
W.	δ Draconis	15 33.70	+ 0.18	— 0.14	0.00	15 33.74	13 31.51	02.23
W.	τ Draconis	20 02.18	+ 0.29	— 0.15	0.00	20 02.32	18 00.04	02.28
W.	κ Aquilæ	32 04.44	— 0.12	— 0.05	0.00	32 04.27	30 01.93	02.34
E.	γ Aquilæ	42 14.56	— 0.08	— 0.02	0.00	42 14.46	40 11.99	02.47
E.	α Aquilæ	46 36.48	— 0.08	— 0.02	0.00	46 36.38	44 33.87	02.51
E.	ε Draconis	49 38.66	+ 0.22	— 0.05	0.00	49 38.83	47 36.33	02.50
E.	τ Aquilæ	50 57.50	— 0.09	— 0.02	0.00	50 57.39	48 54.89	02.50
E.	κ Cephei	20 15 12.40	+ 0.43	— 0.10	0.00	20 15 12.73	20 13 10.17	02.56
W.	α Cephei	17 35.64	+ 0.12	— 0.06	0.00	17 35.70	15 33.22	02.48
W.	β Aquarii	21 27 53.86	— 0.11	— 0.04	0.00	21 27 53.71	21 25 51.39	02.32
W.	ξ Aquarii	33 00.96	— 0.12	— 0.04	0.00	33 00.80	31 58.45	02.35
W.	11 Cephei	42 07.06	+ 0.24	— 0.15	0.00	42 07.15	40 04.82	— 2 02.33

NORMAL EQUATIONS.

$$0 = -0.63 + 14.00\,\delta t - 4.16\,a$$
$$0 = +3.16 - 4.16\,\delta t + 20.61\,a \qquad a = -0^s.157$$

Adopted $c = 0^s.00$.

SALT LAKE CITY, UTAH, OCTOBER 2, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	κ Aquilæ	19 32 07.96	— 0.09	— 0.05	0.00	19 32 07.82	19 30 01.90	— 2 05.92
E.	γ Aquilæ	42 17.98	— 0.06	— 0.03	0.00	42 17.89	40 11.96	05.93
E.	α Aquilæ	46 39.94	— 0.06	— 0.03	0.00	46 39.85	44 33.84	06.01
E.	ε Draconis	50 42.10	+ 0.16	— 0.07	0.00	50 42.19	48 36.20	05.99
W.	τ Aquilæ	20 00 00.81	— 0.06	— 0.06	0.00	20 00 00.69	19 57 54.85	05.84
W.	κ Cephei	15 15.74	+ 0.31	— 0.25	0.00	15 15.80	20 13 09.96	05.84
W.	π Capricorni	22 07.52	— 0.10	— 0.04	0.00	22 07.38	20 01.63	05.75
W.	ε Delphini	29 13.50	— 0.06	— 0.04	0.00	29 13.40	27 07.59	05.81
W.	Groombr. 3241	32 39.56	+ 0.19	— 0.11	0.00	32 39.64	30 33.71	05.93
E.	ξ Aquarii	21 33 04.66	— 0.09	— 0.02	0.00	21 33 04.55	21 31 58.43	06.12
E.	ε Pegasi	40 02.28	— 0.06	— 0.02	0.00	40 02.20	37 56.09	06.11
E.	79 Draconis	53 25.08	+ 0.21	— 0.12	0.00	53 25.17	51 19.10	06.07
E.	α Aquarii	22 01 20.98	— 0.08	— 0.04	0.00	22 01 20.86	21 59 14.81	— 2 06.05

NORMAL EQUATIONS.

$$0 = +0.46 + 13.00\,\delta t - 1.90\,a$$
$$0 = +2.13 - 1.90\,\delta t + 19.45\,a \qquad a = -0^s.115$$

Adopted $c = 0^s.00$

The following tables show the corrections and rates of the chronometers used at Pioche and Salt Lake City:

CHRONOMETER AT PIOCHE.—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1872.	*h.*	*h. m. s.*	*s.*
Sept. 25	22.0	− 2 30 23.65	− 0.032
Sept. 27	22.2	22.07	− 0.018
Sept. 28	22.7	21.63	− 0.029
Sept. 30	22.7	20.22	− 0.021
Oct. 2	23.0	− 2 30 19.19	

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1872.	*h.*	*h. m. s.*	*s.*
Sept. 25	20.4	− 0 01 55.73	+ 0.062
Sept. 27	20.4	01 58.69	+ 0.045
Sept. 28	20.4	01 59.78	+ 0.050
Sept. 30	19.8	02 02.40	+ 0.074
Oct. 2	20.7	− 0 02 05.95	

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
September 25, 1872:		*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*h. m. s.*
Salt Lake City	Salt Lake City	22 49 03.48	—0 01 55.88	22 47 07.60			
	Pioche	1 07 20.86	—2 30 23.63	22 36 57.23	0 10 10.37		
Pioche	Salt Lake City	23 22 33.08	—0 01 55.91	23 20 37.17			
	Pioche	1 40 50.32	—2 30 23.61	23 10 26.71	10.46	0.09	0 10 10.415
September 27, 1872:							
Salt Lake City	Salt Lake City	23 25 09.82	—0 01 58.82	23 23 11.00			
	Pioche	1 43 22.53	—2 30 22.05	23 13 00.48	10.52		
Pioche	Salt Lake City	23 43 20.75	—0 01 58.84	23 41 21.91			
	Pioche	2 01 33.35	—2 30 22.05	23 31 11.30	10.61	0.09	10.565
September 28, 1872:							
Salt Lake City	Salt Lake City	22 54 27.08	—0 01 59.90	22 52 27.18			
	Pioche	1 12 38.48	—2 30 21.63	22 42 16.85	10.33		
Pioche	Salt Lake City	23 04 44.77	—0 01 59.91	23 02 44.86			
	Pioche	1 22 56.04	—2 30 21.63	22 52 34.41	10.45	0.12	10.390
September 30, 1872:							
Salt Lake City	Salt Lake City	22 44 29.41	—0 02 02.61	22 42 26.80			
	Pioche	1 02 36.77	—2 30 20.23	22 32 16.54	10.26		
Pioche	Salt Lake City	23 01 15.54	—0 02 02.64	22 59 12.90			
	Pioche	1 19 22.77	—2 30 20.22	22 49 02.55	10.35	0.09	10.305
October 2, 1872:							
Salt Lake City	Salt Lake City	23 13 20.12	—0 02 06.13	23 11 13.99			
	Pioche	1 31 23.14	—2 30 19.19	23 01 03.95	10.04		
Pioche	Salt Lake City	23 19 54.85	—0 02 06.14	23 17 48.71			
	Pioche	1 37 57.71	—2 30 19.19	23 07 38.52	0 10 10.19	0.15	0 10 10.115

Pioche west of Salt Lake City .... $0^{h}\ 10^{m}\ 10^{s}.358 \pm 0^{s}.075$.

Observations and computations for latitude.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 4...	7262	2.360	32.8	23.5					
	7275	1.418	24.0	32.0		37 56 06.3	− 0 38.1	+0.4	37 55 28.6
	7727	9.405	33.7	23.5					
	7693	17.063	23.5	34.0		49 50.9	+ 5 33.7	−0.1	24.5
	7765	24.230	31.6	25.7					
	7777	8.451	24.0	32.8		38 06 06.1	−10 37.6	−1.0	27.5
	7871	8.547	26.0	30.5		37 46 20.6	+ 9 06.0	−1.1	25.5
	7856	22.063	29.0	27.7					
	8059	21.940	22.0	35.2					
	8091	15.930	33.0	24.1		59 31.2	− 4 02.9	−1.5	26.8
	8114	9.394	22.7	34.6					
	8091	15.930	33.0	24.1		37 51 02.3	− 4 24.1	−1.4	26.8
	8195	20.434	23.3	23.8					
	8136	12.392	23.0	24.0		38 00 49.4	− 5 25.0	+3.0	27.4
	8282	19.079	26.3	30.0					
	8227	14.338	30.1	26.3		37 58 35.4	− 3 11.6	+0.0	23.8
	8268	5.086	26.3	30.5					
	8247	2.478	30.2	26.1		57 12.5	− 1 45.4	−0.0	27.1
	60	16.746	29.5	27.8					
	120	11.579	26.7	30.8		58 56.1	− 3 28.8	−0.8	26.5
	197	15.757	27.4	30.0					
	164	18.454	29.0	28.5		53 36.3	+ 1 49.0	−0.7	24.6
	255	13.663	31.0	26.0					
	223	10.184	25.0	31.8		57 49.2	− 2 20.6	−0.6	28.0
	441	10.115	26.6	32.2					
	349	13.918	30.0	26.9		52 52.3	+ 2 33.7	−0.9	25.1
	508	18.983	28.0	31.2					
	469	16.419	27.8	31.0		53 46.8	+ 1 43.6	−2.2	28.2
	560	6.085	31.5	27.8					
	630	22.257	27.9	31.9		44 28.5	+10 53.3	−0.1	21.7
	673	19.844	29.8	30.1					
	657	21.509	28.9	31.0		54 17.1	+ 1 07.3	−0.8	23.6
	857	16.927	28.1	30.3					
	707	18.600	31.1	28.7		37 54 20.0	+ 1 07.6	−0.3	27 3
	1043	21.089	28.9	30.8					
	1023	13.711	28.9	30.6		38 00 25.9	− 4 58.1	−1.3	26.5
October 5...	6623	17.482	28.0	24.1					
	6602	13.380	27.0	24.6		37 58 08.2	− 2 45.8	+2.2	24.6
	6697	18.140	23.0	28.9					
	6674	17.020	26.1	25.8		56 13.7	− 0 45.1	−2.0	37 55 26.6

Observations and computations—Continued.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 5...	6928	16.844	23.5	27.9					
	6912	8.103	23.8	28.0		38 01 21.0	− 5 53.2	−3.0	37 55 24.8
	6928	16.844	23.5	27.9					
	6968	13.711	29.9	22.0		37 57 30.8	− 2 06.6	+1.3	25.5
	7008	8.748	25.0	26.9					
	6997	19.305	25.1	26.0		48 19.9	+ 7 06.6	−1.0	25.5
	7008	8.748	25.0	26.9					
	7084	23.457	30.2	22.0		45 30.2	+ 9 54.4	+2.2	26.8
	7161	6.230	25.6	26.7					
	7194	22.586	28.1	24.0		44 22.9	+11 00.9	+1.0	24.8
	7262	11.476	24.0	28.4					
	7275	10.453	33.8	18.7		56 06.4	− 0 41.3	+3.8	28.9
	7336	11.900	26.9	26.0					
	7385	21.450	28.0	25.0		48 57.5	+ 6 25.9	+1.4	24.8
	7483	7.190	26.0	28.0					
	7410	12.704	27.0	26 0		51 44.0	+ 3 42.8	−0.4	26.4
	7545	6.167	31.8	23.0					
	7520	14.349	22.7	32.0		49 57.2	+ 5 30 6	−0.2	27.6
	7727	9.720	24.2	31.3					
	7693	18.010	31.2	24.0		49 51.1	+ 5 35.0	+0.0	26.1
	7871	7.619	21.4	31.2					
	7856	21.113	31.1	24.4		37 46 20.8	+ 9 05.3	−1.1	25.0
	8195	21.011	33.8	23.0					
	8136	13.046	19.5	36.8		38 00 49.6	− 5 21.8	−2.3	25.5
	8268	6.685	28.0	29.0					
	8227	15.925	29.0	27.0		37 49 13.1	+ 6 13.4	+0.4	26.9
	8282	20.661	28.0	29.0					
	8227	15.926	29.0	27.0		58 35.6	− 3 11.3	+0.4	24.7
	197	16.866	29.0	29.6					
	164	19.552	30.0	28.5		53 36.5	+ 1 48.5	+0.3	25.3
	255	16.684	31.5	26.6					
	223	13.171	26.9	31.0		57 49.4	− 2 22.0	+0.3	27.7
	441	11.993	30.7	38.0					
	358	15.752	27.5	30.6		52 10.4	+ 3 16.5	−3.6	23.3
	508	12.569	31.2	26.9					
	469	15.013	26.0	32.0		53 47.0	+ 1 38.7	−0.6	25.1
	560	7.097	31.0	26.9					
	630	23.267	27.1	30.6		44 28.7	+10 58.5	+0.2	37 55 27.4

Observations and computations—Continued.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 5...	673	20.916	31.1	26.8					
	657	22.589	27.9	30.0		37 54 17.2	+ 1 07.6	+0.8	37 55 25.6
	857	17.903	24.0	35.0					
	825	20.574	35.0	23.6		59 02.0	− 3 35.3	+0.1	26.8
	1062	13.719	28.0	30.0					
	1096	13.698	32.1	25.7		37 55 26.5	− 0 00.8	+1.4	27.1
	1282	14.259	27.0	31.0					
	1262	6.671	31.3	27.0		38 00 34.1	− 5 06.6	+0.1	27.6
	1424	15.667	32.2	26.0					
	1429	12.072	26.0	32.1		37 57 53.1	− 2 25.2	0.0	27.9
	1477	19.064	32.2	26.0					
	1497	3.360	29.7	28.9		38 05 57.8	−10 34.4	+2.8	26.2
	1546	12.986	30.5	27.8					
	1526	17.720	27.7	30.6		37 52 17.4	+ 3 11.3	−0.1	28.6
October 6...	6623	15.069	29.7	16.3					
	6602	10.986	19.1	26.6		37 58 08.3	− 2 45.0	+2.1	25.4
	6739	6.765	25.9	19.9					
	6712	16.179	25.0	21.0		38 01 43.5	− 6 20.4	+3.5	26.6
	6928	15.983	23.2	22.9					
	6912	7.186	23.1	23.0		38 01 21.0	− 5 55.5	+0.1	25.6
	6928	15.983	23.2	22.9					
	6968	12.751	25.8	21.0		37 57 30.9	− 2 10.6	+1.8	22.1
	7161	5.120	21.0	26.8					
	7194	21.404	28.5	19.9		44 23.0	+10 58.0	+1.0	22.0
	7336	10.257	24.9	23.9					
	7385	19.791	25.1	23.5		48 57.6	+ 6 25.3	+0.9	23.8
	7468	1.460	26.0	22.9					
	7410	9.217	24.7	24.0		50 10.2	+ 5 13.5	+1.3	25.0
	7560	6.724	25.0	23.9					
	7571	14.394	25.2	24.0		50 14.4	+ 5 09.9	+0.8	25.1
	7560	6.724	25.0	23.9					
	7584	14.394	25.2	24.0		48 19.8	+ 7 03.3	+0.9	24.0
	7727	7.315	25.7	21.0					
	7693	15.567	22.3	21.8		49 51.2	+ 5 33.5	+0.7	25.4
	7871	7.707	23.9	26.0					
	7856	21.160	27.5	22.6		46 21.0	+ 9 03.6	+1.0	25.6
	8059	20.544	24.1	27.4					
	8091	14.512	28.6	23.0		37 59 31.1	− 4 03.8	+0.8	37 55 28.1

Observations and computations—Continued.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 6...	8114	7.949	24.0	27.2					
	8097	6.617	28.6	23.0		37 56 19.3	— 0 53.8	+0.8	37 55 26.3
	8195	19.733	25.4	26.2					
	8136	11.717	26.2	24.8		38 00 49.8	— 5 23.9	+0.2	26.1
	8282	18.840	27.2	24.1					
	8227	14.143	23.2	27.0		37 58 35.8	— 3 09.8	—0.3	25.7
	60	16.040	26.0	26.9					
	120	10.841	26.9	26.0		58 56.5	— 3 30.1	0.0	26.4
	255	13.675	31.9	22.1					
	223	10.116	25.9	27.0		57 49.6	— 2 23.8	+3.1	28.9
	508	10.224	29.0	26.9					
	469	12.700	25.9	30.2		53 47.3	+ 1 40.1	—0.8	26.6
	560	5.258	29.2	26.7					
	630	21.893	26.9	27.4		44 29.0	+10 52.0	+0.7	21.7
	673	19.033	28.9	26.6					
	657	20.692	27.2	27.1		54 17.3	+ 1 07.0	+0.8	25.1
	857	14.814	29.1	26.0					
	825	9.457	25.0	30.0		59 02.2	— 3 36.5	—0.7	25.0
	962	5.859	32.3	23.4					
	980	19.899	23.9	32.0		37 45 58.1	+ 9 27.4	+0.3	25.8
	1043	18.394	31.0	25.1					
	1023	10.948	25.0	31.2		38 00 26.2	— 5 00.9	—0.1	25.2
	1062	13.089	30.0	26.2					
	1096	13.061	26.0	30.1		37 55 26.7	— 0 01.1	—0.1	25.5
	1282	13.843	30.0	27.9					
	1262	6.247	26.7	31.0		38 00 34.2	— 5 07.0	—0.8	26.4
	1282	13.843	30.0	27.9					
	1326	15.665	27.0	30.9		37 54 14.9	+ 1 13.6	—0.6	27.9
	1424	10.519	26.0	31.9					
	1449	6.933	31.0	26.0		37 57 53.2	— 2 24.9	—0.3	28.0
	1477	17.950	30.1	26.9					
	1497	2.263	26.0	30.6		38 05 57.8	—10 33.9	—0.5	23.4
	1546	9.562	33.4	23.1					
	1526	14.280	25.0	31.8		37 52 17.5	+ 3 10.7	+1.3	29.5
	1547	11.842	33.4	23.1					
	1526	14.280	25.0	31.8		53 47.2	+ 1 38.5	+1.3	27.0
October 7...	6623	12.838	23.8	20.1					
	6602	8.768	20.2	23.2		37 58 08.3	— 2 44.4	+0.3	37 55 24.2

Observations and computations—Continued.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 7...	6697	16.157	26.4	17.6					
	6674	15.020	16.8	26.9		37 56 13.8	− 0 45.9	−0.4	37 55 27.5
	6928	15.874	22.0	22.0					
	6912	7.058	21.8	22.1		38 01 21.0	− 5 56.2	−0.1	24.7
	6928	15.874	22.0	22.0					
	6968	12.790	20.4	24.4		37 57 30.9	− 2 04.6	−1.4	24.9
	7262	12.763	22.1	23.9					
	7275	11.758	23.0	22.7		56 06.6	− 0 40.6	−0.6	25.4
	7336	7.937	24.8	21.2					
	7385	17.516	20.0	26.4		48 57.7	+ 6 27.1	−1.0	23.8
	7468	0.902	19.0	28.4					
	7410	8.896	20.0	26.9		50 10.4	+ 5 23.0	−5.7	27.7
	7468	0.902	19.0	28.4					
	7474	19.476	27.0	21.0		42 59.4	+12 30.6	−1.2	28.8
	7545	6.662	20.0	27.9					
	7520	14.907	24.6	23.0		49 57.4	+ 5 33.2	−2.2	28.4
	7560	4.698	27.9	20.0					
	7584	15.363	16.6	31.2		48 19.9	+ 7 11.0	−2.4	28.5
	7727	8.667	31.8	17.6					
	7693	16.957	19.1	29.9		37 49 51.4	+ 5 35.0	+1.2	27.6
	7765	19.106	27.4	21.4					
	7777	3.329	20.0	28.8		38 06 06.2	−10 37.6	−1.0	27.6
	8059	20.977	25.8	23.0					
	8091	15.034	18.1	30.9		37 59 31.2	− 4 00.1	−3.5	27.6
	8059	20.977	25.8	23.0					
	8097	7.162	18.1	30.9		38 04 48.4	− 9 18.3	−3.5	26.6
	8263	7.617	24.3	25.8					
	8227	16.875	23.3	26.2		37 49 13.5	+ 6 14.1	−1.5	26.1
	8282	21.516	24.0	26.0					
	8247	5.030	23.0	27.0		38 06 35.6	−11 06.0	−2.1	27.5
	60	14.714	24.0	27.8					
	120	9.549	24.0	27.7		37 58 57.0	− 3 28.7	−2.8	25.5
	197	8.648	20.8	31.2					
	164	11.403	27.0	24.8		53 37.9	+ 1 51.3	−2.9	26.3
	255	11.80	18.0	35.0					
	223	8.39	27.6	24.3		57 49.8	− 2 17.8	−4.8	27.2
	560	3.582	27.1	27.0					
	630	19.771	29.5	25.2		37 44 29.2	+10 54.2	+1.5	37 55 24.9

Observations and computations—Continued.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
October 7..	673	17.417	27.8	27.0					
	657	19.090	29.4	25.3		37 54 17.6	+ 1 07.6	+1.7	37 55 26.9
	690	13.580	31.0	23.9					
	769	18.942	31.2	26.6		37 51 46.6	+ 3 36.7	+4.2	27.5
	858	18.644	26.0	29.0					
	825	11.050	30.7	24.3		38 00 34.4	— 5 06.9	+1.2	28.7
	1043	16.329	29.0	26.0					
	872	3.241	27.0	27.9		38 04 15.6	— 8 48.9	+0.7	27.4
	1043	16.329	29.0	26.0					
	980	17.837	28.5	26.3		37 54 23.3	+ 1 00.9	+2.0	26.2
	1043	16.329	29.0	26.0					
	1023	8.853	27.0	28.0		38 00 26.4	— 5 02.1	+0.7	25.0
	1062	11.796	28.0	27.0					
	1096	11.784	29.0	25.5		37 55 26.8	— 0 00.5	+1.6	27.9
	1139	7.640	32.0	22.0					
	1132	12.894	26.0	28.0		37 51 52.3	+ 3 32.3	+2.8	27.4
	1282	14.741	34.0	21.0					
	1262	7.030	25.0	30.0		38 00 34.4	— 5 11.5	+2.8	25.7
	1424	12.645	27.0	28.5					
	1649	8.991	30.7	25.0		37 57 53.3	— 2 27.7	+1.5	27.1
	1477	18.312	26.0	29.0					
	1497	2.600	33.2	21.9		38 05 57.9	—10 34.9	+2.9	25.9
	1546	7.878	27.4	28.0					
	1526	12.582	30.7	25.0		37 52 17.6	+ 3 10.1	+1.8	29.5
	1547	10.155	27.4	28.0					
	1526	12.582	30.7	25.0		53 47.3	+ 1 38.1	+1.8	27.2
	1567	6.195	27.2	27.9					
	1620	13.707	32.6	23.8		50 21.1	+ 5 03.6	+2.8	27.5
October 10..	6697	15.531	25.0	29.1					
	6674	14.350	27.0	27.0		37 56 13.8	— 0 47.7	—1.4	24.7
	6712	15.446	28.9	25.0					
	6739	5.959	31.7	22.0		38 01 43.5	— 6 23.4	+4.8	24.9
	6928	15.483	31.6	22.0					
	6912	6.607	23.8	30.0		38 01 21.2	— 5 58.7	+1.2	23.7
	6928	15.483	31.6	22.0					
	6968	12.361	23.5	30.5		37 57 31.2	— 2 06.2	+0.9	25.9
	7008	2.763	24.0	29.5					
	6997	13.361	27.0	26.5		37 48 20.2	+ 7 08.3	—1.7	37 55 26.8

Observations and computations—Continued.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 10	7119	19.801	37.6	16.5					
	7103	0.772	21.0	33.0		38 08 11.1	−12 49.0	+3.2	37 55 25.3
	7161	3.982	28.0	26.0					
	7194	20.375	27.0	27.0		37 44 23.4	+11 02.4	+0.7	26.5
	7262	11.924	26.7	27.6					
	7275	11.007	26.6	27.5		56 06.9	− 0 37.1	−0.6	29.2
	7336	6.251	29.0	25.0					
	7385	15.788	24.4	31.0		48 58.1	+ 6 25.4	−0.9	22.6
	7468	0.662	30.5	27.0					
	7410	8.449	27.0	29.0		50 10.7	+ 5 14.7	+0.6	26.0
	7468	0.662	30.5	27.0					
	7474	19.073	27.0	29.0		42 59.7	+12 23.8	+0.6	24.1
	7545	6.930	34.0	23.0					
	7520	15.056	24.7	32.5		49 57.8	+ 5 28.4	+1.1	27.3
	7560	7.858	30.5	26.9					
	7571	15.542	30.0	27.1		50 15.0	+ 5 10.5	+2.3	27.8
	7560	7.858	30.5	26.9					
	7584	18.363	30.0	27.3		48 20.3	+ 7 04.5	+2.2	27.0
	7727	6.773	30.9	20.0					
	7693	15.031	27.0	31.7		37 49 52.1	+ 5 33.7	+2.2	28.0
	7765	17.978	29.7	28.3					
	7777	2.132	28.0	29.6		38 06 07.1	−10 40.3	−0.1	26.7
	7871	5.371	32.0	26.3					
	7856	18.781	27.5	31.0		37 46 21.6	+ 9 01.9	+0.8	24.3
	8059	19.702	29.9	29.9					
	8091	13.691	28.6	31.0		59 32.0	− 4 02.9	−0.8	28.3
	8114	7.121	30.9	29.0					
	8097	5.167	28.6	31.0		56 20.0	− 0 54.7	−0.2	25.1
	8268	4.311	24.0	35.4					
	8227	13.542	32.5	27.0		37 49 14.1	+ 6 13.0	−2.1	25.0
	8282	18.269	24.0	25.3					
	8247	1.707	32.9	26.9		38 06 36.2	−11 09.3	+1.7	28.6
	60	13.653	29.9	28.8					
	120	8.380	26.9	31.5		37 58 57.2	− 3 33.1	−1.3	22.8
	197	10.325	29.1	30.0					
	164	12.999	29.0	29.9		53 37.3	+ 1 48.1	−0.6	24.8
	255	12.311	32.5	27.5					
	223	8.712	28.4	31.0		37 57 50.5	− 2 24.2	+0.8	37 55 27.1

Observations and computations—Continued.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 10..	508	9.996	36.3	24.0					
	469	12.424	24.8	35.5		37 53 48.1	+ 1 38.1	+0.6	37 55 26.8
	560	3.796	29.9	30.8					
	630	19.988	31.6	29.8		44 29.8	+10 54.3	+0.3	24.4
	673	17.621	28.0	33.8					
	657	19.307	31.8	29.7		54 17.9	+ 1 08.1	—1.3	24.7
	690	14.150	31.8	30.0					
	707	18.504	30.8	31.2		52 27.1	+ 2 55.9	+0.5	23.5
	857	15.832	33.3	30.6					
	769	18.484	29.5	33.2		37 53 41.1	+ 1 47.2	—0.4	27.9
	858	18.110	33.3	30.6					
	825	10.514	29.9	34.2		38 00 35.0	— 5 07.0	—0.6	27.4
	962	4.381	29.3	35.0					
	872	3.847	33.8	30.0		37 55 50.7	— 0 21.6	—0.7	28.4
	962	4.381	29.3	35.0					
	980	18.451	34.9	29.8		37 45 58.9	+ 9 28.6	—0.2	27.3
	1043	16.923	29.5	35.0					
	1023	9.432	33.9	30.5		38 00 27.0	— 5 02.7	—0.7	23.6
	1062	12.059	34.3	30.0					
	1096	12.010	29.7	34.7		37 55 27.3	— 0 02.0	—0.3	25.0
	1139	7.862	30.5	33.5					
	1132	13.192	34.5	29.5		51 52.8	+ 3 35.4	+0.7	28.9
	1282	13.532	29.5	34.5					
	1326	15.370	32.0	31.5		37 54 15.4	+ 1 14.3	—1.6	28.1
	1477	18.391	33.7	29.2					
	1497	2.740	26.0	37.0		38 05 58.2	—10 32.5	—2.3	23.4
	1546	10.351	26.4	37.0					
	1526	15.006	35.0	28.0		37 52 17.8	+ 3 08.1	—1.3	24.6
	1547	12.540	26.4	37.0					
	1526	15.006	35.0	28.0		53 47.5	+ 1 39.7	—1.3	25.9
	1567	5.935	32.5	30.9					
	1620	13.499	31.8	31.8		50 21.4	+ 5 05.7	+0.6	27.7
October 11..	6697	14.238	33.5	21.1					
	6674	13.049	21.8	33.0		56 13.8	— 0 48.0	+0.4	26.2
	6697	14.238	33.5	21.1					
	6676	8.620	21.5	33.3		37 59 11.5	— 3 47.0	+0.2	24.7
	6712	14.062	28.6	26.0					
	6739	4.681	29.0	25.5		38 01 43.5	— 6 19.1	+2.1	37 55 26.5

Observations and computations—Continued.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
October 11..	6928	15.776	29.6	26.0					
	6912	6.941	26.0	29.0		38 01 21.2	− 5 57.0	+0.2	37 55 24.4
	6928	15.776	29.6	26.0					
	6968	12.683	25.9	30.5		37 57 31.2	− 2 05.0	−0.4	25.8
	7008	4.384	29.0	28.0					
	6997	14.937	28.0	23.7		48 20.2	+ 7 06.5	+0.1	26.8
	7008	4.384	29.0	28.0					
	7084	19.113	28.9	29.0		37 45 30.6	+ 9 55.2	+0.3	26.1
	7119	20.952	30.0	28.0					
	7103	2.055	24.8	32.8		38 08 11.2	−12 43.6	−2.1	25.5
	7161	3.680	31.9	26.0					
	7194	20.144	25.3	33.0		37 44 23.5	+11 05.3	−0.6	28.2
	7262	11.462	30.8	28.0					
	7275	10.476	28.0	30.7		56 07.0	− 0 39.8	+0.0	27.2
	7468	0.625	30.5	30.0					
	7410	8.432	28.0	31.9		50 10.9	+ 5 15.5	−1.2	25.2
	7483	2.912	30.9	29.7					
	7474	19.030	29.4	30.7		44 33.8	+10 51.3	−0.0	25.1
	7545	5.715	29.3	31.4					
	7520	13.887	31.7	28.7		49 58.0	+ 5 30.2	+0.3	28.5
	7560	8.269	32.3	27.9					
	7584	19.780	26.6	33.5		48 20.5	+ 7 45.2	−0.9	24.8
	7693	14.011	32.1	28.2					
	7727	5.758	30.5	30.1		37 49 52.3	+ 5 33.5	+1.5	27.3
	7765	18.827	33.7	27.0					
	7777	2.872	29.0	31.5		38 06 07.2	−10 41.7	+1.5	24.0
	7871	3.763	32.2	28.9					
	7856	17.218	29.6	31.4		37 46 21.8	+ 9 03.7	+0.6	26.1
	8059	20.841	34.8	28.0					
	8091	14.780	29.4	32.7		59 32.0	− 4 04.9	+1.3	28.4
	8114	8.312	37.0	25.5					
	8097	6.910	20.4	32.7		56 20.1	− 0 56.7	+0.3	23.7
	8268	5.121	26.3	37.0					
	8227	14.354	33.5	29.1		37 49 14.2	+ 6 13.1	−2.2	25.1
	8282	19.028	26.0	36.2					
	8247	2.445	33.4	29.2		38 06 36.3	−11 10.0	−2.1	24.2
	8322	15.424	37.5	25.7					
	8301	6.980	25.8	37.2		01 04.3	− 5 41.2	+0.1	37 55 23.2

Observations and computations—Continued.

PIOCHE, NEVADA.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
October 11..	8330	17.569	37.6	25.5					
	8301	6.980	25.8	37.2		38 02 32.2	— 7 07.9	+0.3	37 55 24.6
	7	14.414	31.7	31.3					
	8	9.712	28.0	35.2		37 58 39.3	— 3 10.0	—2.4	26.9
	60	13.633	29.6	33.8					
	120	8.387	33.6	30.6		58 57.7	— 3 32.0	—0.4	25.3
	197	8.734	26.4	38.2					
	164	11.397	37.0	27.5		53 37.6	+ 1 47.6	—1.0	24.2
	255	11.690	30.1	34.6					
	223	8.187	31.1	33.0		57 50.7	— 2 21.6	—1.9	27.2
	508	9.100	30.9	33.9					
	469	11.584	30.7	33.5		53 48.3	+ 1 40.4	—2.0	26.7
	560	3.046	37.0	27.0					
	630	19.274	22.8	41.5		44 30.0	+10 55.6	—3.1	22.5
	673	16.895	40.3	24.6					
	657	18.581	23.0	41.7		54 18.0	+ 1 08.1	—1.0	25.1
	857	14.920	31.9	33.8					
	769	17.595	31.0	34.0		37 53 41.3	+ 1 48.1	—1.7	27.7
	858	17.202	32.0	33.6					
	825	9.582	30.9	34.7		38 00 33.2	— 5 07.9	—1.9	23.4
	962	4.141	33.5	32.5					
	872	3.573	32.0	33.1		37 55 50.8	— 0 22.9	—0.4	27.5
	962	4.141	33.5	32.5					
	1023	9.200	31.0	34.0		52 02.1	+ 3 24.4	—0.7	25.8
	1062	11.562	31.6	34.2					
	1096	11.530	33.8	32.1		37 55 27.5	— 0 01.3	—0.3	25.9
	1282	14.066	36.3	30.0					
	1262	6.400	31.2	35.0		38 00 35.0	— 5 09.7	+0.9	26.2
	1282	14.066	36.3	30.0					
	1326	15.863	27.5	39.0		37 54 15.5	+ 1 12.6	—1.8	26.3
	1424	13.181	32.0	34.1					
	1449	9.581	34.0	32.2		37 57 53.8	— 2 25.5	—1.1	27.2
	1477	18.253	36.7	29.5					
	1497	2.586	28.0	38.5		38 05 58.3	—10 33.1	—1.1	37 55 24.1

The final result is determined by Wm. A. Rogers by taking the means of groups of stars, ten pairs in a group, and forming from them one individual result. In this way, the following mean values are obtained:

	Means.	No. of observations.
	° ′ ″	
1	37 55 25.58	38
2	26.31	20
3	26.52	36
4	25.51	29
5	26.41	29
6	37 55 26.11	41

And the final result .... 37° 55′ 26″.07 ± 0″.05.

ASTRONOMICAL CO-ORDINATES OF ASTRONOMICAL STATION AT PIOCHE, NEVADA

Longitude . . $7^h\ 37^m\ 45^s.218 \pm 0^s.075$, or 114° 26′ 18″.27 ± 1″.12 west from Greenwich.
$2^h\ 29^m\ 33^s.098$, or 37° 23′ 16″.47 west from U. S. Naval Observatory at Washington, D. C.

Latitude .... 37° 55′ 26″.07 ± 0″.07 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY W. W. MARYATT AND E. P. AUSTIN IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF STATION AT GUNNISON, UTAH.

SEASON OF 1872.

COMPUTATIONS BY

W. W. MARYATT AND WM. A. ROGERS.

7 AST

GUNNISON, UTAH.

GEOGRAPHICAL POSITION OF STATION.

Longitude, 111° 49′ 15″.00 ± 0″.42 west from Greenwich.
34° 46′ 13″.20 west from the U. S. Naval Observatory, Washington, D. C.
Latitude, . . 39° 09′ 25″.62 ± 0″.05 north.
Barometric altitude of observatory above sea-level, 5144.6 feet.

This place, named in honor of the late Captain Gunnison, United States Army, is situated in Sam Pitch Valley, Utah, a dreary waste, which is 9 or 10 miles in extent from east to west and 12 or 13 miles from north to south. The town is a Mormon settlement, 2¼ miles east of Sevier River, and near the north banks of Sam Pitch Creek, lying at the northern extremity of the valley, which is surrounded by high mountains and bluffs.

The astronomical station was established in the southwestern part of the town, and was connected with surrounding points by trigonometrical measurements, so that its position can be ascertained at any time.

For a description of the instruments used, the reader is referred to the report on Beaver. An account of the observatory, methods of work, etc., at Gunnison, is given in the Progress Report of 1872, page 46.

The weather was tolerable during the time of occupation. W. W. Maryatt was observer here, and E. P. Austin at the connected station, Salt Lake City. They exchanged signals over the Deseret Telegraph Line October 23 and 31, and November 1, 5, and 6. The length of circuit was about 100 miles. Signals were sent by the local battery at Gunnison without the assistance of any repeaters.

Observations for latitude were made November 8, 15, 16, 18, 19, 20, 22, and 25. These were reduced by Wm. A. Rogers. Computation of the time-observations at both stations was made by Mr. Maryatt. Final arrangement of the report was made by Dr. F. Kampf.

Tabulation of stars used for determination of time at astronomical station at Gunnison, Utah, and Salt Lake City, Utah, 1872.

Name of star.	Gunnison.						Salt Lake City.					
	October 23.	October 25.	October 31.	November 1.	November 5.	November 6.	October 23.	October 25.	October 31.	November 1.	November 5.	November 6.
α Andromedæ	--	--	--	--	--	--	--	--	×	--	×	--
γ Pegasi	--	--	--	--	×	--	--	--	×	--	×	--
ι Ceti	--	--	--	--	--	--	--	--	--	--	×	--
α Cassiopeiæ	--	--	--	--	--	--	×	--	--	--	--	--
β Ceti	--	--	--	--	--	--	×	--	--	--	--	--
ε Piscium	--	×	--	--	--	--	×	--	--	--	--	--
θ^1 Ceti	--	--	--	--	--	--	--	--	×	×	--	×
38 Cassiopeiæ	×	×	×	×	×	×	--	--	×	×	--	×
η Piscium	--	--	--	--	--	--	--	--	--	--	--	×
ν Piscium	--	--	--	--	--	--	--	--	--	--	--	×
o Piscium	×	--	×	--	×	×	--	--	--	×	--	×
β Arietis	×	×	--	×	×	×	--	--	×	×	--	×
50 Cassiopeiæ	×	×	×	×	×	×	--	--	×	×	--	×
α Arietis	×	×	×	×	×	×	--	--	--	×	--	×
ξ^1 Ceti	×	×	×	×	×	×	--	--	--	--	--	--
ι Cassiopeiæ	--	×	×	×	×	×	--	--	--	--	--	--
5 Ursæ Min., L. C		--	×	×	×	--	--	--	--	--	--	--
γ Ceti	×	×	×	×	×	×	--	--	--	--	--	--
β Ursæ Min., L. C	--	--	×	--	×	--	--	--	--	--	--	--
α Ceti	×	×	×	--	--	--	--	--	--	--	--	--
48 Cephei	×	×	--	--	--	--	--	--	--	--	--	--
Groombr. 3241	--	×	--	--	--	--	--	--	--	--	--	--
α Cygni	--	×	×	×	×	--	--	--	--	--	--	--
μ Aquarii	--	--	×	--	×	--	--	--	--	--	--	--
ν Cygni	--	×	×	×	×	--	--	--	--	--	--	--
61 Cygni	--	×	×	×	×	--	--	--	--	--	--	--

Name of star.	Gunnison.						Salt Lake City.					
	October 23.	October 25.	October 31.	November 1.	November 5.	November 6.	October 23.	October 25.	October 31.	November 1.	November 5.	November 6.
ζ Cygni	--	×	×	×	×	--	×	×	--	--	--	--
α Cephei	--	--	--	--	--	--	×	×	--	--	--	--
1 Pegasi	--	×	--	--	--	--	--	--	--	--	--	--
β Aquarii	--	--	--	--	--	--	--	×	×	--	--	--
β Cephei	×	×	×	--	--	--	×	×	×	×	--	×
ξ Aquarii	--	--	--	--	--	--	×	×	×	×	--	×
ε Pegasi	×	×	--	--	--	--	×	×	×	×	--	×
11 Cephei	-	--	×	--	--	--	--	--	×	×	--	×
μ Capricorni	×	×	--	--	--	--	×	--	×	×	--	×
79 Draconis	×	×	--	--	--	--	×	×	×	×	.	×
α Aquarii	×	--	×	--	--	--	×	--	×	×	--	×
α Gruis	--	×	--	--	--	--	--	--	--	--	--	--
θ Aquarii	×	×	×	×	×	--	×	--	×	×	--	×
π Aquarii	×	×	×	×	×	×	×	--	--	×	--	×
9 Draconis, L. C	--	--	--	--	--	--	--	--	×	×	--	--
226 Cephei	×	×	×	×	×	×	--	--	.	--	--	--
ζ Pegasi	--	×	×	×	×	×	--	--	--	--	--	--
ι Cephei	--	×	×	×	×	×	--	--	--	--	--	--
α Piscis Australis	×	×	×	×	×	×	--	--	--	--	--	--
α Pegasi	×	×	×	×	×	×	--	--	--	--	--	--
o Cephei	×	×	×	×	×	×	--	×	--	--	×	×
θ Piscium	--	--	×	×	--	×	--	×	--	--	×	×
ι Piscium	--	--	--	--	--	--	×	×	--	--	×	×
γ Cephei	--	--	--	×	--	×	--	--	--	--	×	×
Groombr. 4163	--	--	--	--	×	--	×	--	--	--	×	--
ω Piscium	--	--	--	--	--	--	×	--	--	--	×	--

Observations and reductions for time taken at sending station.

GUNNISON, UTAH, OCTOBER 23, 1872.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	β Cephei	23 46 50.01	— 7.59	+ 0.18	0.00	23 46 42.60	21 27 00.93	—2 19 41.67
W.	ε Pegasi	57 34.82	+ 2.55	+ 0.06	0.00	57 37.43	37 55.83	41.60
W.	μ Capricorni	0 05 58.52	+ 4.18	+ 0.04	0.00	0 06 02.74	46 21.10	41.64
W.	79 Draconis	11 08.79	— 9.72	+ 0.20	0.00	10 59.27	51 17.83	41.44
W.	α Aquarii	18 52.95	+ 3.26	+ 0.05	0.00	18 56.26	59 14.58	41.68
W.	θ Aquarii	29 44.68	+ 3.77	+ 0.05	0.00	29 48.50	22 10 06.88	41.62
E.	π Aquarii	38 23.64	+ 2.48	+ 0.05	0.00	38 26.17	18 46.49	39.68
E.	226 Cephei	49 52.35	— 9.50	+ 0.22	0.00	49 43.07	30 03.48	39.59
E.	α Piscis Australis	1 10 12.42	+ 4.33	+ 0.03	0.00	1 10 16.78	50 37.10	39.68
E.	α Pegasi	18 03.74	+ 1.72	+ 0.06	0.00	18 05.52	58 25.39	40.13
E.	ο Cephei	33 10.61	— 4.91	+ 0.16	0.00	33 05.86	23 13 25.60	—2 19 40.26

NORMAL EQUATIONS.

For W.: $0 = + \ 9.35 + 6.00\,\delta t - 0.70\,a$

$0 = - 40.11 - 0.70\,\delta t + 7.78\,a \qquad a = + 5^s.07$

For E.: $0 = + \ 1.95 + 5.00\,\delta t - 1.48\,a$

$0 = - 34.55 - 1.48\,\delta t + 8.94\,a \qquad a = + 3^s.99$

The error of collimation will be eliminated in the mean of the corrections for W. and E.

GUNNISON, UTAH, OCTOBER 23, 1872.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	38 Cassiopeiæ	3 41 34.69	— 6 67	+ 0.19	+ 1.88	3 41 30.09	1 21 49.32	—2 19 40.77
E.	ο Piscium	58 18.69	+ 2.37	+ 0.09	+ 0.66	58 21.81	38 41.00	40.81
E.	β Arietis	4 07 15.51	+ 1.61	+ 0.10	+ 0.70	4 07 17.92	47 37.19	40.73
E.	50 Cassiopeiæ	12 25.06	— 7.95	+ 0.27	+ 2.10	12 19.48	52 38.63	40.85
E.	α Arietis	19 39.32	+ 1.40	+ 0.10	+ 0.71	19 41.53	2 00 00.59	40.94
E.	ξ¹ Ceti	25 53.46	+ 2.39	+ 0.09	+ 0.66	25 56.60	06 15.78	40.82
W.	γ Ceti	56 21.44	+ 2.74	+ 0.21	— 0.66	56 23.73	36 42.94	40.79
W.	α Ceti	5 15 16.73	+ 2.68	+ 0.22	— 0.65	5 15 18.98	55 38.15	40.83
W.	48 Cephei	24 13.89	—12.88	+ 1.06	— 2.97	23 59.10	3 04 18.26	—2 19 40.84

NORMAL EQUATIONS.

$0 = + 13.96 + 9.00\,\delta t - \ 3.13\,a + \ 3.71\,c$

$0 = - 69.11 - 3.13\,\delta t + 14.36\,a + \ 3.54\,c \qquad a = + 4^s.602$

$0 = - 45.34 + 3.71\,\delta t + \ 3.54\,a + 45.41\,c \qquad c = + 0^s.656$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, OCTOBER 25, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	Groombr. 3241	22 50 14.42	— 1.71	+ 0.48	— 1.27	22 50 11.92	20 30 32.05	—2 19 39.87
W.	α Cygni	56 44.92	— 0.14	+ 0.25	— 0.55	56 44.48	37 05.04	39.44
E.	ν Cygni	23 12 04.05	— 0.07	+ 0.23	+ 0.51	23 12 04.72	52 25.23	39.49
E.	61 Cygni	20 49.88	+ 0.02	+ 0.22	+ 0.50	20 50.62	21 01 11.22	39.40
W.	ζ Cygni	27 10.24	+ 0.18	+ 0.20	— 0.45	27 10.17	07 30.75	39.42
W.	1 Pegasi	35 50.91	+ 0.35	+ 0.18	— 0.41	35 50.85	16 11.68	39.17
W.	β Cephei	23 46 42.42	— 1.45	+ 0.44	— 1.14	46 40.27	27 00.80	—2 19 39.47

NORMAL EQUATIONS.

$$0 = + \ 6.66 + 7.00\,\delta t - 2.91\,a - \ 7.21\,c$$
$$0 = - \ 9.11 - 2.91\,\delta t + 5.57\,a + \ 8.57\,c \qquad a = +0^s.966$$
$$0 = -20.05 - 7.21\,\delta t + 8.57\,a + 26.94\,c \qquad c = +0^s.390$$

GUNNISON, UTAH, OCTOBER 25, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	ε Pegasi	23 57 34.80	+ 0.33	+ 0.12	— 0.33	23 57 34.92	21 37 55.80	—2 19 39.12
W.	μ Capricorni	0 06 00.03	+ 0.54	+ 0.09	— 0.34	0 06 00.32	46 21.08	39.24
W.	79 Draconis	10 58.89	— 1.25	+ 0.40	— 1.14	10 56.90	51 17.71	39.19
W.	α Gruis	19 50.58	+ 0.96	+ 0.01	— 0.49	19 51.06	22 00 12.29	38.77
E.	θ Aquarii	29 45.17	+ 0.48	+ 0.10	+ 0.33	29 46.08	10 06.85	39.23
E.	π Aquarii	38 24.79	+ 0.40	+ 0.11	+ 0.33	38 25.63	18 46.49	39.14
E.	226 Cephei	0 49 42.32	— 1.54	+ 0.45	+ 1.44	49 42.67	30 03.35	—2 19 39.32

NORMAL EQUATIONS.

$$0 = -0.75 + 7.00\,\delta t - \ 0.12\,a - \ 0.94\,c$$
$$0 = -7.08 - 0.12\,\delta t + 13.44\,a - \ 5.13\,c \qquad a = +0^s.65$$
$$0 = -7.79 - 0.94\,\delta t - \ 5.13\,a + 34.25\,c \qquad c = +0^s.33$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, OCTOBER 25, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	ζ Pegasi	0 54 45.42	+ 0.38	+ 0.06	+ 0.34	0 54 46.20	22 35 06.77	—2 19 39.43
E.	ι Cephei	1 04 49.21	— 0.83	+ 0.14	+ 0.80	1 04 49.32	45 09.91	39.41
E.	α Piscis Australis	10 15.23	+ 0.85	+ 0.03	+ 0.38	10 16.49	50 37.08	39.41
E.	α Pegasi	18 04.04	+ 0.34	+ 0.06	+ 0.33	18 04.77	58 25.37	39.40
E.	ο Cephei	33 04.85	— 0.96	+ 0.15	+ 0.86	1 33 04.90	23 13 25.55	—2 19 39.35

NORMAL EQUATIONS.

$0 = +0.75 + 5.00\,\delta t - 0.30\,a$

$0 = -3.28 - 0.30\,\delta t + 4.28\,a$ $\qquad a = +0^s.78$

Adopted $\qquad c = +0^s.33$

GUNNISON, UTAH, OCTOBER 25, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s*	*h. m. s.*
E.	ε Piscium	3 15 59.14	+ 0.47	+ 0.07	+ 0.35	3 16 00.03	0 56 20.78	—2 19 39.25
E.	38 Cassiopeiæ	41 28.74	— 1.29	+ 0.17	+ 1.00	41 28.62	1 21 49.33	39.29
E.	β Arietis	4 07 15.42	+ 0.31	+ 0.08	+ 0.37	4 07 16.18	47 37.20	38.98
E.	50 Cassiopeiæ	12 17.95	— 1.54	+ 0.23	+ 1.12	12 17.76	52 38.67	39 09
E.	α Arietis	19 39.04	+ 0.27	+ 0.09	+ 0.38	19 39.78	2 00 00.61	39.17
E.	ξ^1 Ceti	25 54.07	+ 0.46	+ 0.07	+ 0.35	25 54.95	06 15.80	39.15
W.	ι Cassiopeiæ	38 19.30	— 1.05	+ 0.19	— 0.89	38 17.55	18 37.90	39.65
W.	γ Ceti	56 21.85	+ 0.53	+ 0.07	— 0.35	56 22.10	36 42.97	39.13
W.	α Ceti	5 15 17.04	+ 0.52	+ 0.07	— 0.35	5 15 17.28	55 38 18	39.10
W.	48 Cephei	24 01.09	— 2.50	+ 0.30	— 1.58	23 57.31	3 04 18.37	—2 19 38.94

NORMAL EQUATIONS.

$0 = +2.67 + 10.00\,\delta t - 4.28\,a + 1.16\,c$

$0 = -16.06 - 4.28\,\delta t + 15.76\,a + 6.66\,c$ $\qquad a = +0^s.893$

$0 = -24.19 + 1.16\,\delta t + 6.66\,a + 51.87\,c$ $\qquad c = +0^s.349$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, OCTOBER 31, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	α Cygni	22 56 31.24	— 0.08	+ 0.09	+ 0.09	22 56 31.34	20 37 04.88	—2 19 26.46
W.	μ Aquarii	23 05 12.37	+ 0.38	+ 0.04	+ 0.06	23 05 12.85	45 46.51	26.34
W.	ν Cygni	11 51.26	— 0.04	+ 0.08	+ 0.08	11 51.38	52 25.09	26.29
E.	61 Cygni	20 37.24	+ 0.01	+ 0.08	— 0.08	20 37.25	21 01 11.10	26.15
E.	ζ Cygni	26 56.87	+ 0.11	+ 0.07	— 0.07	26 56.98	07 30.64	26.34
E.	β Cephei	23 46 27.57	— 0.74	+ 0.16	— 0.21	23 46 26.78	21 27 00.44	—2 19 26.34

NORMAL EQUATIONS.

$0 = + 0.58 + 6.00\,\delta t - 0.74\,a$
$0 = - 1.46 - 0.74\,\delta t + 2.88\,a$ $\qquad a = + 0^s.50$

c found by preliminary reduction to be $= + 0^s.06$.

GUNNISON, UTAH, OCTOBER 31, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	11 Cephei	23 59 30.19	— 0.57	+ 0.10	— 0.22	23 59 29.50	21 40 03.10	—2 19 26.40
E.	α Aquarii	0 18 40.64	+ 0.24	+ 0.03	— 0.07	0 18 40.84	59 14.48	26.36
W.	θ Aquarii	29 32.78	+ 0.28	+ 0.03	+ 0.07	29 33.16	22 10 06.78	26.38
W.	π Aquarii	38 12.48	+ 0.24	+ 0.03	+ 0.07	38 12.82	18 46.42	26.40
W.	226 Cephei	49 29.56	— 0.84	+ 0.13	+ 0.29	49 29.14	30 02.95	26.19
W.	ζ Pegasi	54 32.65	+ 0.19	+ 0.04	+ 0.07	54 32.95	35 06.71	26.24
W.	ι Cephei	1 04 36.44	— 0.38	+ 0.09	+ 0.18	1 04 36.33	45 09.69	26.64
W.	α Piscis Australis	10 02.84	+ 0.40	+ 0.02	+ 0.08	10 03.34	50 37.00	26.34
W.	α Pegasi	27 51.12	+ 0.16	+ 0.04	+ 0.08	27 51.40	23 08 25.31	26.09
W.	ο Cephei	32 51.83	— 0.44	+ 0.09	+ 0.19	32 51.67	13 25.34	26.33
W.	θ Piscium	1 40 56.96	+ 0.21	+ 0.03	+ 0.07	1 40 57.27	23 21 30.81	—2 19 26.46

NORMAL EQUATIONS.

$0 = + 0.74 + 11.00\,\delta t - 2.30\,a$ $\qquad a = + 0^s.36$
$0 = - 4.89 - 2.30\,\delta t + 13.58\,a$ $\qquad c = + 0^s.06$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, OCTOBER 31, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	38 Cassiopeiæ	3 41 15.98	— 1.18	+ 0.62	— 0.06	3 41 15.36	1 21 49.31	—2 19 26.05
E.	o Piscium	58 06.72	+ 0.42	+ 0.27	— 0.02	58 07.39	38 41.04	26.35
E.	50 Cassiopeiæ	4 12 05.56	— 1.41	+ 0.85	— 0.06	4 12 04.94	52 38.71	26.23
E.	α Arietis	19 26.28	+ 0.25	+ 0.33	— 0.02	19 26.84	2 00 00.66	26.18
W.	ξ^1 Ceti	25 41.33	+ 0.43	+ 0.27	+ 0.02	25 42.05	06 15.85	26.20
W.	ι Cassiopeiæ	38 04.12	— 0.96	+ 0.71	+ 0.05	38 03.92	18 37.99	25.93
W.	5 Urs. Minoris, L.C.	47 08.32	+ 3.11	— 0.57	— 0.08	47 10.78	27 44.78	26.00
W.	γ Ceti	56 08.49	+ 0.49	+ 0.25	+ 0.02	56 09.25	36 43.03	26.22
W.	β Urs. Minoris, L.C.	5 10 25.70	+ 2.83	— 0.48	— 0.07	5 10 27.98	51 01.87	26.11
W.	α Ceti	15 03.67	+ 0.48	— 0.26	+ 0.02	15 04.43	2 55 38.25	—2 19 26.18

NORMAL EQUATIONS.

$$0 = + 0.51 + 10.00\,\delta t + 5.42\,a + 10.60\,c$$
$$0 = + 25.78 + 5.42\,\delta t + 34.23\,a + 21.64\,c \qquad a = + 0^s.82$$
$$0 = + 12.58 + 10.60\,\delta t + 21.64\,a + 62.21\,c \qquad c = - 0^s.02$$

GUNNISON, UTAH, NOVEMBER 1, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	α Cygni	22 56 28.60	— 0.07	+ 0.21	+ 0.03	22 56 28.77	20 37 04.86	—2 19 23.91
W.	ν Cygni	23 11 48.65	— 0.04	+ 0.20	+ 0.02	23 11 48.83	52 25.06	23.77
E.	61 Cygni	20 34.77	+ 0.01	+ 0.19	— 0.03	20 34.94	21 01 11.07	23.87
E.	ζ Cygni	23 26 54.46	+ 0.11	+ 0.17	— 0.03	23 26 54.71	07 30.62	—2 19 24.09

NORMAL EQUATIONS.

$$0 = - 1.04 + 4.00\,\delta t + 0.00\,a + 0.05\,c$$
$$0 = - 0.03 + 0.00\,\delta t + 0.07\,a + 0.54\,c \qquad a = + 0^s.58$$
$$0 = - 0.24 + 0.05\,\delta t + 0.54\,a - 6.68\,c \qquad c = - 0^s.02$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, NOVEMBER 1, 1872.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	θ Aquarii	0 29 29.96	+ 0.75	+ 0.05	— 0.05	0 29 30.71	22 10 06.77	—2 19 23.94
E.	π Aquarii	38 09.87	+ 0.63	+ 0.06	— 0.05	38 10.51	18 46.41	24.10
E.	226 Cephei	49 28.76	— 2.40	+ 0.25	— 0.21	49 26.40	30 02.85	23.55
E.	ζ Pegasi	54 30.25	+ 0.50	+ 0.07	— 0.06	54 30.76	35 06.69	24.07
E.	ι Cephei	1 04 34.77	— 1.08	+ 0.16	— 0.13	1 04 33.72	45 09.64	24.08
W.	a Piscis Australis	09 59.91	+ 1.10	+ 0.03	+ 0.06	10 01.10	50 36.98	24.12
W.	a Pegasi	17 48.79	+ 0.44	+ 0.07	+ 0.05	17 49.35	58 25.30	24.05
W.	o Cephei	32 50.24	— 1.24	+ 0.17	+ 0.11	32 49.28	23 13 25.30	23.98
W.	θ Piscium	40 54.05	+ 0.55	+ 0.06	+ 0.05	40 54.71	21 30.80	23.91
W.	γ Cephei	1 53 36.45	— 2.73	+ 0.27	+ 0.23	1 53 34.22	34 10.39	—2 19 23.83

NORMAL EQUATIONS.

$$0 = -\ 4.11 + 10.00\,\delta t - 4.46\,a - 0.78\,c$$
$$0 = +17.38 - 4.46\,\delta t + 17.53\,a + 3.65\,c \qquad a = +1^s.01$$
$$0 = +\ 0.75 - 0.78\,\delta t + 3.65\,a + 54.73\,c \qquad c = -0^s.05$$

GUNNISON, UTAH, NOVEMBER 1, 1872.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	38 Cassiopeiæ	3 41 13.93	— 1.45	+ 0.47	+ 0.23	3 41 13.18	1 21 49.30	—2 19 23.88
W.	β Arietis	4 07 00.20	+ 0.35	+ 0.24	+ 0.09	4 07 00.88	47 37.24	23.64
W.	50 Cassiopeiæ	12 03.61	— 1.73	+ 0.64	+ 0.26	12 02.78	52 38.71	24.07
E.	a Arietis	19 23.92	+ 0.31	+ 0.25	— 0.09	19 24.39	2 00 00.66	23.73
E.	ξ^1 Ceti	25 39.11	+ 0.52	+ 0.21	— 0.08	25 39.76	06 15.85	23.91
E.	ι Cassiopeiæ	38 02.41	— 1.18	+ 0.54	— 0.21	38 01.56	18 38.00	23.56
E.	5 Urs. Minoris, L.C.	47 04.68	+ 3.80	— 0.43	+ 0.34	47 08.39	27 44.77	23.62
E.	γ Ceti	4 56 06.23	+ 0.59	+ 0.19	— 0.08	4 56 06.93	2 36 43.04	—2 19 23.89

NORMAL EQUATIONS.

$$0 = -\ 0.97 + 10.00\,\delta t + 1.21\,a - 5.71\,c$$
$$0 = -22.28 + 1.21\,\delta t + 21.77\,a - 8.33\,c \qquad a = +1^s.90$$
$$0 = +10.81 - 5.71\,\delta t - 8.33\,a + 37.01\,c \qquad c = -0^s.08$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, NOVEMBER 5, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	α Cygni	22 56 21.77	− 0.13	− 0.03	− 0.07	22 56 21.54	20 37 04.75	−2 19 16.79
E.	μ Aquarii	23 05 02.83	+ 0.72	− 0.01	− 0.05	23 05 03.49	45 46.43	17.06
E.	ν Cygni	11 42.06	− 0.07	− 0.03	− 0.07	11 41.89	52 24.97	16.92
W.	61 Cygni	20 27.76	+ 0.02	− 0.02	+ 0.06	20 27.82	21 01 10.99	16.83
W.	ζ Cygni	23 26 47.33	+ 0.18	− 0.02	+ 0.06	23 26 47.55	07 30.55	−2 19 17.00

NORMAL EQUATIONS.

$$0 = -0.05 + 5.00\,\delta t + 0.76\,a + 1.32\,c$$
$$0 = -0.51 + 0.76\,\delta t + 0.64\,a + 0.23\,c \qquad a = +0^s.96$$
$$0 = +0.31 + 1.32\,\delta t + 0.23\,a + 7.70\,c \qquad c = -0^s.05$$

GUNNISON, UTAH, NOVEMBER 5, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	θ Aquarii	0 29 22.82	+ 0.46	− 0.02	+ 0.13	0 29 23.39	22 10 06.71	−2 19 16.68
W.	π Aquarii	38 02.52	+ 0.39	− 0.02	+ 0.13	38 03.02	18 46.36	16.66
W.	226 Cephei	49 20.28	− 1.47	− 0.08	+ 0.51	49 19.24	30 02.55	16.69
W.	ζ Pegasi	54 23.05	+ 0.30	− 0.02	+ 0.13	54 23.46	35 06.65	16.81
W.	ι Cephei	1 04 26.55	− 0.66	− 0.05	+ 0.31	1 04 26.15	45 09.49	16.66
E.	α Piscis Australis	09 52.85	+ 0.67	− 0.01	− 0.15	09 53.36	50 36.93	16.43
E.	α Pegasi	17 41.90	+ 0.27	− 0.02	− 0.13	17 42.02	58 25.26	16.76
E.	ο Cephei	32 43.02	− 0.76	− 0.06	− 0.34	32 41.86	23 13 25.16	16.70
E.	Groombr. 4163	2 08 00.20	− 1.25	− 0.07	− 0.46	2 07 58.42	48 41.35	17.07
E.	γ Pegasi	25 57.67	+ 0.27	− 0.02	− 0.13	25 57.79	0 06 41.27	−2 19 16.52

NORMAL EQUATIONS.

$$0 = +\ 1.76 + 10.00\,\delta t - 2.90\,a - 0.06\,c$$
$$0 = -10.34 - 2.90\,\delta t + 15.09\,a + 0.91\,c \qquad a = +0^s.62$$
$$0 = +\ 5.90 - 0.06\,\delta t + 0.91\,a + 47.95\,c \qquad c = -0^s.13$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, NOVEMBER 5, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	38 Cassiopeiæ	3 31 07.00	− 1.29	+ 0.06	− 0.23	3 41 05.54	1 11 49.28	−2 19 16.26
E.	ο Piscium	57 57.28	+ 0.46	+ 0.03	− 0.08	57 57.69	38 41.05	16.64
E.	β Arietis	4 06 53.45	+ 0.31	+ 0.03	− 0.09	4 06 53.70	47 37.26	16.44
E.	50 Cassiopeiæ	11 56.76	− 1.53	+ 0.08	− 0.26	11 55.05	52 38.73	16.32
W.	α Arietis	19 16.87	+ 0.27	+ 0.03	+ 0.09	19 17.26	2 00 00.69	16.57
W.	ξ¹ Ceti	25 31.87	+ 0.46	+ 0.03	+ 0.08	25 32.44	06 15.88	16.56
W.	ι Cassiopeiæ	37 56.14	− 1.05	+ 0.07	+ 0.21	37 55.37	18 38.05	17.32
W.	5 Ursæ Min., L. C.	46 58.61	+ 3.38	− 0.04	− 0.34	47 01.61	27 44.77	16.84
W.	γ Ceti	55 59.01	+ 0.53	+ 0.02	+ 0.08	55 59.64	36 43.07	16.57
W.	β Ursæ Min., L. C.	5 10 15.48	+ 3.07	− 0.03	− 0.31	5 10 18.21	2 51 01.82	−2 19 16.39

NORMAL EQUATIONS.

$$0 = +\ 0.92 + 9.00\,\delta t + 1.72\,a - 6.72\,c$$
$$0 = -17.56 + 1.72\,\delta t + 22.04\,a - 8.85\,c \qquad a = +\,0^s.89$$
$$0 = +\ 3.44 - 6.72\,\delta t - 8.85\,a + 48.03\,c \qquad c = -\,0^s.08$$

GUNNISON, UTAH, NOVEMBER 6, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	π Aquarii	0 38 00.04	+ 0.21	+ 0.03	− 0.12	0 38 00.16	22 18 46.35	−2 19 13.81
E.	226 Cephei	49 17.30	− 0.79	+ 0.14	− 0.48	49 16.17	30 02.47	13.70
E.	ζ Pegasi	54 20.45	+ 0.16	+ 0.04	− 0.12	54 20.53	35 06.64	13.89
E.	ι Cephei	1 04 24.17	− 0.35	+ 0.09	− 0.29	1 04 23.62	45 09.45	14.17
W.	α Piscis Australis	09 50.28	+ 0.36	+ 0.02	+ 0.14	09 50.80	50 36.92	13.88
W.	α Pegasi	17 38.84	+ 0.14	+ 0.04	+ 0.12	17 39.14	58 25.25	13.89
W.	ο Cephei	32 39.21	− 0.40	+ 0.10	+ 0.31	32 39.22	23 13 25.11	14.11
W.	θ Piscium	40 44.38	+ 0.18	+ 0.04	+ 0.12	40 44.72	21 30.76	13.96
W.	γ Cephei	1 53 24.21	− 0.89	+ 0.15	+ 0.53	1 53 24.00	23 34 10.07	−2 19 13.93

NORMAL EQUATIONS.

$$0 = +\,2.21 + 9.00\,\delta t - 4.21\,a + 1.78\,c$$
$$0 = -\,6.04 - 4.21\,\delta t + 17.97\,a - 2.89\,c \qquad a = +\,0^s.33$$
$$0 = -\,5.15 + 1.78\,\delta t - 2.89\,a + 53.71\,c \qquad c = -\,0^s.12$$

Observations and reductions for time taken at sending station—Continued.

GUNNISON, UTAH, NOVEMBER 6, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	38 Cassiopeiæ	3 41 03.13	— 0.70	+ 0.08	+ 0.34	3 41 02.85	1 21 49.27	—2 19 13.58
W.	ο Piscium	57 54.04	+ 0.25	+ 0.03	+ 0.12	57 54.44	38 41.05	13.39
W.	β Arietis	4 06 50.38	+ 0.17	+ 0.04	+ 0.13	4 06 50.72	47 37.26	13.46
W.	50 Cassiopeiæ	11 52.47	— 0.83	+ 0.11	+ 0.38	11 52.13	52 38.72	13.41
E.	α Arietis	19 14.12	+ 0.15	+ 0.04	— 0.13	19 14.18	2 00 00.69	13.49
E.	ξ^1 Ceti	25 29.27	+ 0.25	+ 0.03	— 0.12	25 29.43	06 15.88	13.55
E.	ι Cassiopeiæ	37 52.29	— 0.57	+ 0.09	— 0.30	37 51.51	18 38.06	13.45
E.	γ Ceti	4 55 56.36	+ 0.29	+ 0.03	— 0.12	4 55 56.56	2 36 43.08	—2 19 13.48

NORMAL EQUATIONS.

$$0 = +0.54 + 8.00\,\delta t - 2.08\,a + 2.50\,c$$
$$0 = -2.76 - 2.08\,\delta t + 7.58\,a - 7.16\,c \qquad a = +0^s.48$$
$$0 = -0.23 + 2.50\,\delta t - 7.16\,a + 30.30\,c \qquad c = -0^s.12$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, OCTOBER 23, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s	s.	s.	h. m. s.	h. m. s.	m. s.
E.	ζ Cygni	21 10 08.87	+ 0.05	— 0.06	— 0.06	21 10 08.80	21 07 30.79	— 2 38.01
E.	α Cephei	18 10.58	— 0.18	+ 0.18	— 0.11	18 10.47	15 32.43	38.04
E.	β Cephei	29 39.17	— 0.33	+ 0.18	— 0.15	29 38.87	27 00.93	37.94
E.	ξ Aquarii	33 36.19	+ 0.17	+ 0.03	— 0.05	33 36.34	30 58.17	38.17
E.	ε Pegasi	40 33.88	+ 0.12	+ 0.03	— 0.05	40 33.98	37 55.73	38.25
W.	μ Capricorni	48 58.87	+ 0.19	+ 0.05	+ 0.05	48 59.16	46 21.10	38.06
W.	79 Draconis	53 55.99	— 0.42	+ 0.32	+ 0.17	53 56.06	51 17.85	38.21
W.	α Aquarii	22 01 52.32	+ 0.15	+ 0.07	+ 0.05	22 01 52.59	59 14.58	38.01
W.	θ Aquarii	12 44.66	+ 0.17	+ 0.06	+ 0.05	12 44.94	22 10 06.88	38.06
W.	π Aquarii	21 24.22	+ 0.15	+ 0.08	+ 0.05	21 24.50	18 46.52	— 2 37.98

NORMAL EQUATIONS.

$$0 = -0.47 + 10.00\,\delta t + 0.39\,a$$
$$0 = -2.11 + 0.39\,\delta t + 9.17\,a \qquad a = +0^s.228$$

Adopted $c = +0^s.05$ for W.

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 23, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	ι Piscium	23 36 02.20	+ 0.11	+ 0.25	+ 0.05	23 36 02.61	23 33 24.52	— 2 38.09
W.	Groombr. 4163	51 19.43	— 0.36	+ 0.87	+ 0.17	51 20.11	48 41.87	38.24
W.	ω Piscium	55 24.55	+ 0.11	+ 0.22	+ 0.05	55 24.93	52 46.87	38.06
E.	α Cassiopeiæ	0 35 56.85	+ 0.09	— 0.21	— 0.09	0 35 56.64	0 33 18.69	37.95
E.	β Ceti	39 50.94	+ 0.17	— 0.06	— 0.05	39 50.88	37 12.55	38.33
E.	ε Piscium	0 58 59.12	+ 0.11	— 0.07	— 0.05	0 58 59.11	0 56 20.78	— 2 38.33

NORMAL EQUATIONS.

$0 = + 0.29 + 6.00\,\delta t + 1.16\,a$
$0 = - 1.00 + 1.16\,\delta t + 5.73\,a \qquad a = + 0^s.19$
Adopted $c = + 0^s.05$ for W.

SALT LAKE CITY, UTAH, OCTOBER 25, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	ζ Cygni	21 10 12.12	+ 0.01	— 0.17	— 0.06	21 10 11.90	21 07 30.75	— 2 41.15
E.	α Cephei	18 13.75	— 0.03	— 0.42	— 0.11	18 13.19	15 32.34	40.85
E.	β Aquarii	27 32.44	+ 0.03	— 0.14	— 0.05	27 32.28	24 51.08	41.20
E.	β Cephei	30 41.33	— 0.06	— 0.51	— 0.15	30 40.61	28 00.81	40.80
E.	ξ Aquarii	33 39.36	+ 0.03	— 0.13	— 0.05	33 39.21	30 58.14	41.07
W.	ε Pegasi	40 36.79	+ 0.02	— 0.08	+ 0.05	40 36.78	37 55.80	40.98
W.	79 Draconis	21 53 59.66	— 0.07	— 0.52	+ 0.17	21 53 59.24	21 51 17.72	— 2 41.52

NORMAL EQUATIONS.

$0 = - 0.89 + 7.00\,\delta t - 1.79\,a$
$0 = - 0.04 - 1.79\,\delta t + 7.79\,a \qquad a = + 0^s.04$
Adopted $c = + 0^s.05$ for W.

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 25, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	o Cephei	23 16 06.09	+ 0.44	— 0.33	+ 0.13	23 16 06.33	23 13 25.55	— 2 40.78
W.	θ Piscium	24 12.06	— 0.22	— 0.09	+ 0.05	24 11.80	21 30.85	40.95
W.	ι Piscium	23 36 05.33	— 0.22	— 0.03	+ 0.05	36 05.13	33 24.51	— 2 40.62

NORMAL EQUATIONS.

$$0 = -1.25 + 3.00\,\delta t + 0.00\,a$$
$$0 = +0.77 + 0.00\,\delta t + 2.03\,a \qquad a = -0.38$$

Adopted $c = +0^s.05$.

SALT LAKE CITY, UTAH, OCTOBER 31, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	β Aquarii	21 27 33.29	+ 0.15	— 0.15	+ 0.05	21 27 33.34	21 24 50.99	— 2 42.35
W.	β Cephei	29 42.97	— 0.29	— 0.97	+ 0.15	29 41.83	27 00.45	41.38
W.	ξ Aquarii	33 40.35	+ 0.16	— 0.28	+ 0.05	33 40.28	30 58.05	42.23
W.	ε Pegasi	40 37.94	+ 0.11	— 0.26	+ 0.05	40 37.84	37 55.71	42.13
W.	11 Cephei	42 46.36	— 0.31	— 0.60	+ 0.15	42 45.60	40 03.11	42.49
E.	μ Capricorni	49 03.23	+ 0.17	— 0.25	— 0.05	49 03.10	46 21.00	42.10
E.	79 Draconis	54 01.03	— 0.38	— 1.25	— 0.17	53 59.23	51 17.30	41.93
E.	α Aquarii	22 01 56.88	+ 0.14	— 0.32	— 0.05	22 01 56.65	59 14.48	42.17
E.	θ Aquarii	12 49.21	+ 0.16	— 0.28	— 0.05	12 49.04	22 10 06.78	42.26
E.	9 Draconis, L. C	26 50.85	+ 0.77	+ 0.59	+ 0.21	26 52.42	24 10.51	41.91
E.	α Andromedæ	0 04 31.08	+ 0.05	— 0.06	— 0.06	0 04 31.01	0 01 48.98	42.03
E.	γ Pegasi	09 23.31	+ 0.09	0.00	— 0.05	09 23.35	06 41.28	— 2 42.07

NORMAL EQUATIONS.

$$0 = -0.73 + 12.00\,\delta t + 0.60\,a$$
$$0 = -5.19 + 0.60\,\delta t + 25.18\,a \qquad a = +0^s.205$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, OCTOBER 31, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	θ^1 Ceti	1 20 22.54	0.00	+ 0.02	+ 0.05	1 20 22.61	1 17 40.30	— 2 42.31
W.	38 Cassiopeiæ	24 31.06	0.00	+ 0.08	+ 0.14	24 31.28	21 49.32	41.96
W.	β Arietis	50 19.26	0.00	+ 0.15	+ 0.05	50 19.46	47 37.23	42.23
W.	50 Cassiopeiæ	1 55 20.49	0.00	+ 0.60	+ 0.16	55 21.25	52 38.71	— 2 42.54

NORMAL EQUATIONS.

$$0 = +1.06 + 4.00\,\delta t - 2.08\,a$$
$$0 = -0.56 - 2.08\,\delta t + 5.09\,a \qquad a = 0^s.00$$
$$c = +0^s.05 \text{ for W.}$$

SALT LAKE CITY, UTAH, NOVEMBER 1, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	β Cephei	21 29 41.64	— 0.04	0.00	+ 0.15	21 20 41.75	21 18 00.39	— 2 41.36
W.	ξ Aquarii	33 39.86	+ 0.02	0.00	+ 0.05	33 39.93	30 58.08	41.85
W.	ε Pegasi	40 37.52	+ 0.01	0.00	+ 0.05	40 37.58	37 55.70	41.88
W.	11 Cephei	42 44.58	— 0.04	0.00	+ 0.15	42 44.69	40 03.05	41.64
W.	μ Capricorni	49 02.86	+ 0.02	0.00	+ 0.05	49 02.93	46 20.98	41.95
E.	79 Draconis	53 59.19	— 0.05	+ 0.23	— 0.17	53 59.20	51 17.23	41.97
E.	α Aquarii	22 01 56.38	+ 0.01	+ 0.03	— 0.05	22 01 56.36	59 14.47	41.89
E.	θ Aquarii	12 48.67	+ 0.02	0.00	— 0.05	12 48.64	22 10 06.77	41.87
E.	π Aquarii	21 28.39	+ 0.01	0.00	— 0.05	21 28.35	18 46.41	41.94
E.	9 Draconis, L. C.	22 26 52.12	+ 0.09	— 0.46	— 0.21	26 51.54	24 10.60	— 2 41.94

NORMAL EQUATIONS.

$$0 = +0.51 + 10.00\,\delta t - 4.32\,a$$
$$0 = -0.81 - 4.32\,\delta t + 24.78\,a \qquad a = +0^s.026$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, NOVEMBER 1, 1872.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	θ^1 Ceti	1 20 22.28	− 0.15	+ 0.02	− 0.05	1 20 22.10	1 17 40.30	− 02 41.80
E.	38 Cassiopeiæ	24 30.42	+ 0.28	+ 0.13	− 0.14	24 30.69	21 49.31	41.38
W.	*o* Piscium	41 22.71	− 0.11	− 0.07	+ 0.05	41 22.58	38 41.04	41.54
W.	β Arietis	50 18.73	− 0.07	+ 0.08	+ 0.05	50 18.79	47 37.24	41.55
W.	50 Cassiopeiæ	55 19.59	+ 0.32	+ 0.68	+ 0.16	55 20.75	52 38.73	42.02
W.	α Arietis	2 02 42.22	− 0.07	+ 0.26	+ 0.05	2 02 42.46	2 00 00.67	− 02 41.79

NORMAL EQUATIONS.

$$0 = -0.98 + 6.00\,\delta t - 1.01\,a$$
$$0 = +1.12 - 1.01\,\delta t + 5.75\,a \qquad a = -0^s.21$$

SALT LAKE CITY, UTAH, NOVEMBER 5, 1872.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	*o* Cephei	23 16 01.13	+ 5.09	− 0.46	+ 0.08	23 16 05.84	23 13 25.09	− 02 40.75
W.	θ Piscium	24 14.06	− 2.52	− 0.07	+ 0.03	24 11.50	21 30.82	40.68
W.	ι Piscium	36 07.59	− 2.57	− 0.10	+ 0.03	36 04.95	33 24.40	40.55
W.	γ Cephei	36 40.31	+11.31	− 0.62	+ 0.13	36 51.13	34 10.29	40.84
E.	Groombr. 4163	51 14.14	+ 8.44	− 0.44	− 0.11	51 22.03	48 41.35	40.68
E.	ω Piscium	55 30.21	− 2.48	− 0.09	− 0.03	55 27.61	52 46.80	40.81
E.	α Andromedæ	0 04 30.97	− 1.04	− 0.10	− 0.03	0 04 29.80	0 01 48.96	40.84
E.	γ Pegasi	09 24.11	− 2.00	− 0.06	− 0.03	09 22.02	06 41.26	40.76
E.	ι Ceti	15 41.21	− 3.39	+ 0.02	− 0.03	15 37.81	12 56 96	− 62 40.85

NORMAL EQUATIONS.

$$0 = -13.12 + 9.00\,\delta t - 2.49\,a + 1.27\,c$$
$$0 = +60.68 - 2.49\,\delta t + 13.78\,a - 8.53\,c \qquad a = -4^s.346$$
$$0 = -38.70 + 1.27\,\delta t - 8.53\,a + 45.30\,c \qquad c = +0^s.029$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, NOVEMBER 6, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	β Cephei	21 29 40.35	+ 0.56	— 0.48	— 0.15	21 29 40.28	21 27 00.08	2 40.20
E.	ξ Aquarii	33 38.50	— 0.29	— 0.13	— 0.05	33 38.03	30 57.97	40.06
E.	ε Pegasi	40 36.12	— 0.20	— 0.15	— 0.05	40 35.72	37 55.63	40.09
E.	11 Cephei	42 42.60	+ 0.60	— 0.47	— 0.15	42 42.58	40 02.73	39.85
E.	μ Capricorni	49 01.37	— 0.32	— 0.10	— 0.05	49 00.90	46 20.91	39.99
W.	79 Draconis	53 55.92	+ 0.72	0.00	+ 0.17	53 56.91	51 16.88	40.03
W.	α Aquarii	22 01 54.71	— 0.26	— 0.01	+ 0.05	22 01 54.49	59 14.41	40.08
W.	θ Aquarii	12 46.97	— 0.29	— 0.02	+ 0.05	12 46.71	22 10 06.70	40.01
W.	π Aquarii	21 26.50	— 0.24	+ 0.08	+ 0.05	21 26.39	18 46.35	40.04
W.	ο Cephei	23 16 04.72	+ 0.45	+ 0.16	+ 0.13	23 16 05.46	23 13 25.12	40.34
W.	θ Piscium	24 11.02	— 0.20	+ 0.04	+ 0.05	24 10.91	21 30.76	40.15
W.	ι Piscium	36 04.64	— 0.21	+ 0.00	+ 0.05	36 04.48	33 24.43	40.05
W.	γ Cephei	23 36 48.92	+ 0.82	— 0.07	+ 0.22	36 49.89	34 10.08	— 2 39.81

NORMAL EQUATIONS.

$0 = - 3.48 + 13.00\,\delta t - 2.97\,a$
$0 = + 8.12 - 2.97\,\delta t + 19.48\,a$ $\qquad a = - 0^{s}.39$

Adopted $c = + 0^{s}05$ for W.

SALT LAKE CITY, UTAH, NOVEMBER 6, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	θ¹ Ceti	1 20 20.64	— 0.31	— 0.03	— 0.05	1 20 20.25	1 17 40.30	— 2 39.95
E.	38 Cassiopeiæ	24 28.78	+ 0.55	— 0.05	— 0.14	24 29.14	21 49.28	39.86
E.	η Piscium	27 21.37	— 0.18	0.00	— 0.05	27 21.14	24 40.93	40.21
E.	ν Piscium	37 29.50	— 0.23	+ 0.02	— 0.05	37 29.24	34 49.04	40.20
E.	ο Piscium	41 21.26	— 0.21	+ 0.04	— 0.05	41 21.04	38 41.05	39.99
E.	β Arietis	50 17.43	— 0.15	+ 0.08	— 0.05	50 17.31	47 37.26	40.05
E.	50 Cassiopeiæ	55 18.20	+ 0.66	+ 0.29	— 0.16	55 18.99	52 38.73	40.26
E.	α Arietis	2 02 40.87	— 0.13	+ 0.11	— 0.05	2 02 40.80	2 00 00.69	— 2 40.11

NORMAL EQUATIONS.

$0 = + 0.63 + 8.00\,\delta t + 0.03\,a$
$0 = + 2.51 + 0.03\,\delta t + 6.30\,a$ $\qquad a = - 0^{s}.40$

Adopted $c = + 0^{s}.05$ for W.

The following tables show the corrections and rates of the chronometers used at Gunnison and Salt Lake City:

CHRONOMETER AT GUNNISON.—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1872.	*h.*	*h. m. s.*	*s.*
Oct. 23	0.1	− 2 19 40.78	
Oct. 25	0.0	39.24	− 0.032
Oct. 31	0.0	26.25	− 0.090
Nov. 1	0.3	23.86	− 0.099
Nov. 5	0.5	16.71	− 0.071
Nov. 6	0.5	− 2 19 13.70	− 0.125

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1872.	*h.*	*h. m. s.*	*s.*
Oct. 23	23.0	− 0 02 38.12	
Oct. 25	22.4	40.92	+ 0.058
Oct. 31	23.8	42.10	+ 0.008
Nov. 1	23.8	41.77	− 0.014
Nov. 5	23.5	40.75	− 0.011
Nov. 6	0.0	− 0 02 40.05	− 0.030

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
October 23, 1872:		*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*h. m. s.*
Salt Lake City.	Salt Lake City.	0 12 18.51	—0 02 38.18	0 09 40.33			
	Gunnison......	2 29 39.05	—2 19 40.78	0 09 58.27	0 00 17.94		
Gunnison......	Salt Lake City.	0 21 08.62	—0 02 38.19	0 18 30.43			
	Gunnison......	2 38 29.13	—2 19 40.77	0 18 48.36	17.93	....	0 00 17.935
October 31, 1872:							
Salt Lake City.	Salt Lake City.	0 39 28.98	—0 02 42.09	0 36 46.89			
	Gunnison......	2 56 31.09	—2 19 26.19	0 37 04.90	18.01		
Gunnison......	Salt Lake City	0 46 03.22	—0 02 42.09	0 43 21.13			
	Gunnison......	3 03 05.26	—2 19 26.18	0 43 39.08	17.95	....	17.980
November 1, 1872:							
Salt Lake City.	Salt Lake City.	0 37 21.66	—0 02 41.77	0 34 39.89			
	Gunnison......	2 54 21.52	—2 19 23.84	0 34 57.68	17.79		
Gunnison......	Salt Lake City.	0 44 09.97	—0 02 41.77	0 41 28.20			
	Gunnison......	3 01 09.82	—2 19 23.83	0 41 44.99	17.79	....	17.790
November 5, 1872:							
Salt Lake City.	Salt Lake City.	0 46 18.32	—0 02 40.72	0 43 37.60			
	Gunnison......	3 03 12.04	—2 19 16.68	0 43 55.36	17.76		
Gunnison......	Salt Lake City.	0 59 45.04	—0 02 40.71	0 57 04.33			
	Gunnison......	3 16 38.77	—2 19 16.66	0 57 22.11	17.78	....	17.770
November 6, 1872:							
Salt Lake City.	Salt Lake City.	0 55 31.06	—0 02 40.02	0 52 51.04			
	Gunnison......	3 12 22.56	—2 19 13.65	0 53 08.91	17.87		
Gunnison......	Salt Lake City.	1 02 05.48	—0 02 40.02	0 59 25.46			
	Gunnison......	3 18 56.87	—2 19 13.64	0 59 43.23	0 00 17.77	....	0 00 17.820

Gunnison east of Salt Lake City............ $0^h\ 00^m\ 17^s.86 \pm 0^s.028$.

Observations and computations for latitude.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
1872. November 8.	7281	10.808	18.0	16.9					
	7275	14.113	18.8	15.7		39 07 10.8	+ 2 13.6	+1.5	39 09 25.9
	7476	6.688	13.3	22.1					
	7450	19.543	19.9	15.7		00 49.8	+ 8 39.5	−1.6	27.7
	7637	24.057	24.0	28.3					
	7586	21.141	30.1	22.4		11 21.2	− 1 57.7	+1.2	24.7
	7642	21.006	24.0	28.3					
	7571	17.340	30.1	22.4		39 11 54.4	− 2 28.1	+1.2	27.5
	7848	6.515	20.3	31.1					
	7807	21.593	31 5	20.5		38 59 15.9	+10.09.3	0.0	25.2
	7961	10.772	22.0	29.3					
	7945	19.030	28.1	22.8		39 03 53.9	+ 5 33.6	−0.7	26.8
	8107	25.117	29.6	23.0					
	8079	8.245	24.9	27.7		20 47.9	−11 21.8	+1.3	27.4
	80	22.490	30.5	25.5					
	101	22.238	31.4	24.2		09 33.1	− 0 10.2	+4.3	27.2
	201	11.420	37.3	17.8					
	178	4.828	26.4	29.0		13 48.6	− 4 26.4	+6.0	28.2
	201	11.420	37.3	17.8					
	215	20.731	24.0	31.0		03 06.5	+ 6 16.3	+4.3	27.1
	283	19.876	29.5	25.5					
	259	12.699	30.0	25.0		14 13.0	− 4 50.0	+3.2	26.2
	450	21.589	24.0	20.8					
	370	17.734	25.1	29.5		11 59.8	− 2 35.8	−0.4	23.6
	628	14.463	29.0	25.0					
	576	18.467	27.0	27.0		06 42.0	+ 2 41.8	+1.4	25.2
	628	14.463	29.0	25.0					
	580	12.911	27.0	27.0		10 26.5	− 1 02.7	+1.4	25.2
	653	15.823	25.3	28.6					
	647	14.660	28.2	25.0		39 10 12.1	− 0 47.0	0.0	25.1
	695	5.062	34.2	18.0					
	682	22.360	24.0	30.4		38 57 41.2	+11 38.8	+3.4	23.4
November 15	7477	12.313	28.0	20.5					
	7399	19.533	19.9	27.9		39 04 32.8	+ 4 51.8	−0.2	24.4
	7637	25.007	29.0	20.3					
	7586	22.047	24.0	25.4		11 54.4	− 2 29.2	+2.8	28.0
	7683	18.794	26.5	23.3					
	7712	11.476	26.1	23.9		39 14 18.5	− 4 55.7	+1.9	39 09 24.7

Observations and computations—Continued.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
November 15	7749	27.163	28.1	21.6					
	7712	11.476	26.1	23.9		39 19 55.9	—10 33.9	+3.1	39 09 25.1
	7915	16.256	26.0	25.9					
	7931	13.833	28.0	24.2		10 59.7	— 1 37.9	+1.4	23.2
	8107	26.218	31.8	22.2					
	8079	9.291	25.3	29.1		20 48.4	—11 24.0	+2.0	26.4
	8261	19.415	33.5	22.3					
	8211	10.398	26.1	29.0		15 23.7	— 6 04.4	+2.9	22.2
	80	21.757	34.2	22.7					
	101	21.421	30.5	26.7		09 34.1	— 0 13.6	+5.6	26.1
	152	21.251	37.0	19.6					
	158.	13.236	26.5	30.3		14 43.1	— 5 23.9	+4.8	24.0
	201	9.067	31.8	25.5					
	215	18.223	35.2	21.9		03 07.5	+ 6 09.9	+7.0	24.4
	283	19.638	41.4	16.8					
	259	12.422	24.0	33.7		14 14.1	— 4 51.6	+5.2	27.7
	318	14.255	31.8	26.7					
	334	18.585	35.2	23.2		06 24.2	+ 3 55.0	+6.0	25.2
	416	10.638	35.1	23.8					
	427	20.830	20.2	38.5		02 35.4	+ 6 51.9	—2.8	24.5
	515	25.600	38.5	21.2					
	431	17.651	20.2	38.5		14 47.0	— 5 21.2	—0.4	25.4
	653	14.870	34.8	25.6					
	647	13.644	27.2	32.6		39 10 13.2	— 0 49.5	+1.3	25.0
	714	6.367	35.6	24.0					
	752	22.259	24.7	35.6		38 58 44.1	+10 42.2	+0.3	26.6
	816	22.931	32.0	28.4					
	796	7.661	29.9	30.8		39 19 43.0	—10 17.1	+1.0	26.9
	1007	24.633	31.0	30.3					
	974	23.158	30.7	30.7		39 10 23.8	— 0 59.6	+0.3	24.5
	1043	9.153	31.8	29.8					
	1025	23.395	30.7	30.9		38 59 50.8	+ 9 35.5	+0.6	26.9
	1254	23.367	31.1	28.0					
	1265	7.887	29.0	30.7		39 19 49.4	—10 25.6	+0.5	24.3
	1301	22.512	32.8	27.2					
	1265	7.887	29.0	30.7		19 13.3	— 9 51.0	+1.4	23.7
	1504	17.575	37.8	26.0					
	1528	13.790	27.0	34.1		39 11 56.7	— 2 33.0	+1.7	39 09 25.4

Observations and computations—Continued.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
November 15	1546	24.990	32.0	29.7					
	1563	20.163	32.1	29.5		39 12 38.6	− 3 15.1	+1.7	39 09 25.2
	1721	15.831	34.9	27.5					
	1737	17.209	29.0	32.9		08 29.7	+ 0 55.7	+1.3	26.7
	1747	13.235	43.0	18.9					
	1792	12.271	16.6	45.1		10 06.9	− 0 39.0	−1.5	26.4
November 16	7171	13.266	20.5	22.0					
	7204	12.811	19.0	24.7		09 48.0	− 0 18.4	−2.5	27.1
	7281	12.273	17.5	27.2					
	7275	15.736	22.0	27.7		07 10.3	+ 2 19.9	−5.3	24.9
	7411	22.308	23.6	22.9					
	7368	5.852	20.7	25.0		20 32.1	−11 05.0	−1.3	25.8
	7476	11.020	31.8	15.1					
	7450	23.778	19.0	27.5		00 49.7	+ 8 35.4	+2.8	27.9
	7559	18.219	26.0	21.0					
	7566	23.022	24.2	23.0		39 06 08.4	+ 3 14.0	+2.2	24.6
	7848	8.652	37.4	12.5					
	7807	23.694	17.4	32.7		38 59 16.2	+10 07.9	+3.4	27.5
	8212	11.165	27.6	15.7					
	8195	21.559	23.5	20.0		39 02 21.2	+ 7 00.0	+5.6	26.8
	80	21.440	35.1	10.0					
	101	21.150	15.3	30.2		09 34.3	− 0 11.7	+3.6	26.2
	180	18.970	37.5	09.0					
	164	13.172	18.0	28.5		13 13.6	− 3 54.3	+6.3	25.6
	227	9.752	22.9	23.9					
	259	14.831	22.8	24.4		06 00.1	+ 3 25.2	−0.9	24.4
	283	22.071	29.7	17.7					
	259	14.831	22.8	24.4		39 14 14.3	− 4 52.6	+3.6	25.3
	416	10.519	25.8	23.0					
	427	20.686	24.2	24.0		37 02 35.9	+ 6 50.9	+1.0	27.8
	515	25.490	29.7	20.0					
	431	17.511	24.2	24.0		39 14 47.2	− 5 22.4	+3.5	28.3
	525	20.309	28.0	21.7					
	556	10.074	24.5	25.9		16 17.8	− 6 53.5	+1.7	26.0
	628	19.780	28.6	22.3					
	580	18.217	24.9	25.6		39 10 27.8	− 1 13.2	+1.9	26.5
	695	4.927	30.0	19.0					
	682	22.253	21.6	29.9		38 57 42.8	+11 40.1	+1.0	39 09 23.9

Observations and computations—Continued.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
November 16	714	7.780	24.9	26.0					
	752	23.603	29.6	21.9		38 58 44.3	+10 39.4	+2.3	39 09 26.0
	829	20.910	29.9	21.5					
	877	21.817	22.5	29.3		39 08 46.0	+ 0 36.7	+0.5	23.2
November 18	7637	24.702	18.2	13.8					
	7627	6.170	13.2	19.0		39 21 55.8	—12 28.9	—0.5	26.4
	7642	21.717	18.5	14.0					
	7586	21.952	10.1	22.0		39 09 18.7	+ 0 09.5	—2.8	25.4
	7683	18.943	24.1	23.9					
	7712	11.735	23.9	24.3		14 18.4	— 4 51.3	—0.1	27.0
	7749	27.267	22.3	26.0					
	7712	11.735	23.9	24.3		19 55.9	—10 27.6	—1.7	26.6
	7882	9.877	29.0	21.6					
	7914	21.053	24.8	26.8		01 52.1	+ 7 31.6	+1.9	25.6
	7961	12.702	27.0	24.6					
	7945	20.936	25.0	26.5		03 54.5	+ 5 32.7	+0.3	27.5
	8107	25.520	25.0	27.6					
	8079	8.623	26.9	25.7		20 48.6	—11 22.8	—0.5	25.3
	8212	11.242	29.9	23.4					
	8195	21.717	24.2	28.6		02 21.3	+ 7 03.3	+0.7	25.3
	80	21.604	29.7	25.9					
	101	21.363	29.6	26.0		09 34.4	— 0 09.7	+2.6	27.3
	180	18.961	35.0	20.5					
	164	13.250	25.3	30.3		13 13.8	— 3 50.8	+3.4	26.4
	227	8.553	29.1	25.9					
	259	13.630	28.0	27.3		06 00.2	+ 3 25.2	+1.4	26.8
	318	13.890	28.9	26.9					
	334	18.300	30.2	25.1		06 24.6	+ 2 58.2	+2.5	25.3
November 19	7642	21.733	26.3	15.4					
	7586	21.889	17.4	23.8		09 18.6	+ 0 06.3	+1.6	26.5
	7683	19.972	22.0	20.0					
	7712	12.683	22.2	19.8		14 18.4	— 4 54.6	+1.5	25.3
	7749	28.260	17.0	25.0					
	7712	12.683	22.2	19.8		39 19 55.9	—10 29.5	—1.9	24.5
	7848	7.156	22.6	20.4					
	7807	22.303	19.0	24.0		38 59 16.2	+10 12.1	—1.0	27.3
	7882	10.071	20.0	23.1					
	7914	21.248	24.7	18.9		39 01 52.1	+ 7 31.7	+1.0	39 09 24.8

Observations and computations—Continued.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refer.	Level.	
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
November 19	7945	21.297	19.9	24.0					
	7961	13.063	23.7	20.2		39 03 54.5	+ 5 32.7	−0.2	39 09 27.0
	8107	25.304	25.6	20.3					
	8079	8.361	23.2	22.5		20 48.6	−11 24.7	+2.1	26.0
	8212	11.437	27.7	19.2					
	8195	21.891	20.0	26.9		39 02 21.3	+ 7 02.5	+0.6	24.4
	8231	18.247	24.4	22.2					
	8256	13.014	24.7	22.2		39 12 54.0	− 3 31.5	+1.7	24.2
	80	22.539	30.6	18.2					
	101	22.284	21.0	27.9		09 34.6	− 0 10.3	+2.0	26.3
	152	22.245	23.7	24.6					
	158	14.337	26.3	21.0		14 43.5	− 5 19.6	+1.5	25.4
	180	20.229	37.7	25.6					
	164	14.527	28.0	36.7		13 13.8	− 3 50.4	+1.4	24.8
	201	12.412	29.8	30.7					
	215	21.676	33.1	27.1		03 08.0	+ 6 14.4	+1.8	24.2
	283	20.247	28.0	20.2					
	259	13.917	23.3	24.8		14 14.7	− 4 52.2	+2.2	24.7
	318	14.757	21.4	26.2					
	334	19.142	30.2	18.0		06 24.8	+ 2 57.2	+2.8	24.8
	450	23.457	34.8	14.9					
	370	19.509	22.0	25.9		11 59.8	− 2 39.5	+5.6	25.9
	676	8.504	31.0	19.8					
	656	21.440	24.5	26.5		00 39.8	+ 8 42.7	+3.2	25.7
	816	24.697	30.2	21.1					
	796	9.300	27.0	24.0		19 44.1	−10 22.2	+4.2	26.1
	916	15.225	35.4	16.0					
	888	13.751	23.0	28.5		10 23.3	− 0 59.6	+4.9	28.6
	1007	24.522	35.4	15.8					
	974	22.992	23.3	28.2		39 10 24.4	− 1 01.8	+5.2	27.8
	1043	9.143	38.0	13.2					
	1025	23.267	16.8	34.6		38 59 51.4	+ 9 30.8	+2.4	24.6
November 20	7637	23.580	26.4	16.8					
	7627	4.870	22.0	21.0		39 21 55.7	−12 36.1	+3.7	23.3
	7662	20.545	26.5	16.7					
	7571	16.771	20.7	22.1		11 54.4	− 2 32.5	+2.9	24.8
	7642	20.545	26.5	16.7					
	7586	20.602	20.8	22.0		09 18.6	+ 0 02.3	+3.0	39 09 23.9

Observations and computations—Continued.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
November 20	7683	19.277	28.5	26.9					
	7712	11.946	30.5	24.9		39 14 18.3	− 4 56.3	+2.5	39 09 24.5
	7749	27.582	27.9	27.6					
	7712	11.946	30.5	24.9		39 19 55.9	−10 31.9	+2.1	26.1
	7848	7.417	30.6	25.7					
	7807	22.442	28.1	27.8		38 59 16.3	+10 07.2	+1.8	25.3
	7882	10.289	28.7	27.6					
	7914	21.489	29.6	26.9		39 01 52.1	+ 7 32.6	+1.3	26.0
	7961	12.701	24.9	31.7					
	7945	20.908	29.8	26.8		03 54.5	+ 5 31.6	−1.3	24.8
	8107	25.865	26.9	30.2					
	8079	8.983	30.0	27.0		20 50.7	−11 22.2	−0.1	28.4
	8231	19.885	26.5	30.4					
	8256	14.677	34.5	32.8		12 54.1	− 3 30.4	−0.8	22.9
	80	21.561	30.7	29.3					
	101	21.175	35.3	24.6		09 34.7	− 0 15.6	+4.2	23.3
	201	13.386	33.9	26.0					
	215	22.650	31.1	28.6		03 08.0	+ 6 14.4	+3.6	26.0
	227	9.609	28.7	30.5					
	259	14.656	35.8	23.3		06 00.2	+ 3 24.0	+3.8	28.0
	283	21.866	28.6	30.2					
	259	14.656	35.8	23.3		39 14 14.8	− 4 51.4	+3.8	27.2
	330	5.575	30.5	27.9					
	321	23.965	30.7	28.1		38 57 00.9	+12 23.1	+1.8	25.8
	416	9.261	30.8	28.0					
	431	16.093	39.0	19.6		39 04 44.7	+ 4 36.0	+7.8	28.5
	525	18.840	30.0	29.3					
	556	8.550	32.2	27.7		16 18.3	− 6 55.8	+1.8	24.3
	628	19.462	29.2	30.6					
	580	17.862	32.2	27.0		10 28.4	− 1 04.7	+1.3	25.0
	653	16.237	34.1	25.8					
	647	14.945	29.5	30.5		39 10 13.9	− 0 52.2	+2.8	24.5
	695	6.982	37.6	22.7					
	682	24.220	26.9	33.0		38 57 43.0	+11 36.6	+3.1	22.7
	714	6.673	33.0	27.0					
	752	22.555	30.0	31.0		38 58 44.9	+10 41.8	+1.7	28.4
	829	19.199	39.9	22.2					
	877	20.035	27.2	35.3		39 08 46.5	+ 0 33.8	+3.4	39 09 23.7

Observations and computations—Continued.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
November 20	1007	24. 893	24. 1	39. 0					
	974	23. 430	42. 1	21. 7		39 10 24. 5	— 0 59. 1	+2. 0	39 09 27. 4
	1043	9. 465	25. 0	39. 2					
	1025	23. 608	43. 5	30. 6		38 59 51. 6	+ 9 31. 5	—0. 4	22. 7
	1459	10. 319	26. 1	24. 3					
	1449	20. 514	25. 0	25. 7		39 02 33. 7	+ 6 52. 0	+0. 4	26. 1
	1494	20. 644	33. 0	27. 0					
	1463	15. 007	22. 9	27. 6		39 13 11. 4	— 3 43. 7	+0. 4	28. 1
	1504	17. 500	29. 5	20. 5					
	1528	13. 673	24. 5	25. 6		11 57. 4	— 2 34. 7	+2. 8	25. 5
	1546	16. 172	24. 0	25. 8					
	1563	11. 201	33. 2	16. 0		12 39. 2	— 3 20. 9	+5. 4	23. 7
	1583	10. 606	30. 0	19. 0					
	1601	5. 852	25. 0	24. 3		12 31. 6	— 3 12. 1	+4. 1	23. 6
November 22	7637	25. 083	30. 4	12. 0					
	7627	6. 422	18. 0	24. 2		21 55. 6	—12 34. 2	+4. 3	25. 7
	7642	22. 053	30. 4	12. 0					
	7571	18. 279	17. 6	23. 7		11 54. 2	— 2 32. 5	+4. 3	26. 0
	7642	22. 053	30. 4	12. 0					
	7586	22. 093	18. 0	23. 3		09 18. 5	+ 0 01. 8	+4. 6	24. 9
	7683	19. 951	26. 2	32. 1					
	7712	12. 557	41. 2	17. 7		39 14 18. 2	— 4 53. 8	+6. 2	25. 6
	7848	7. 313	31. 0	28. 9					
	7807	22. 350	31. 7	28. 0		38 59 16. 2	+10 07. 6	+2. 0	25. 8
	7882	9. 420	31. 6	27. 9					
	7914	20. 574	30. 8	28. 4		39 01 52. 1	+ 7 30. 7	+2. 1	24. 9
	7961	12. 543	26. 0	36. 0					
	7945	20. 740	30. 3	29. 1		03 54. 5	+ 5 31. 2	—2. 4	23. 3
	8107	25. 722	38. 0	24. 4					
	8079	8. 752	28. 0	34. 3		20 48. 8	—11 25. 8	+2. 6	25. 6
	8118	20. 855	33. 1	28. 8					
	8136	9. 290	30. 6	31. 7		17 11. 2	— 7 47. 3	+1. 1	25. 0
	8212	11. 294	33. 9	28. 8					
	8195	21. 723	30. 2	32. 1		02 21. 5	+ 7 01. 4	+1. 1	24. 0
	80	22. 358	30. 7	33. 2					
	101	22. 094	37. 2	26. 9		09 34. 9	— 0 10. 7	+2. 8	27. 0
	152	19. 999	35. 1	28. 6					
	158	12. 129	29. 6	34. 1		39 14 44. 0	— 5 18. 0	+0. 7	39 09 26. 7

Observations and computations—Continued.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
November 22	201	13.801	34.2	29.2					
	215	23.165	28.0	35.8		39 03 08.2	+ 6 18.4	−1.0	39 09 25.6
	261	22.359	31.7	31.7					
	269	6.043	39.0	24.3		20 17.0	−10 59.3	+5.2	22.9
	416	9.502	26.9	37.8					
	427	19.571	42.1	22.4		39 02 36.7	+ 6 46.9	+3.1	26.7
	515	24.378	25.0	40.7					
	431	16.420	42.1	22.4		39 14 48.0	− 5 21.6	+1.4	27.8
	525	20.334	30.3	35.0					
	556	10.101	41.1	24.3		16 18.6	− 6 53.5	+4.2	29.3
	628	16.449	27.8	37.2					
	580	14.982	32.0	32.9		39 10 28.7	− 0 59.3	−3.6	25.8
	695	5.466	11.6	48.3					
	682	23.137	31.0	34.0		38 57 43.3	+11 54.1	−13.9	23.5
	714	7.964	31.3	33.2					
	752	23.835	30.7	34.6		38 58 45.2	+10 41.4	−2.0	24.6
	829	18.301	28.4	37.9					
	877	19.258	36.7	29.6		39 08 46.8	+ 0 38.7	−0.8	24.7
	916	16.508	34.0	32.0					
	888	15.123	32.6	33.5		10 23.7	− 0 56.0	+0.4	28.1
	1007	24.087	28.9	37.8					
	974	22.660	36.0	30.6		10 24.8	− 1 57.6	−1.3	25.9
	1254	22.730	34.9	24.7					
	1265	7.313	23.2	36.3		19 50.4	−10 23.0	−1.0	26.4
	1292	15.973	30.0	29.9					
	1321	13.267	30.2	29.7		11 15.9	− 1 49.4	−0.2	26.3
	1459	10.535	26.7	33.3					
	1449	20.621	32.1	28.0		02 38.8	+ 6 47.6	−0.9	25.5
	1494	17.821	29.0	31.3					
	1463	12.343	26.0	34.3		13 11.6	− 3 41.4	−3.7	26.5
	1504	17.973	34.1	26.0					
	1528	14.151	28.0	32.2		11 57.5	− 2 34.5	+1.4	24.4
	1546	17.117	33.8	26.0					
	1563	12.353	22.8	37.5		12 39.4	− 3 12.5	−2.4	24.5
	1547	19.390	34.2	26.0					
	1563	12.353	22.8	37.5		39 14 09.1	− 4 44.4	−2.2	22.5
	1583	9.895	28.7	31.1					
	1591	25.351	36.2	23.8		38 58 56.1	+10 24.6	+3.5	39 09 26.2

Observations and computations—Continued.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		t.	d.	d.		° ′ ″	′ ″	″	° ′ ″
November 22	1631	10.894	31.0	29.0					
	1602	10.729	29.0	31.0		39 09 29.7	− 0 06.7	0.0	39 09 23.0
	1721	15.694	32.5	27.7					
	1737	17.037	28.9	31.3		08 30.3	+ 0 54.3	+0.8	25.4
	1777	17.771	36.5	23.4					
	1764	15.286	25.0	35.3		39 11 07.4	− 1 40.4	+1.0	28.0
November 25	7637	22.525	29.2	16.8					
	7627	3.951	14.9	30.9		39 21 55.5	−12 30.6	−1.3	23.6
	7642	19.455	28.5	17.5					
	7571	15.860	14.3	30.5		11 54.0	− 2 25.3	−1.8	26.9
	7642	19.455	28.5	17.5					
	7586	19.665	14.3	30.6		09 18.4	+ 0 08.5	−1.8	25.1
	7683	18.854	25.0	21.4					
	7712	11.684	16.9	30.3		14 18.0	− 4 49.7	−3.4	24.9
	7746	12.978	20.9	26.4					
	7757	19.027	23.2	24.2		39 05 24.0	+ 4 04.5	−2.3	26.2
	7848	6.716	19.7	28.7					
	7807	21.876	22.9	25.1		38 59 16.2	+10 12.6	−3.9	24.9
	7882	9.777	18.3	30.5					
	7914	21.050	28.9	20.8		39 01 52.1	+ 7 35.4	−1.4	26.1
	8118	20.608	30.0	23.0					
	8136	9.122	21.7	31.3		17 11.3	− 7 44.2	−0.9	26.2
	8212	12.831	22.4	30.6					
	8195	23.399	27.7	25.3		02 21.6	+ 7 06.7	−2.0	26.3
	8231	17.528	28.5	24.5					
	8256	12.456	23.3	29.7		12 54.4	− 3 25.0	−0.8	28.6
	80	20.945	24.0	31.0					
	101	20.776	30.2	24.9		09 35.2	− 0 06.8	−0.6	27.8
	228	14.102	32.0	23.0					
	211	12.882	24.3	31.0		39 10 12.3	− 0 49.3	+0.8	23.8
	330	5.974	34.0	21.0					
	321	24.423	19.9	35.0		38 57 01.0	+12 25.5	−0.7	25.8
	416	9.094	31.8	23.8					
	427	19.255	22.1	33.2		39 02 37.0	+ 6 50.6	−1.1	26.5
	515	24.047	30.0	26.0					
	431	16.076	22.1	33.2		14 48.4	− 5 22.1	−2.5	23.8
	525	19.138	29.0	27.0					
	556	8.964	25.3	30.6		39 16 18.9	− 6 51.1	−1.1	39 09 26.7

Observations and computations—Continued.

GUNNISON, UTAH.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1872.		t.	d.	d.		° ′ ″	° ′ ″	″	° ′ ″
November 25	653	12.907	30.1	25.8					
	647	11.728	22.0	34.0		39 10 14.6	− 0 47.6	−2.7	39 09 24.3
	695	6.490	30.8	25.2					
	682	23.822	24.5	31.4		38 57 43.8	+11 40.4	−0.4	23.8
	1007	25.182	29.0	28.7					
	974	23.760	27.0	31.0		39 10 25.3	− 0 57.5	−1.3	26.5
	1043	9.659	27.7	30.2					
	1025	23.892	28.0	30.0		38 59 52.3	+ 9 35.2	−1.6	39 09 25.9

The final result for latitude was obtained by Wm. A. Rogers in the same way as that of Pioche. The following are the single results of six groups:

Means.	No. of observations.
° ′ ″	
39 09 25.76	35
25.83	28
25.40	29
25.41	17
25.64	25
39 09 25.69	45

Mean 39° 09′ 25″.62.

ASTRONOMICAL CO-ORDINATES OF STATION AT GUNNISON, UTAH.

Longitude. . $7^h\ 27^m\ 17^s.00 \pm 0^s.028$, or $111°\ 49'\ 15''.00 \pm 0''.42$ west from Greenwich.
$2^h\ 19^m\ 4^s.88$, or $34°\ 46'\ 13''.20$ west from U. S. Naval Observatory at Washington, D. C.

Latitude . . . . $39°\ 09'\ 25''.62 \pm 0''.05$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY W. W. MARYATT AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF STATION AT GREEN RIVER, WYOMING.

SEASON OF 1873.

COMPUTATIONS BY

JOHN H. CLARK and Prof. T. H. SAFFORD.

GREEN RIVER, WYOMING.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . 109° 28′ 06″.57 ± 0″.40 west from Greenwich.
32° 25′ 04″.77 west from United States Naval Observatory at Washington, D. C.
Latitude, . 41° 31′ 38″.12 ± 0″.10 north.
Barometric altitude of observatory above sea-level, 6096.9 feet.

Green River is a station of the Union Pacific Railroad, containing about fifty buildings, which are used as dwellings, stores, and eating-houses. It is situated on the river of the same name, in a barren valley, which is surrounded by rocky hills from 400 to 500 feet high.

The astronomical pier is in the centre of the settlement, near the railroad depot, 160.4 feet north and 213 feet east of the nearer rail of the track, which here runs to the northwest. Its position is ascertained by direct measurement to other objects in the vicinity, and by triangulation with ten sharp and well-defined rocks on the neighboring hill-tops and bluffs.

METEOROLOGICAL CONDITIONS—OBSERVATORY—INSTRUMENTS.

The weather was quite favorable during the time of occupation. Though generally cloudy during the day, it cleared away at 11 o'clock at night. The general direction of the wind was northwest. It attained its greatest force in the afternoon.

The observatory was a small tent supported by a solid frame-work. The observations were made on a wooden block.

The astronomical instruments were the same as those used in 1874 at Las Vegas, and described in the report on that station. The chronometer was the Negus sidereal, No. 1499. The length of telegraphic circuit from

Green River to Salt Lake, via Ogden, is 220 miles. There was no repeater on the route, which was over the wires of the Atlantic and Pacific and Deseret Telegraph Lines.

Connection for time was made with Salt Lake City, at which point John H. Clark was observer, using the observatory of the president of the Mormon Church. Observations for longitude were made June 10, 12, 19, 20, 25, and 26, and observations for latitude on June 9, 10, 11, 12, 16, 17, 20, 21, 24, 27, 28, and 29. All observations taken at this station, by W. W. Maryatt, were reduced by Prof. T. H. Safford, who gives the following information in relation to the reduction for time:

"The weights assigned to each star in the formation and solution of the least-square equations were proportioned to the square of the cosine of the star's declination. Not having at hand the explanations on page 8 of the Report on Cheyenne and Colorado Springs when I found the values of T, it does not contain rate. The assumed rates were put into the values of $\triangle T_0$."

Tabulation of stars used for determination of time at Green River, Wyoming, and Salt Lake City, Utah.

Name of star.	GREEN RIVER.						SALT LAKE CITY.					
	June 10.	June 12.	June 19.	June 20.	June 25.	June 26.	June 10.	June 12.	June 19.	June 20.	June 25.	June 26.
12 Can. Venat	×	......	......	......	......	......	......	......	......	......	......	......
ε Virginis	×	......	......	......	......	......	......	......	......	......	......	......
θ Virginis	×	......	......	......	......	......	......	......	......	......	......	......
20 Can. Venat	×	×	......	......	......	......	......	......	......	......	......	......
α Virginis	......	......	......	......	......	......	......	×	......	......	......	......
Groombr. 2001	×	×	......	......	......	......	......	......	......	......	......	......
ζ Virginis	......	......	......	......	......	......	......	×	......	......	......	......
Groombr. 2029	×	×	......	......	......	......	......	......	......	......	......	......
m Virginis	......	......	......	......	......	......	......	×	......	......	......	......
η Ursæ Minoris	×	×	×	......	......	......	......	×	......	......	......	......
η Bootis	×	×	×	......	......	......	......	×	......	......	......	......
τ Virginis	×	×	×	......	......	......	×	×	×	......	......	......
α Draconis	×	×	×	......	......	......	×	......	×	......	......	......
κ Virginis	×	×	......	×	......	......	×	......	×	......	......	......
α Bootis	×	×	×	×	......	......	×	×	×	......	×	......
λ Virginis	......	......	......	......	......	......	......	......	×	......	......	......
θ Bootis	......	×	×	×	×	×	×	×	×	......	×	×
5 Ursæ Minoris	......	×	......	×	×	×	×	×	×	......	×	×
π Bootis	......	×	×	×	×	×	......	......	......	......	......	......
μ Virginis	......	......	......	......	......	......	......	......	×	......	×	×
ε Bootis	......	×	×	×	×	......	......	......	×	......	×	×
α^2 Libræ	......	......	×	×	×	×	......	......	×	......	×	×
β Ursæ Minoris	......	......	×	×	×	......	......	......	......	......	×	×

Tabulation of stars, &c.—Continued.

Name of star.	GREEN RIVER.						SALT LAKE CITY.					
	June 10.	June 12.	June 19.	June 20.	June 25.	June 26.	June 10.	June 12.	June 19.	June 20.	June 25.	June 26.
β Bootis					×	×					×	×
48 Cephei, S. P.											×	×
β Libræ			×	×	×	×						×
o² Libræ											×	×
μ¹ Bootis											×	×
γ Ursæ Minoris				×	×	×						
ν Bootis						×						
α Coronæ					×							
α Serpentis	×				×							
ε Serpentis	×					×				×		
ζ Ursæ Minoris	×			×				×		×		
β¹ Scorpii				×				×		×		
Groombr. 2320	×	×						×				
δ Ophiuchi				×						×		
ε Ophiuchi		×		×								
τ Herculis	×	×		×				×		×		
α Scorpii		×										
η Draconis				×				×	×	×		×
A Draconis				×				×	×			×
ζ Ophiuchi	×	×								×		
η Herculis	×	×	×	×		×		×	×	×		×
49 Herculis		×	×	×		×						
κ Ophiuchi		×		×					×	×		×
d Herculis				×		×			×	×		×
ε Ursæ Minoris		×	×							×		×
α Herculis			×			×			×	×		×
44 Ophiuchi			×			×						
β Draconis			×			×						
ω Draconis			×									
μ Herculis						×						
γ Draconis						×						
γ Sagittarii						×						
o Herculis			×			×						
η Serpentis											×	
1 Aquilæ			×		×						×	
α Lyræ					×						×	
β Lyræ					×						×	
σ Sagittarii					×							
50 Draconis					×						×	
ζ Aquilæ					×						×	
ι Lyræ					×							
d Sagittarii											×	
5 Draconis					×							

Observations and reductions for time taken at sending station.

GREEN RIVER, WYOMING, JUNE 10, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
W.	12 Can. Venat......	12 49 49.14	+ 0.06	— 0.06	+ 0.11	12 49 49.25	12 50 06.39	+ 17.14
W.	ε Virginis	55 34.78	+ 0.52	— 0.05	+ 0.08	55 35.33	55 52.36	17.03
W.	θ Virginis	13 03 05.70	+ 0.74	— 0.06	+ 0.08	13 03 06.46	13 03 23.60	17.14
W.	20 Can. Venat......	11 35.32	+ 0.01	— 0.18	+ 0.11	11 35.26	11 52.27	17.01
W.	Groombr. 2001...	22 42.14	— 1.82	— 0.49	+ 0.28	22 40.11	22 57.22	17.11
W.	Groombr. 2029...	33 56.24	— 1.65	— 0.48	+ 0.26	33 54.37	34 11.55	17.18
E.	η Ursæ Minoris....	42 17.42	— 0.23	— 0.27	— 0.13	42 16.79	42 34.04	17.25
E.	η Bootis	48 22.42	+ 0.41	— 0.17	— 0.09	48 22.57	48 39.67	17.10
E.	τ Virginis.........	54 54.58	+ 0.64	— 0.14	— 0.08	54 55.00	55 12.38	17.38
E.	α Draconis	14 00 44.80	— 0.96	— 0.42	— 0.19	14 00 43.23	14 01 00.04	16.81
E.	κ Virginis.........	05 51.36	+ 0.80	— 0.13	— 0.08	05 51.95	06 08.78	16.83
E.	α Bootis	09 36.60	+ 0.40	— 0.21	— 0.09	09 36.70	09 53.61	+ 16.91

NORMAL EQUATIONS.

$a_0 = +0^s.92 \qquad c_0 = -0^s.06 \qquad \triangle T_0 = 16^s.99 - 0^s.045\,(T - 14^h.8)$

$0 = -0.317 + 2.776\,da + 1.574\,dc + 2.788\,d\triangle T \qquad da = +0^s.095 \qquad$ Weight of $a = 1.64$

$0 = +0.090 + 1.574\,da + 12.000\,dc + 0.831\,d\triangle T \qquad dc = -0^s.022 \qquad c = 10.99$

$0 = -0.486 + 2.788\,da + 0.831\,dc + 7.646\,d\triangle T \qquad d\triangle T = +0^s.031 \qquad \triangle T = 4.80$

GREEN RIVER, WYOMING, JUNE 10, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
E.	α Serpentis	15 37 45.52	+ 0.44	— 0.28	— 0.03	15 37 45.65	15 38 02.53	+ 16.88
E.	ε Serpentis	44 13.86	+ 0.46	— 0.29	— 0.03	44 14.00	44 30.94	16.94
E	ζ Ursæ Minoris.....	48 31.72	— 2.22	— 1.48	— 0.15	48 27.87	48 44.68	16.81
W.	Groombr. 2320....	16 05 47.72	— 0.91	— 0.92	+ 0.09	16 05 45.98	16 06 02.72	16.74
W.	τ Herculis	15 41.18	— 0.10	— 0.35	+ 0.05	15 40.78	15 57.73	16.95
W.	ζ Ophichi...........	29 54.46	+ 0.61	— 0.05	+ 0.03	29 55.05	30 11.90	16.85
W.	η Herculis	16 38 17.74	+ 0.04	— 0.10	+ 0.04	16 38 17.72	16 38 34.73	+ 17.01

NORMAL EQUATIONS.

$a_0 = +0^s.92 \qquad c_0 = -0^s.06 \qquad \triangle T_0 = 16^s.99 - 0^s.045\,(T - 14^h.8)$

$0 = +0.293 + 1.866\,da + 0.279\,dc + 1.615\,d\triangle T \qquad da = -0^s.160 \qquad$ Weight of $a = 1.21$

$0 = -0.170 + 0.279\,da + 7.000\,dc - 0.624\,d\triangle T \qquad dc = +0^s.028 \qquad c = 6.69$

$0 = +0.285 + 1.615\,da - 0.624\,dc + 4.201\,d\triangle T \qquad d\triangle T = -0^s.002 \qquad \triangle T = 2.70$

Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
W.	20 Can. Venat.*	13 11 32.54:	0.00	— 0.19	— 0.12	13 11 32.23	13 11 52.24	+ [20.01]
W.	Groombr. 2001	22 39.84	— 1.12	— 0.47	— 0.31	22 37.94	22 57.10	19.16
W.	Groombr. 2029	33 53.94	— 1.01	— 0.48	— 0.29	33 52.16	34 11.45	19.29
W.	η Ursæ Majoris	42 15.18	— 0.14	— 0.30	— 0.14	42 14.60	42 34.00	19.40
W.	η Bootis	48 20.22	+ 0.25	— 0.20	— 0.10	48 20.17	48 39.66	19.49
W.	τ Virginis	54 52.84	+ 0.39	— 0.15	— 0.09	54 52.99	55 12.37	19.38
E.	α Draconis	14 00 41.62	— 0.59	— 0.49	+ 0.21	14 00 40.75	14 00 59.98	19.23
E.	κ Virginis	05 49.06	+ 0.49	— 0.15	+ 0.09	05 49.49	06 08.78	19.29
E.	α Bootis	09 34.02	+ 0.24	— 0.24	+ 0.10	09 34.12	09 53.60	19.48
E.	θ Bootis	20 35.70	— 0.19	— 0.40	+ 0.15	20 35.26	20 54.61	19.35
E.	5 Ursæ Minoris	27 36.58	— 1.49	— 0.88	+ 0.38	27 34.59	27 54.25	19.66
E.	π Bootis, pr	34 27.80	+ 0.27	— 0.24	+ 0.09	34 27.92	34 47.04	19.12
E.	ε Bootis	39 09.00	+ 0.17	— 0.29	+ 0.10	14 39 08.98	14 39 28.18	+ 19.20

*Not good; note by Mr. Maryatt.

NORMAL EQUATIONS.

$a_0 = +0^s.72 \qquad c_0 = +0^s.09 \qquad \Delta T_0 = 19^s.32 - 0^s.071\,(T - 15^h.3)$

$0 = +0.398 + 2.594\,da + 0.808\,dc + 1.902\,d\Delta T$	$da = -0^s.098$	Weight of $a = 2.04$
$0 = +0.218 + 0.808\,da + 12.000\,dc + 1.851\,d\Delta T$	$dc = 0^s.000$	$c = 11.45$
$0 = +0.688 + 1.902\,da + 1.851\,dc + 6.653\,d\Delta T$	$d\Delta T = -0^s.075$	$\Delta T = 5.12$

GREEN RIVER, WYOMING, JUNE 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
E.	Groombr. 2320	16 05 44.96	— 1.00	— 0.76	+ 0.24	16 05 43.44	16 06 02.69	+ 19.25
E.	ε Ophiuchi	11 18.32	+ 0.60	— 0.22	+ 0.09	11 18.79	11 37.97	19.18
E.	τ Herculis	15 39.24	— 0.10	— 0.47	+ 0.13	15 38.80	15 57.72	18.92
E.	α Scorpii	21 19.40	+ 0.86	— 0.13	+ 0.10	21 20.23	21 39.43	19.20
E.	ζ Ophiuchi	29 52.12	+ 0.66	— 0.18	+ 0.09	29 52.69	30 11.91	19.22
W.	η Herculis	38 15.92	+ 0.04	— 0.32	— 0.12	38 15.52	38 34.74	19.22
W.	49 Herculis	46 00.48	+ 0.38	— 0.22	— 0.09	46 00.55	46 19.83	19.28
W.	κ Ophiuchi	51 21.78	+ 0.45	— 0.21	— 0.09	51 21.93	51 41.25	19.32
W.	ε Ursæ Minoris	16 58 59.61	— 4.01	— 1.35	— 0.68	16 58 53.57	16 59 13.16	+ 19.59

NORMAL EQUATIONS.

$a_0 = +0^s.72 \qquad c_0 = +0^s.09 \qquad \Delta T_0 = 19^s.32 - 0^s.071\,(T - 15^h.3)$

$0 = -0.286 + 3.103\,da + 1.530\,dc + 2.985\,d\Delta T$	$da = +0^s.110$	Weight of $a = 1.48$
$0 = -0.158 + 1.530\,da + 9.000\,dc + 1.077\,d\Delta T$	$dc = +0^s.001$	$c = 8.19$
$0 = -0.213 + 2.985\,da + 1.077\,dc + 5.900\,d\Delta T$	$d\Delta T = -0^s.020$	$\Delta T = 3.01$

Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 19, 1873.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
E.	η Ursæ Majoris	13 42 02.14	− 0.15	+ 0.01	+ 0.11	13 42 02.11	13 42 33.87	+ 31.76
E.	η Bootis	48 07.38	+ 0.27	+ 0.16	+ 0.07	48 07.88	48 39.60	31.72
E.	τ Virginis	54 40.24	+ 0.43	+ 0.07	+ 0.07	54 40.81	55 12.33	31.52
E.	α Draconis	14 00 28.62	+ 0.64	+ 0.05	+ 0.16	14 00 28.19	14 00 59.74	31.55
E.	α Bootis	09 21.54	− 0.27	− 0.04	− 0.07	09 21.84	09 53.55	31.71
W.	θ Bootis	20 23.40	− 0.21	− 0.08	− 0.11	20 23.00	20 54.48	31.48
W.	π Bootis, pr	34 15.10	+ 0.29	+ 0.04	− 0.07	34 15.36	34 47.00	31.64
W.	ε Bootis	38 56.26	+ 0.18	+ 0.08	− 0.08	38 56.44	39 28.13	31.69
W.	α^2 Libræ	43 20.66	+ 0.59	+ 0.05	− 0.07	43 21.23	43 52.85	31.62
W.	β Ursæ Minoris	50 39.80	− 1.40	+ 0.40	− 0.26	50 38.54	51 10.24	31.70
W.	β Libræ	15 09 39.96	+ 0.53	+ 0.08	− 0.07	15 09 40.50	15 10 12.12	+ 31.62

NORMAL EQUATIONS.

$a_0 = +0^s.78 \qquad c_0 = +0^s.05 \qquad \triangle T_0 = 31^s.55 - 0^s.045\ (T - 15^h.9)$

$0 = +0.234 + 2.729\,da - 0.690\,dc + 3.004\,d\triangle T$	$da = -0^s.103$	Weight of $a =$ 1.51
$0 = -0.252 - 0.690\,da + 11.000\,dc - 0.718\,d\triangle T$	$dc = +0^s.018$	$c =$ 10.82
$0 = +0.174 + 3.004\,da - 0.718\,dc + 7.418\,d\triangle T$	$d\triangle T = +0^s.020$	$\triangle T =$ 4.11

GREEN RIVER, WYOMING, JUNE 19, 1873.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
W.	η Herculis	16 38 03.08	+ 0.04	+ 0.14	− 0.12	16 38 03.14	16 38 34.74	+ 31.60
W.	49 Herculis	45 48.06	+ 0.36	+ 0.09	− 0.10	45 48.41	46 19.87	31.46
W.	ε Ursæ Minoris	58 45.12	− 3.79	+ 0.43	− 0.74	58 41.02	59 12.82	31.80
W.	α Herculis	17 08 21.40	+ 0.37	+ 0.06	− 0.10	17 08 21.73	17 08 53.36	31.63
W.	44 Ophiuchi	18 06.94	+ 0.78	+ 0.04	− 0.10	18 07.66	18 39.10	31.44
W.	β Draconis	27 05.14	− 0.24	+ 0.18	− 0.16	27 04.92	27 36.36	31.44
E.	ω Draconis	37 14.80	− 1.00	+ 0.21	+ 0.26	37 14.27	37 45.53	31.26
E.	o Herculis	18 02 05.58	+ 0.20	− 0.12	+ 0.11	18 02 05.77	18 02 37.33	31.56
E.	1 Aquilæ	27 47.64	+ 0.60	− 0.09	+ 0.10	27 48.25	28 19.72	+ 31.47

NORMAL EQUATIONS.

$a_0 = +0^s.78 \qquad c_0 = +0^s.05 \qquad \triangle T_0 = 31^s.55 - 0^s.045\ (T - 15^h.9)$

$0 = -0.053 + 2.539\,da - 0.482\,dc + 2.311\,d\triangle T$	$da = +0^s.005$	Weight of $a =$ 1.56
$0 = -0.349 - 0.482\,da + 9.000\,dc - 2.139\,d\triangle T$	$dc = +0^s.045$	$c =$ 8.08
$0 = -0.066 + 2.311\,da - 2.139\,dc + 5.573\,d\triangle T$	$d\Delta T = +0^s.027$	$\triangle T =$ 3.15

Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 20, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
E.	κ Virginis	14 05 37.66	— 0.36	+ 0.02	+ 0.04	14 05 37.36	14 06 08.73	+ 31.37
E.	α Bootis	09 22.20	— 0.18	+ 0.03	+ 0.04	09 22.09	09 53.55	31.46
E.	θ Bootis	20 22.96	+ 0.14	+ 0.04	+ 0.06	20 23.20	20 54.46	31.26
E.	5 Ursæ Minoris	27 21.08	+ 1.10	+ 0.06	+ 0.15	27 22.39	27 53.74	31.35
E.	π Bootis	34 15.78	— 0.20	+ 0.01	+ 0.04	34 15.63	34 47.00	31.37
W.	ε Bootis	38 56.82	— 0.12	0.00	— 0.04	38 56.66	39 28.12	31.46
W.	α^2 Libræ	43 22.02	— 0.40	0.00	— 0.04	43 21.58	43 52.84	31.26
W.	β Ursæ Minoris	50 38.40	+ 0.95	— 0.03	— 0.13	50 39.19	51 10.18	30.99
W.	β Libræ	15 09 41.12	— 0.36	— 0.02	— 0.04	15 09 40.70	15 10 12.12	31.42
W.	γ Ursæ Minoris	20 28.92	+ 0.77	— 0.09	— 0.12	20 29.48	21 01.10	+ 31.62

NORMAL EQUATIONS.

$a_0 = -0^s.40 \quad c_0 = 0^s.000 \quad \Delta T_0 = 31^s.35 - 0^s.017\ (T - 15^h.5)$

$0 = +0.140 + 3.196\,da + 0.014\,dc + 2.747\,d\Delta T$	$da = -0^s.058$	Weight of $a = 1.95$
$0 = -0.353 + 0.014\,da + 10.000\,dc + 0.325\,d\Delta T$	$dc = +0^s.035$	$c = 9.97$
$0 = +0.061 + 2.747\,da - 0.353\,dc + 6.053\,d\Delta T$	$d\Delta T = +0^s.013$	$\Delta T = 3.68$

GREEN RIVER, WYOMING, JUNE 20, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
W.	ζ Ursæ Minoris	15 48 12.36	+ 0.88	— 0.18	— 0.04	15 48 13.02	15 48 44.14	+ 31.12
W.	β Scorpii	57 34.08	— 0.28	— 0.03	— 0.01	57 33.76	58 05.15	31.40
W.	δ Ophiuchi	16 07 12.28	— 0.21	— 0.02	— 0.01	16 07 12.04	16 07 43.34	31.30
W.	ε Ophiuchi	11 06.84	— 0.22	— 0.01	— 0.01	11 06.60	11 38.00	31.40
W.	τ Herculis	15 26.46	+ 0.04	— 0.01	— 0.01	15 26.48	15 57.69	31.21
E.	η Draconis	21 47.86	+ 0.22	+ 0.03	+ 0.02	21 48.13	22 19.68	31.55
E.	A Draconis	27 46.26	+ 0.39	+ 0.06	+ 0.03	27 46.74	28 18.14	31.40
E.	η Herculis	38 03.24	— 0.02	+ 0.05	+ 0.01	38 03.28	38 34.74	31.46
E.	49 Herculis	45 48.78	— 0.14	+ 0.05	+ 0.01	45 48.70	46 19.87	31.17
E.	κ Ophiuchi	51 10.08	— 0.16	+ 0.04	+ 0.01	51 09.97	51 41.30	31.33
E.	d Herculis	16 56 25.80	— 0.05	+ 0.06	+ 0.01	16 56 25.82	16 56 57.00	+ 31.18

NORMAL EQUATIONS.

$a_0 = -0^s.40 \quad c_0 = 0^s.000 \quad \Delta T_0 = 31^s.35 - 0^s.017\ (T - 15^h.5)$

$0 = -0.245 + 2.973\,da - 1.271\,dc + 2.826\,d\Delta T$	$da = +0^s.097$	Weight of $a = 1.60$
$0 = +0.030 - 1.271\,da + 11.000\,dc + 0.558\,d\Delta T$	$dc = +0^s.009$	$c = 9.72$
$0 = -0.204 + 2.826\,da + 0.558\,dc + 6.940\,d\Delta T$	$d\Delta T = -0^s.011$	$\Delta T = 3.96$

Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
W.	θ Bootis	14 20 13.32	+ 0.06	— 0.10	— 0.23	14 20 13.05	14 20 54.36	+ 41.31
W.	5 Ursæ Minoris	27 12.84	+ 0.49	— 0.16	— 0.58	27 12.59	27 53.38	40.79
W.	π Bootis, pr	34 05.76	— 0.09	— 0.03	— 0.14	34 05.50	34 46.97	41.47
W.	ε Bootis	38 46.66	— 0.06	— 0.04	— 0.16	38 46.40	39 28.08	41.68
W.	α² Libræ	43 11.50	— 0.18	— 0.03	— 0.14	43 11.15	43 52.82	41.67
E.	β Ursæ Minoris	51 27.56	+ 0.43	— 0.38	+ 0.52	51 28.13	51 09.88	41.75
E.	β Bootis	56 30.06	— 0.00	— 0.21	+ 0.18	56 30.03	57 11.60	41.57
E.	β Libræ	15 09 30.98	— 0.16	— 0.17	+ 0.14	15 09 30.79	15 10 12.10	41.31
E.	γ Ursæ Minoris	20 19.02	+ 0.35	— 0.86	+ 0.45	20 18.96	21 00.88	41.92
E.	α Coronæ	28 39.20:	— 0.06	— 0.32	+ 0.16	28 38.98	29 20.47	41.49
E.	α Serpentis	37 21.38	— 0.12	— 0.24	+ 0.14	15 37 21.16	15 38 02.53	+ 41.37

NORMAL EQUATIONS.

$a_0 = -0^s.37 \qquad c_0 = +0^s.18 \qquad \triangle T_0 = 41^s.43 - 0^s.025\,(T - 16^h.8)$

$0 = -0.507 + 2.837\,da - 0.197\,dc + 2.425\,d\triangle T$	$da = +0^s.164$	Weight of $a =$ 1.93
$0 = +0.495 - 0.197\,da + 11.000\,dc + 0.541\,d\triangle T$	$dc = -0^s.042$	$c =$ 10.96
$0 = -0.481 + 2.425\,da + 0.541\,dc + 6.545\,d\triangle T$	$d\triangle T = +0^s.014$	$\triangle T =$ 4.46

GREEN RIVER, WYOMING, JUNE 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
E.	1 Aquilæ	18 27 38.84	— 0.44	— 0.06	+ 0.19	18 27 38.53	18 28 19.80	+ 41.27
E.	α Lyræ	31 58.86	+ 0.04	— 0.10	+ 0.24	31 58.96	32 40.47	41.51
E.	β Lyræ	44 44.16	— 0.10	— 0.13	+ 0.23	44 44.17	45 25.48	41.31
E.	σ Sagittarii	46 44.70	— 0.59	— 0.05	+ 0.21	46 44.27	47 25.77	41.50
E.	50 Draconis	49 49.14	+ 1.25	— 0.39	+ 0.74	49 50.74	50 32.01	41.27
W.	ζ Aquilæ	58 55.56	— 0.27	— 0.13	— 0.19	58 54.97	59 36.28	41.31
W.	ι Lyræ	19 02 07.42	— 0.07	— 0.19	— 0.23	19 02 06.93	19 02 48.27	41.34
W.	δ Draconis	11 53.06	+ 0.65	— 0.38	— 0.49	11 52.84	12 34.37	+ 41.53

NORMAL EQUATIONS.

$a_0 = -0^s.37 \qquad c_0 = +0^s.18 \qquad \triangle T_0 = 41^s.43 - 0^s.025\,(T - 16^h.8)$

$0 = +0.467 + 2.195\,da + 1.203\,dc + 1.970\,d\triangle T$	$da = -0^s.201$	Weight of $a =$ 1.36
$0 = +0.198 + 1.203\,da + 8.000\,dc + 1.590\,d\triangle T$	$dc = +0^s.009$	$c =$ 7.26
$0 = +0.470 + 1.970\,da + 1.590\,dc + 4.903\,d\triangle T$	$d\triangle T = -0^s.018$	$\triangle T =$ 3.10

Observations and reductions for time taken at sending station—Continued.

GREEN RIVER, WYOMING, JUNE 26, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
W.	θ Bootis	14 20 11.02	— 0.09	— 0.21	— 0.28	14 20 10.44	14 20 54.34	+ 43.90
W.	5 Ursæ Minoris	27 11.52	— 0.69	— 0.44	— 0.72	27 09.67	27 53.30	43.63
W.	π Bootis	34 03.28	+ 0.12	— 0.12	— 0.18	34 03.10	34 46.96	43.86
W.	α^2 Libræ	43 08.90	+ 0.25	— 0.09	— 0.18	43 08.88	43 52.82	43.94
W.	β Bootis	56 28.02	0.00	— 0.25	— 0.23	56 27.54	57 11.59	44.05
E.	β Libræ	15 09 27.88	+ 0.23	— 0.15	+ 0.17	15 09 28.13	15 10 12.10	43.97
E.	γ Ursæ Minoris	20 17.40	— 0.48	— 0.66	+ 0.56	20 16.82	21 00.83	44.01
E.	ν Bootis, pr	25 40.28	0.00	— 0.30	+ 0.23	25 40.21	26 24.04	43.83
E.	ε Serpentis	15 43 47.14	+ 0.17	— 0.16	+ 0.17	15 43 47.32	15 44.30.95	+ 43.63

NORMAL EQUATIONS.

$a_0 = +0^s.38 \qquad c_0 = +0^s.22 \qquad \triangle T_0 = 43^s.82 - 0^s.045\,(T - 16^h.2)$

$0 = +0.257 + 2.451\,da + 0.352\,dc + 2.169\,d\triangle T$	$da = -0^s.094$	Weight of $a = 1.56$
$0 = +0.480 + 0.352\,da + 9.000\,dc - 0.485\,d\triangle T$	$dc = -0^s.050$	$c = 8.77$
$0 = +0.201 + 2.169\,da - 0.485\,dc + 5.469\,d\triangle T$	$d\triangle T = -0^s.004$	$\triangle T = 3.48$

GREEN RIVER, WYOMING, JUNE 26, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
E.	η Herculis	16 37 50.74	+ 0.02	— 0.16	+ 0.11	16 37 50.71	16 38 34.72	+ 44.01
E.	49 Herculis	45 35.82	+ 0.19	— 0.10	+ 0.09	45 36.00	46 19.89	43.89
E.	d Herculis	56 13.22	+ 0.07	— 0.11	+ 0.10	56 13.28	56 56.99	43.71
E.	a Herculis	17 08 09.40	+ 0.19	— 0.11	+ 0.08	17 08 09.56	17 08 53.39	43.83
E.	44 Ophiuchi	17 54.94	+ 0.41	— 0.06	+ 0.09	17 55.38	18 39.16	43.78
W.	β Draconis	26 53.34	— 0.13	— 0.26	— 0.13	26 52.82	27 36.35	43.53
W.	μ Herculis	40 47.50	+ 0.11	— 0.11	— 0.09	40 47.41	41 31.38	43.97
W.	γ Draconis	52 58.60	— 0.11	— 0.08	— 0.13	52 58.28	53 41.98	43.70
W.	γ Sagittarii	56 57.38	+ 0.45	— 0.02	— 0.13	56 57.68	57 41.46	43.78
W.	o Herculis	18 01 53.46	+ 0.10	— 0.05	— 0.09	18 01 53.42	18 02 37.38	+ 43.96

NORMAL EQUATIONS.

$a_0 = +0^s.38 \qquad c_0 = +0^s.22 \qquad \triangle T_0 = 43^s.82 - 0^s.045\,(T - 16^h.2)$

$0 = -0.126 + 2.327\,da + 0.938\,dc + 2.844\,d\triangle T$	$da = +0^s.030$	Weight of $a = 1.14$
$0 = +1.319 + 0.938\,da + 10.000\,dc + 0.596\,d\triangle T$	$dc = -0^s.138$	$c = 9.54$
$0 = -0.462 + 2.844\,da + 0.596\,dc + 7.050\,d\triangle T$	$d\triangle T = +0^s.065$	$\triangle T = 3.54$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, JUNE 10, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	τ Virginis	5 47 27.73	+ 0.04	+ 0.06	— 0.20	5 47 27.63	13 55 12.37	8 07 44.74
W.	α Draconis	53 15.42	— 0.06	+ 0.15	— 0.47	53 15.04	14 01 00.06	. 45.02
W.	κ Virginis	58 24.05	+ 0.05	+ 0.04	— 0.20	58 23.94	06 08.73	44.79
W.	α Bootis	6 02 08.87	+ 0.02	+ 0.07	— 0.21	6 02 08.75	09 53.63	44.88
W.	θ Bootis	03 10.01	— 0.02	+ 0.11	— 0.33	03 09.77	10 54.60	44.83
W.	5 Ursæ Minoris	20 10.41	— 0.15	+ 0.24	— 0.84	6 20 09.66	14 27 54.38	8 07 44.72

NORMAL EQUATIONS.

$$6.00\,\delta t + 1.97\,a = -1.14 \qquad a = -0^s.06$$
$$1.97\,\delta t + 8.18\,a = -0.85 \qquad \delta t = -0^s.17$$

NOTE.—Observations incomplete in consequence of cloud. The value of c is assumed to be $+0^s.20$ clamp east.

SALT LAKE CITY, UTAH, JUNE 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	α Virginis	5 10 49.09	+ 0.06	+ 0.02	+ 0.18	5 10 49.35	13 18 31.41	+ 8 07 42.06
E.	ζ Virginis	20 32.32	+ 0.05	+ 0.02	+ 0.18	20 32.57	28 14.58	42.01
E.	m Virginis	27 15.90	+ 0.05	+ 0.02	+ 0.18	27 16.15	34 58.14	41.99
E.	η Ursæ Majoris	34 51.53	— 0.02	+ 0.05	+ 0.28	34 51.84	42 34.03	42.19
E.	η Bootis	40 57.38	+ 0.03	+ 0.03	+ 0.19	40 57.63	48 39.72	42.09
W.	τ Virginis	47 30.37	+ 0.04	+ 0.02	— 0.18	47 30.25	55 12.36	42.11
W.	α Bootis	6 02 11.50	+ 0.03	+ 0.03	— 0.19	6 02 11.37	14 09 53.62	42.25
W.	θ Bootis	13 12.65	— 0.02	+ 0.05	— 0.30	13 12.38	20 54.57	42.19
W.	5 Ursæ Minoris	20 13.06	— 0.17	+ 0.10	— 0.76	20 12.23	27 54.26	+ 8 07 42.03

NORMAL EQUATIONS.

$$9.00\,\delta t - 0.56\,a - 2.28\,c = +0.54 \qquad a = -0^s.07$$
$$-0.56\,\delta t + 8.46\,a - 12.08\,c = -2.82 \qquad c = +0^s.18$$
$$-2.28\,\delta t - 12.08\,a + 29.12\,c = +5.92 \qquad \delta t = +0^s.10$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	ζ Ursæ Minoris....	7 41 03.47	+ 0.03	+ 0.31	— 0.98	7 41 02.83	15 48 44.96	+ 8 07 42.13
W.	β^1 Scorpii	50 23.20	— 0.01	+ 0.05	— 0.20	50 23.04	58 05.14	42.10
W.	Groombr. 2320 ...	58 21.29	+ 0.01	+ 0.21	— 0.54	58 20.97	16 06 02.68	41.71
W.	τ Herculis..........	8 08 15.88	+ 0.00	+ 0.14	— 0.29	8 08 15.73	15 57.65	41.92
E.	η Draconis	14 37.12	+ 0.01	+ 0.20	+ 0.42	14 37.75	22 19.73	41.98
E.	A Draconis	20 35.73	+ 0.01	+ 0.27	+ 0.56	20 36.57	28 18.51	41.94
E.	η Herculis..........	8 30 52.43	0.00	+ 0.14	+ 0.26	8 30 52.83	16 38 34.71	+ 8 07 41.88

NORMAL EQUATIONS.

$$7.00\,\delta t + 5.48\,a - 3.88\,c = -1.05 \qquad a = +0^s.01$$
$$5.48\,\delta t + 13.55\,a - 11.81\,c = -2.43 \qquad c = +0^s.20$$
$$-3.88\,\delta t - 11.81\,a + 48.29\,c = +9.33 \qquad \delta t = -0^s.04$$

SALT LAKE CITY, UTAH, JUNE 19, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	χ Virginis..........	5 47 39.02	+ 1.73	+ 0.08	— 0.22	5 47 40.61	13 55 12.31	+8 07 31.70
W.	α Draconis	53 31.21	— 2.71	+ 0.18	— 0.52	53 28.16	14 00 59.77	31.61
W.	κ Virginis..........	58 35.10	+ 2.18	+ 0.06	— 0.22	58 37.12	06 08.68	31.56
W.	α Bootis	6 02 20.90	+ 1.06	+ 0.05	— 0.23	6 02 21.78	09 53.57	31.79
W.	λ Virginis..........	04 42.03	+ 2.32	+ 0.03	— 0.23	04 44.15	12 15.81	31.66
E.	θ Bootis	13 23.43	— 0.92	+ 0.10	+ 0.36	13 22.97	20 54.44	31.47
E.	5 Ursæ Minoris	20 27.74	— 6.84	+ 0.27	+ 0.92	20 22.09	27 53.81	31.72
E.	μ Virginis..........	28 49.69	+ 2.00	+ 0.04	+ 0.22	28 51.95	36 23.58	31.63
E.	ε Bootis	31 55.27	+ 0.73	+ 0.06	+ 0.25	31 56.31	39 28.13	31.82
E.	α^2 Libræ............	6 36 18.62	+ 2.40	+ 0.03	+ 0.23	36 21.28	43 52.85	+8 07 31.57

NORMAL EQUATIONS.

$$10.00\,\delta t - 0.70\,a + 2.54\,c = -0.94 \qquad a = -2^s.79$$
$$0.70\,\delta t + 10.20\,a + 9.32\,c = -26.13 \qquad c = +0^s.22$$
$$2.54\,\delta t + 9.32\,a + 33.59\,c = -19.46 \qquad \delta t = -0^s.35$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 19, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	η Draconis	8 14 49.77	− 2.58	+ 0.15	+ 1.00	8 14 48.34	16 22 19.65	+8 07 31.31
E.	A Draconis	21 49.92	− 4.49	+ 0.20	+ 1.32	21 46.95	28 18.38	31.43
E.	η Herculis	31 02.79	− 0.14	+ 0.10	+ 0.61	31 03.36	38 34.72	31.36
W.	κ Ophiuchi	44 08.62	+ 1.80	+ 0.05	− 0.48	44 09.99	51 41.31	31.32
W.	*d* Herculis	49 25.51	+ 0.51	+ 0.06	− 0.57	49 25.51	56 57.00	31.49
W.	*a* Herculis	9 01 20.80	+ 0.56	+ 0.06	− 0.49	9 01 21.93	17 08 53.36	+8 07 31.43

NORMAL EQUATIONS.

$$6.00\,\delta t + 0.90\,a + 2.97\,c = -5.61$$
$$0.90\,\delta t + 2.83\,a + 6.55\,c = -7.14$$
$$2.97\,\delta t + 6.55\,a + 17.51\,c = -15.99$$

$$a = -3^s.40$$
$$c = -0^s.47$$
$$\delta t = -0^s.64$$

SALT LAKE CITY, UTAH, JUNE 20, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	ε Serpentis	7 36 58.78	+ 1.65	+ 0.09	+ 0.18	7 37 00.70	15 44 30.97	+8 07 30.27
E.	3 Ursæ Minoris	41 21.24	− 8.29	+ 0.43	+ 0.86	41 14.24	48 44.52	30.28
E.	β Scorpii	50 32.11	+ 2.57	+ 0.06	+ 0.19	50 34.93	58 05.17	30.24
E.	δ Ophiuchi	8 00 10.89	+ 1.96	+ 0.08	+ 0.18	8 00 13.11	16 07 43.31	30.20
E.	τ Herculis	08 27.52	− 0.41	+ 0.17	+ 0.25	08 27.54	15 57.62	30.08
E.	η Draconis	14 50.90	− 2.12	+ 0.20	+ 0.38	14 49.36	22 19.63	30.27
E.	ζ Ophiuchi	22 39.17	+ 2.20	+ 0.07	+ 0.18	22 41.62	30 11.96	30.34
E.	η Herculis	31 03.88	+ 0.11	+ 0.10	+ 0.23	31 04.32	38 34.72	30.40
W.	κ Ophiuchi	44 09.54	+ 1.48	+ 0.10	− 0.18	44 10.94	51 41.31	30.37
W.	*d* Herculis	49 26.50	+ 0.41	+ 0.16	− 0.21	49 26.86	56 57.00	30.14
W.	ε Ursæ Minoris	51 56.68	−13.70	+ 0.78	− 1.31	51 42.45	59 12.76	30.31
W.	*a* Herculis	9 01 21.93	+ 1.28	+ 0.15	− 0.18	9 01 23.18	17 08 53.37	+8 07 30.19

NORMAL EQUATIONS.

$$12.00\,\delta t + 4.61\,a + 3.20\,c = -9.20$$
$$4.61\,\delta t + 36.30\,a - 22.01\,c = -103.88$$
$$3.20\,\delta t - 22.01\,a + 94.72\,c = +78.80$$

$$a = -2^s.787$$
$$c = +0^s.177$$
$$\delta t = +0^s.26$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	α Bootis	6 02 33.98	− 5.16	− 0.05	+ 0.18	6 02 28.95	14 09 53.52	+8 07 24.57
E.	θ Bootis	13 24.91	+ 4.51	− 0.06	+ 0.28	13 29.64	20 54.32	24.68
E.	5 Ursæ Minoris	20 54.82	+33.28	− 0.14	+ 0.71	20 28.67	27 53.38	24.71
E.	μ Virginius	29 08.58	− 9.81	− 0.03	+ 0.17	29 01.09	36 23.54	24.63
E.	ε Bootis	32 06.69	− 3.53	− 0.03	+ 0.19	32 03.35	39 28.08	24.73
E.	α^2 Libræ	36 39.68	−11.74	− 0.02	+ 0.18	36 28.10	43 52.82	24.72
W.	β Ursæ Minoris	43 16.97	−28.73	+ 0.30	− 0.66	43 45.36	51 09.97	24.61
W.	β Bootis	49 46.97	+ 0.04	+ 0.14	− 0.22	49 46.93	57 11.60	24.67
W.	48 Cephei, S. P	57 42.95	−54.48	− 0.17	+ 0.77	56 49.07	15 04 13.71	24.64
W.	o^2 Libræ	7 08 45.64	−11.57	+ 0.03	− 0.18	7 08 33.92	15 58.55	24.63
W.	μ Bootis	12 19.77	− 0.89	+ 0.02	− 0.21	12 18.69	19 43.53	+8 07 24.84

NORMAL EQUATIONS.

$$11.00\,\delta t + 2.25\,a + 7.22\,c = -5.96 \qquad a = -1^s.61$$
$$2.25\,\delta t + 28.75\,a + 16.62\,c = -44.43 \qquad c = +0^s.17$$
$$7.22\,\delta t + 16.62\,a + 64.18\,c = -18.24 \qquad \delta t = -0^s.32$$

SALT LAKE CITY, UTAH, JUNE 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	η Serpentis	10 07 31.28	− 9.38	+ 0.05	− 0.14	10 07 21.81	18 14 46.29	+8 07 24.48
W.	1 Aquilæ	20 05.66	−10.36	+ 0.05	− 0.14	20 55.21	28 19.80	24.59
W.	α Lyræ	25 16.60	− 0.64	+ 0.09	− 0.17	25 15.88	32 40.46	24.58
E.	β Lyræ	38 02.78	− 2.13	+ 0.13	+ 0.16	38 00.94	45 25.50	24.56
E.	50 Draconis	43 36.36	+30.26	+ 0.32	+ 0.53	43 07.47	50 31.99	24.52
E.	3 Aquilæ	52 17.89	+ 6.37	+ 0.06	+ 0.14	52 11.72	59 36.25	24.53
E.	d Sagittarii	11 02 02.12	−12.43	+ 0.03	+ 0.14	11 02 49.86	19 10 14.39	+8 07 24.53

NORMAL EQUATIONS.

$$7.00\,\delta t + 0.82\,a + 3.93\,c = -3.97 \qquad a = -1^s.565$$
$$0.82\,\delta t + 7.12\,a - 8.67\,c = -12.68 \qquad c = +0^s.135$$
$$3.93\,\delta t - 8.67\,a + 22.82\,c = +14.76 \qquad \delta t = -0^s.46$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 26, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	θ Bootis	6 13 30.23	+ 0.58	+ 0.03	+ 0.18	6 13 31.02	14 20 54.29	+8 07 23.27
E.	5 Ursæ Minoris	20 25.10	+ 4.29	+ 0.10	+ 0.45	20 29.94	27 53.31	23.37
E.	μ Virginis	29 01.20	— 1.16	+ 0.00	+ 0.11	29 00.15	26 23.53	23.38
E.	ε Bootis	32 04.81	— 0.46	+ 0.07	+ 0.12	32 04.54	39 28.07	23.53
E.	α² Libræ	36 30.76	— 1.51	+ 0.05	+ 0.11	36 29.41	43 52.81	23.40
W.	β Ursæ Minoris	43 42.84	+ 3.69	+ 0.57	— 0.41	43 46.69	51 09.90	23.21
W.	β Bootis	49 47.93	+ 0.01	+ 0.24	— 0.14	49 48.04	57 11.59	23.55
W.	48 Cephei (s. pol.)	56 57.44	— 7.00	— 0.40	+ 0.49	56 50.53	15 04 13.82	23.29
W.	β Libræ	7 02 50.04	— 1.31	+ 0.10	+ 0.11	7 02 48.72	10 12.11	23.39
W.	o² Libræ	08 36.93	— 1.49	+ 0.07	+ 0.11	08 35.40	15 58.54	23.14
W.	μ Bootis	12 20.19	— 0.12	+ 0.16	+ 0.14	12 20.19	19 43.52	+8 07 23.43

NORMAL EQUATIONS.

$$11.00\ \delta t + 2.64\ a + 5.15\ c = + 0.05 \qquad a = -1^s.75$$
$$2.64\ \delta t + 29.18\ a + 15.43\ c = -48.44 \qquad c = +0^s.11$$
$$5.15\ \delta t + 15.43\ a + 64.10\ c = -18.08 \qquad \delta t = +0^s.36$$

SALT LAKE CITY, UTAH, JUNE 26, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	η Draconis	8 14 54.69	+ 1.42	+ 0.24	— 0.33	8 14 56.02	16 22 19.52	+8 07 23.50
W.	A Draconis	20 52.58	+ 2.47	+ 0.30	— 0.43	20 54.92	28 18.20	23.28
W.	π Herculis	31 11.47	— 0.07	+ 0.15	— 0.20	31 11.35	38 34.70	23.35
E.	κ Ophiuchi	44 18.84	— 0.99	+ 0.08	+ 0.16	44 18.09	51 41.33	23.24
E.	α Herculis	49 33.77	— 0.28	+ 0.08	+ 0.18	49 33.75	56 56.99	23.24
E.	ε Ursæ Minoris	50 38.22	+ 9.18	+ 0.39	+ 1.14	50 48.93	59 12.32	23.39
E.	α¹ Herculis	9 01 30.62	— 0.86	+ 0.06	+ 0.16	9 01 29.98	17 08 53.39	+8 07 23.41

NORMAL EQUATIONS.

$$7.00\ \delta t - 5.81\ a + 4.44\ c = + 13.95 \qquad a = -1^s.87$$
$$5.81\ \delta t + 26.94\ a - 29.93\ c = -57.10 \qquad c = -0^s.15$$
$$4.44\ \delta t - 29.93\ a + 72.42\ c = + 68.66 \qquad \delta t = +0^s.34$$

The following tables give the corrections and rates for the chronometers used at Green River and Salt Lake City:

CHRONOMETER AT GREEN RIVER.—NEGUS, No. 1499.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	h.	s. s.	s.
June 10	14.8	+ 17.004 ± 0.022	— 0.045
June 12	15.3	19.272 ± 0.017	— 0.071
June 19	15.9	31.573 ± 0.028	— 0.045
June 20	15.5	31.351 ± 0.027	— 0.017
June 25	16.8	41.428 ± 0.027	— 0.025
June 26	16.2	+ 43.851 ± 0.028	— 0.045

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	h.	h. m. s.	s.
June 10	14.0	+ 8 07 44.83	— 0.058
June 12	14.75	42.02	— 0.059
June 19	15.5	31.51	— 0.053
June 20	16.0	30.25	— 0.051
June 25	16.5	24.61	— 0.053
June 26	15.5	+ 8 07 23.35	— 0.054

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
June 10, 1873:		h. m. s.	h. m. s.	h. m. s.	m. s.	s.	m. s.
Salt Lake City.	Salt Lake City.	6 53 18.46	+ 8 07 44.77	15 01 03.23			
	Green River...	15 10 28.58	+ 0 00 16.99	10 45.57	9 42.34		
Green River...	Salt Lake City.	7 00 19.82	+ 8 07 44.77	15 08 04.59			
	Green River...	15 17 29.80	+ 0 00 16.99	17 46.79	9 42.20	+ 0.14	9 42.270
June 12, 1873:							
Salt Lake City.	Green River...	15 32 57.15	+ 0 00 19.25	15 33 16.40			
	Salt Lake City.	7 15 52.04	+ 8 07 41.98	23 34.02	9 42.38		
Green River...	Green River...	15 38 29.81	+ 0 00 19.26	15 38 49.05			
	Salt Lake City.	7 21 24.73	+ 8 07 41.98	29 06.71	9 42.34	+ 0.04	9 42.360
June 19, 1873:							
Salt Lake City.	Green River...	16 03 25.84	+ 0 00 31.57	16 03 57.41			
	Salt Lake City.	7 46 43.54	+ 8 07 31.49	15 54 15.03	9 42.38		
Green River...	Green River...	16 12 59.90	+ 0 00 31.56	16 13 31.46			
	Salt Lake City.	7 56 17.54	+ 8 07 31.48	16 03 49.02	9 42.44	— 0.06	9 42.410

Final results of longitude—Continued.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
June 20, 1873:		h. m. s.	h. m. s.	h. m. s.	m. s.	s.	m. s.
Salt Lake City.	Green River...	15 29 34.24	+ 0 00 31.35	15 30 05.59			
	Salt Lake City.	7 12 52.76	+ 8 07 30.29	20 23.05	9 42.54		
Green River...	Green River...	15 35 59.94	+ 0 00 31.35	36 31.29			
	Salt Lake City.	7 19 18.58	+ 8 07 30.28	26 48.86	9 42.43	+ 0.11	9 42.485
June 25, 1873:							
Salt Lake City.	Green River...	18 02 59.77	+ 0 00 41.40	18 03 41.17			
	Salt Lake City.	9 46 34.08	+ 8 07 24.54	17 53 58.62	9 42.55		
Green River...	Green River...	18 08 40.00	+ 0 00 41.39	18 09 21.39			
	Salt Lake City.	9 52 14.38	+ 8 07 24.53	17 59 38.91	9 42.48	+ 0.07	9 42.515
June 26, 1873:							
Salt Lake City.	Green River...	15 48 21.47	+ 0 00 43.87	15 49 05.34			
	Salt Lake City.	7 31 59.51	+ 8 07 23.34	39 22.85	9 42.49		
Green River...	Green River...	15 53 49.87	+ 0 00 43.86	54 33.73			
	Salt Lake City.	7 37 27.90	+ 8 07 23.34	15 44 51.24	9 42.49	0.00	9 42.490

Green River east of Salt Lake City........................ $0^h\ 09^m\ 42^s.472 \pm 0^s.029$ (by sums of errors),
$\pm 0^s.028$ (by sums of squares),

not yet including the personal equation.

Salt Lake City west of Greenwich........................ $7^h\ 27^m\ 34^s.86$

Green River west of Greenwich........................ $7^h\ 17^m\ 52^s.438$

Green River west of Greenwich........................ $109^\circ\ 28'\ 06''.57$

Mean places of stars for 1873.0 *used for determination of latitude of Green River, Wyoming.*

No. of pair.	No. in B. A. C.	Right ascension.	Declination.	No. of pair.	No. in B. A. C.	Right ascension.	Declination.
		h. m. s.	° ′ ″			h. m. s.	° ′ ″
1	4741	14 11 33	46 40 19.74	13	5643	16 42 54	57 00 33.82
	4747	12 37	36 05 46.76		5703	49 50	25 56 12.22
2	4804	14 24 13	50 24 50.62	14	5747	16 56 55	33 45 12.56
	4820	28 47	33 05 32.84		*5776	17 01 28	48 58 47.42
3	4863	14 37 31	37 17 55.00	15	5842	17 12 38	33 14 17.72
	4881	39 49	45 43 26.14		5853	13 35	49 49 40.56
4	4917	14 47 35	47 00 01.34	16	5871	17 16 46	46 21 58.58
	4961	58 02	35 42 15.40		5895	20 03	37 03 57.44
5	5033	15 09 35	42 38 43.44	17	5937	17 27 33	52 23 46.14
	5076	17 55	40 02 09.94		5962	31 47	30 51 54.52
6	5131	15 27 48	31 47 19.92	18	6082	17 51 54	37 16 06.96
	5181	34 52	50 50 18.82		6109	56 19	45 30 30.74
7	5248	15 44 34	55 45 58.04	19	6203	18 11 42	42 07 01.44
	5302	52 20	27 14 49.34		6218	13 05	40 53 15.48
8	5321	15 56 21	30 12 27.82	20	6311	18 24 56	59 37 34.44
	5341	58 51	53 16 09.72		6322	27 29	23 31 25.08
9	5434	16 10 52	23 26 24.66	21	6470	18 50 04	50 33 04.20
	5459	15 08	60 03 48.02		6491	54 12	32 31 00.00
10	5473	16 17 09	31 11 17.94	22	6520	18 57 51	46 45 20.56
	5503	21 47	52 00 17.76		6556	19 02 46	35 54 08.16
11	5541	16 28 32	30 45 59.86	23	6650	19 17 59	73 07 08.16
	5549	30 53	52 30 05.20		6772	19 40 13	10 18 19.31
12	5596	16 35 18	49 10 39.46				
	5619	39 11	34 16 26.24				

* The declination of the star 5776 as given in the Catalogue of 981 Stars is 48° 58′ 50″.12; a proper motion of — 0″.10 annually has been assumed here.

Observations and computations for latitude.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
June 9..	5131	30.730	24.0	13.9	Illumination					
	5181	10.431	......	44.1	poor.	41 18 48.28	+13 21.48	−9.26	......	41 31 40.50
	5248	20.412	15.6	22.6	Observed off					
	5302	22.195	37.0	1.3	line of col-	30 21.74	+ 1 08.74	+6.64	+0.12	37.32
					limation.					
	5321	10.017	23.5	14.2						
	5341	29.907	33.2	4.7		44 16.34	−12 46.72	+8.75	......	38.37
	5473	15.434	21.2	16.0						
	5503	21.850	19.6	19.0		35 44.26	− 0 47.33	+1.34	......	38.27
	5541	15.822	28.6	9.5						
	5549	25.692	5.5	33.0		37 58.41	− 6 20.47	−1.94	......	36.00
	5747	27.103	30.0	9.0						
	5776	12.010	12.3	26.9		21 54.37	+ 9 41.81	+1.48	......	37.66
	5937	23.820	12.3	27.1						
	5962	14.287	30.5	9.0		37.43.29	− 6 07.48	+1.55	......	37.36
	6082	25.357	18.0	22.3	Growing					
	6109	12.198	31.4	9.2	cloudy.	23 10.63	+ 8 27.26	+4.14	......	42.03
	6203	18.641	17.0	23.9						
	6218	21.074	32.9	8.2		29 59.46	+ 1 33.79	+4.12	......	37.37
	6311	21.863	17.4	24.2						
	6322	17.618	26.8	15.0		34 20.45	− 2 43.64	+1.16	......	37.97
	6520	10.152	20.2	21.9						
	6566	28.863	28.0	14.0		19 33.58	+12 01.27	+2.85	......	37.70
	6650	27.124	17.0	25.0						
	6772	10.030	31.0	11.0		42 33.57	−10 58.99	+2.78	......	37.36
June 10.	5747	26.799	24.0	14.5						
	5776	11.660	15.2	24.0		21 54.65	+ 9 43.58	+0.16	......	38.39
	5842	18.986	28.0	11.0						
	5853	19.465	16.0	23.0		31 53.12	− 0 18.46	+2.32	......	36.98
	5871	23.748	24.1	14.8						
	5895	6.120	23.4	15.7		42 51.74	−11 19.53	+3.94	......	36.15
	5937	23.303	20.1	18.9						
	5962	13.726	23.7	15.5		37 43.58	− 6 09.18	+2.18	......	36.58
	6082	24.691	5.6	33.3						
	6109	11.583	39.0	0.0		23 10.93	+ 8 25.29	+2.62	......	38.84
	6311	22.743	20.1	19.2						
	6322	18.393	28.0	11.4		34 20.74	− 2 47.68	+4.05	......	37.11
	6470	20.410	24.2	16.3						
	6491	19.972	26.3	14.5		41 31 51.96	− 0 16.88	+4.56	......	31 39.64

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
June 10.	6520	9.917	27.0	13.5						
	6556	28.551	27.8	13.1		41 19 33.88	+11 58.31	+6.53	....	41 31 38.72
	6650	28.097	19.3	21.5						
	6772	11.082	19.1	22.5		42 33.84	—10 55.94	—1.30	....	36.60
June 11.	4804	34.610	32.8	1.9						
	4820	13.237	15.9	19.0		45 14.60	—13 43.88	+6.43	......	37.15
	4863	20.413	13.0	22.0						
	4881	19.047	29.8	5.3		30 42.84	+ 0 53.00	+3.59	......	39.43
	4917	11.316	20.8	15.0						
	4961	27.682	11.2	24.5		21 09.88	+10 30.88	—1.74	......	39.02
	5033	12.631	23.7	13.0						
	5076	29.988	17.2	19.8		20 27.12	+11 09.07	+1.88	....	38.07
	5131	29.658	19.0	18.0						
	5181	9.700	19.7	17.9		18 48.76	+12 49.34	+0.65	......	38.75
	5248	20.132	19.6	18.3						
	5302	22.063	21.1	17.3		30 22.23	+ 1 14.44	+1.18	....	37.85
	5321	10.119	23.0	15.6						
	5341	29.878	23.0	15.9		44 16.84	—12 41.67	+3.36	....	38.53
	5434	9.264	22.2	17.0						
	5459	30.221	20.0	19.7		45 03.47	—13 27.85	+1.27	+0.35	37.24
	5473	14.861	20.0	19.7	Observed off line of collimation.					
	5503	21.321	20.9	16.0		35 44.80	— 4 09.02	+0.51	+0.21	36.50
	5541	16.352	27.0	13.0						
	5549	26.355	23.0	17.0		37 58.94	— 6 25.60	+4.63	.....	37.97
	5596	28.224	35.8	4.0						
	5619	9.620	20.6	19.7		43 28.96	—11 57.15	+7.55	....	39.36
	5643	17.689	32.0	8.9						
	5703	22.809	15.4	25.5		28 18.66	+ 3 17.37	+3.01	....	39.04
	5747	28.249	19.0	22.0						
	5776	13.183	31.3	9.8		21 54.95	+ 9 40.77	+4.28	....	40.00
	5842	19.522	20.2	21.3						
	5853	19.887	20.2	21.7		31 53.40	— 0 14.07	—0.60	.....	38.73
	5937	23.102	23.4	18.7						
	5962	13.582	20.7	21.5		37 43.88	— 6 06.98	+0.90	......	37.80
	6082	24.305	23.1	19.8						
	6109	11.141	20.4	23.0		23 11.24	+ 8 27.45	+0.16	....	38.85
	6203	20.923	25.4	17.8						
	6218	23.427	24.1	19.0		41 30 00.08	+ 1 36.52	+2.94	....	41 31 39.54

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
June 11.	6311	22. 392	27. 3	16. 0						
	6322	18. 123	18. 0	25. 4		41 34 21. 04	− 2 44. 56	+0. 90	......	41 31 37. 38
	6470	20. 563	32. 0	12. 0						
	6491	20. 130	20. 8	23. 4		31 52. 27	− 0 16. 69	+4. 35	......	39. 93
	6520	9. 620	34. 3	10. 0						
	6556	18. 320	19. 0	25. 1		19 34. 19	+12 00. 85	+4. 21	......	39. 25
	6650	27. 065	36. 4	8. 0						
	6772	9. 931	17. 2	28. 0		42 34. 10	−11 00. 53	+4. 07	......	37. 64
June 12.	5842	19. 163	15. 8	20. 0						
	5853	19. 251	......	45. 0		31 53. 70	− 0 02. 39	−13.36	......	36 95
	5937	22. 110	21. 5	15. 3						
	5962	12. 543	20. 4	16. 6		37 44. 18	− 6 08. 79	+2. 32	......	37. 71
	6082	25. 237	17. 8	20. 2						
	6109	12. 113	26. 0	12. 5		23 11. 54	+ 8 25. 91	+2. 57	......	40. 02
	6203	19. 336	19. 0	19. 0						
	6218	21. 820	23. 9	14. 4		30 00. 38	+ 1 35. 75	+2. 20	......	38. 33
	6311	22. 863	28. 2	10. 0						
	6322	18. 522	15. 8	22. 3		34 21. 34	− 2 47. 34	+2. 71	......	36. 71
	6470	20. 892	37. 0	2. 0	(*)					
	6491	20. 412	14. 8	24. 0	(*)	31 52. 57	− 0 18. 50	+0. 63	+0. 35	35. 05
	6520	8. 890	23. 0	16. 0						
	6556	27. 576	24. 3	14. 5		19 34. 50	+12 00. 31	+3. 89	......	38. 70
	6650	26. 961	37. 0	2. 0						
	6772	9. 918	3. 7	30. 0		42 34. 36	−10 57. 02	+0. 63	......	37. 97
June 16.	5131	31. 121	21. 2	24. 6						
	5181	11. 179	30. 5	16. 0		18 49. 90	+12 48. 72	+2. 57	......	41. 19
	5248	20. 642	26. 8	20. 0						
	5302	22. 533	21. 9	25. 3		30 23. 40	+ 1 12. 90	+0. 79	......	37. 09
	5321	10. 052	23. 0	24. 1						
	5341	29. 801	27. 2	20. 1		44 18. 06	−12 41. 29	+1. 38	......	38. 15
	5473	15. 698	22. 5	24. 4						
	5503	22. 205	34. 2	14. 5		35 46. 09	− 4 10. 83	+4. 12	......	39. 38
	5596	27. 320	33. 6	15. 1	(*)					
	5619	8. 721	19. 0	29. 5	(*)	43 30. 31	−11 56. 96	+1. 85	+0. 24	35. 44
	5643	17. 850	26. 0	22. 8						
	5703	22. 931	26. 2	23. 0		28 19. 99	+ 3 15. 87	+1. 48	......	37. 34
	5747	27. 570	22. 0	27. 2						
	5776	12. 510	36. 8	13. 0		41 21 56. 35	+ 9 40. 54	+4. 31	......	41 31 41. 20

* Off line of collimation.

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level N.	Level S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
June 16.	5842	18.708	22.9	37.0						
	5853	19.248	34.0	16.0	Through clouds; faint.	41 31 54.84	− 0 20.81	+0.90	......	41 31 34.93
	5937	22.158	39.0	11.0						
	5962	12.517	17.2	33.0		37 45.32	− 6 11.64	+2.82	......	36.50
June 17.	4804	33.764	24.1	16.0						
	4820	12.550	16.3	23.9		45 15.66	−13 37.76	+0.12	......	38.02
	4917	11.593	20.2	20.0						
	4961	27.902	16.7	24.1		21 11.08	+10 28.68	−1.67	......	38.09
	5033	13.567	24.0	17.7						
	5076	30.978	15.9	26.2		20 28.44	+11 11.15	−0.93	......	38.66
	5131	29.772	19.0	23.5						
	5181	9.830	24.1	18.3		18 50.12	+12 48.72	+0.30	......	39.14
	5248	20.557	24.1	19.0						
	5302	22.515	16.0	27.3		30 23.63	+ 1 15.48	−1.44	......	37.67
	5321	9.981	19.0	24.0						
	5341	29.722	24.1	19.0		44 18.30	−12 40.98	+0.02	......	37.34
	5434	9.108	21.9	21.4						
	5459	30.087	23.0	20.6	(*)	45 04.94	−13 28.71	+0.67	+0.22	37.12
	5473	14.120	16.5	27.3	(*)					
	5503	20.668	30.5	13.5	Very faint.	35 46.35	− 4 10.49	+1.44	+0.14	37.44
	5541	15.673	22.8	21.3						
	5549	25.628	25.3	18.9		38 00.52	− 6 23.75	+1.82	......	38.59
	5596	28.153	22.3	21.9						
	5619	9.599	26.4	18.0		43 30.58	−11 55.22	+2.03	......	37.39
	5643	18.185	29.8	14.9						
	5703	23.304	17.5	27.4		28 20.25	+ 3 17.33	+1.16	......	38.74
	5747	28.320	20.9	24.0						
	5776	13.231	27.2	18.2		21 56.62	+ 9 41.65	+1.37	......	39.64
	5842	19.510	17.8	28.0						
	5853	20.005	32.0	14.0		31 55.12	− 0 19.08	+1.81	......	37.85
	5871	21.800	25.1	20.8						
	5895	4.182	21.9	24.2		42 53.78	−11 19.14	+0.46	......	35.70
	5937	22.510	24.3	22.0						
	5962	12.921	27.6	19.6		37 45.61	− 6 09.64	+2.38	......	38.35
	6082	24.645	26.0	21.5						
	6109	11.587	27.0	20.3		23 13.04	+ 8 23.36	+2.59	......	38.99
	6203	19.680	30.2	18.0						
	6218	22.109	22.9	24.3		41 30 01.91	+ 1 33.63	+2.50	......	41 31 38.04

* Off line of collimation.

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
June 17.	6311	22.317	39.0	9.3						
	6322	17.950	15.9	32.7		41 34 22.80	− 2 48.34	+2.99	......	41 31 37.45
	6470	19.932	41.0	8.9						
	6491	19.423	19.2	30.7		31 54.10	− 0 19.62	+4.77	......	39.25
	6520	9.170	34.3	15.3						
	6556	27.870	19.1	30.8		19 36.04	+12 00.85	+1.69	......	38.58
	6650	27.803	34.5	15.8						
	6772	10.637	19.0	31.0		42 35.70	−11 01.76	+1.55	......	35.49
June 20.	5842	20.193	25.9	22.8						
	5853	20.711	25.8	23.0		31 55.96	− 0 19.96	+1.37	......	37.37
	5871	23.611	25.5	23.3						
	5895	5.932	30.8	18.0		42 54.64	−11 21.49	+3.47	......	36.62
	5937	23.398	33.3	15.9						
	5962	13.753	26.7	22.9		37 46.46	− 6 11.80	+4.91	......	39.57
	6082	25.463	23.0	27.0						
	6109	12.382	31.5	19.0		23 13.94	+ 8 24.25	+1.97	......	40.16
	6203	18.347	28.0	23.5						
	6218	20.785	30.2	21.0		30 02.82	+ 1 33.98	+3.17	......	39.97
	6311	22.192	36.0	15.8						
	6322	17.839	22.0	30.0		34 23.68	− 2 47.80	+2.82	......	38.70
	6470	20.023	36.8	16.5						
	6491	19.523	26.2	26.8		31 55.02	− 0 19.27	+4.56	......	40.31
	6520	10.263	40.7	12.6						
	6556	28.923	19.0	34.2		19 36.96	+11 59.31	+2.80	......	39.07
	6650	27.227	34.4	19.1						
	6772	10.063	27.0	27.0		42 36.52	−11 01.68	+3.54	......	38.38
June 21.	5248	20.206	24.5	19.1						
	5302	22.083	20.8	23.0		30 24.51	+ 1 12.34	+0.74	......	37.59
	5321	10.200	22.0	21.3						
	5341	29.937	20.1	23.4		44 19.22	−12 40.82	−0.51	......	37.89
	5434	9.191	23.3	20.1						
	5459	30.190	23.0	20.9		45 05.87	−13 25.63	+1.27	......	41.51
	5473	15.655	19.1	24.5						
	5503	22.212	33.0	10.4	Very faint.	35 47.34	− 4 12.76	+3.77	......	38.35
	5541	16.270	19.0	24.7						
	5549	26.300	31.3	12.7		38 01.52	− 6 26.64	+2.93	......	37.81
	5596	27.300	24.2	20.0						
	5619	8.688	24.2	20.1		41 43 31.61	−11 57.46	+1.92	......	41 31 36.07

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
June 21	5643	17.947	25.5	19.0						
	5703	22.974	22.0	23.0		41 28 21.28	+ 3 13.79	+1.27	......	41 31 36.34
	5747	28.564	21.0	24.0						
	5776	13.572	32.0	13.0		21 57.71	+ 9 37.92	+3.70	......	39.33
	5842	19.973	20.0	24.7						
	5853	20.552	34.7	10.9		31 56.24	− 0 22.31	+4.63	......	38.56
	5871	22.381	23.0	21.3						
	5895	4.649	29.1	14.8		42 54.92	−11 23.53	+3.70	......	35.09
	5937	24.107	31.6	12.2						
	5962	14.403	25.5	18.0		37 46.75	− 6 14.07	+6.23	......	38.91
	6470	20.231	39.0	14.9						
	6491	19.632	23.9	29.7		31 55.32	− 0 23.09	+4.24	......	36.47
June 22.	5033	8.273	30.7	25.0						
	5076	25.619	25.0	31.0		20 29.44	+11 08.65	−0.07	......	38.02
	5131	30.008	31.0	25.0						
	5181	10.121	28.7	27.6		18 51.18	+12 46.60	+1.64	......	39.42
June 24.	5434	7.684	26.0	21.7						
	5459	28.739	27.1	21.0		45 06.56	−13 31.64	+2.36	......	37.28
	5473	16.613	20.9	27.2						
	5503	23.223	37.0	11.3		35 48.06	− 4 14.80	+4.49	......	37.75
	5541	16.016	25.9	21.7						
	5549	26.073	31.0	12.0		38 02.26	− 6 27.68	+5.32	......	39.90
	5596	28.023	27.3	20.6						
	5619	9.383	26.9	21.1		43 32.37	−11 58.54	+2.89	......	36.72
	5643	17.042	33.5	14.6						
	5703	22.027	24.2	24.0		28 22.02	+ 3 12.17	+4.42	......	38.61
	5747	28.294	23.6	24.6						
	5776	13.355	34.5	14.9		21 58.51	+ 9 35.87	+4.31	......	38.69
	5871	24.283	17.3	31.3						
	5895	6.506	41.1	7.7		42 55.77	−11 25.27	+4.49	......	34.99
	5937	23.460	36.2	12.1						
	5962	13.763	23.2	25.0		37 47.60	− 6 13.80	+5.16	......	38.96
	6082	25.771	20.0	28.5						
	6109	11.739	39.0	9.9		23 15.12	+ 8 22.36	+4.77	......	42.25
	6203	19.403	31.1	17.8						
	6218	21.721	31.9	17.9		30 04.04	+ 1 29.35	+6.10	......	39.49
	6311	21.103	40.3	8.9						
	6322	16.616	19.0	29.9		41 34 24.84	− 2 52.96	+4.75	......	41 31 36.63

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
June 24.	6470	19.867	35.4	11.0						
	6491	19.285	24.0	23.0		41 31 56.25	− 0 22.43	+5.88	....	41 31 39.70
	6520	10.572	34.4	12.3						
	6556	29.148	25.7	21.3		19 38.20	+11 56.07	+6.13	....	40.40
	6650	28.091	27.0	22.0						
	6772	10.847	33.5	17.5		42 37.62	−11 04.77	+4.86	....	37.71
June 25.	4863	19.837	20.3	24.1						
	4881	18.684	41.7	3.3		30 45.76	+ 0 44.45	+8.01	....	38.22
	4917	12.035	36.2	9.5						
	4961	28.178	20.5	25.4		21 13.00	+10 22.28	+5.05	....	40.33
	5033	13.150	30.1	10.0						
	5076	30.405	15.8	31.0		20 30.56	+11 05.14	+2 52	....	38.22
	5131	30.311	25.3	21.2						
	5181	10.559	39.0	8.0		18 52.36	+12 41.40	+8.13	....	41.89
	5248	21.960	27.1	20.0						
	5302	23.711	29.8	17.2		30 25.97	+ 1 07.50	+4.56	....	38.03
	5321	10.271	23.0	24.3						
	5341	30.190	37.2	10.0		44 20.76	−12 47.84	+6.00	....	38.92
	5434	8.559	21.2	26.4						
	5459	29.691	40.1	7.9		45 07.44	−13 34.61	+6.25	....	39.08
	5473	16.000	15.9	32.0						
	5503	22.685	47.9	0.0		35 48.99	− 4 17.69	+7.36	....	38.66
	5596	28.659	0.0	48.5						
	5619	10.348	26.9	21.5		43 33.36	−11 45.86	−9.98	....	37.52
	5643	18.495	34.9	13.6						
	5703	23.486	15.1	32.9		28 23.00	+ 3 12.40	+0.81	....	36.21
	5747	29.106	24.7	24.0						
	5776	14.182	33.3	15.7		21 59.55	+ 9 35.29	+4.24	....	39.08
	5842	18.533	20.0	29.7						
	5853	19.136	39.0	10.8		31 58.14	− 0 23.23	+4.28	....	39.19
	5871	22.585	29.6	20.2						
	5895	5.117	28.0	22.3		42 56.89	−11 13.36	+3.50	....	47.03
	5937	22.971	35.6	15.0						
	5962	13.238	25.0	25.7		37 48.70	− 6 15.19	+4.61	....	38.12
	6082	25.423	19.0	32.3						
	6109	12.464	38.9	12.6		23 16.30	+ 8 19.55	+3.01	....	38.86
	6203	18.719	24.7	27.7						
	6218	21.005	29.0	23.0		41 30 05.24	+ 1 28.12	+0.69	....	41 31 34.05

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1873.		t.	d	d.		° ′ ″	′ ″	″	″	° ′ ″
June 25.	6311	21.755	31.0	21.4						
	6322	17.301	21.3	31.3		41 34 26.00	− 2 51.69	−0.09	....	41 31 34.22
June 27.	4741	13.136	26.9	19.0						
	4747	26.260	26.2	20.0		23 09.23	+ 8 25.90	+3.26	....	38.39
	4804	33.359	23.4	25.0						
	4820	12.063	27.3	21.3		45 17.18	−13 40.92	+1.02	....	37.28
	4863	20.703	23.9	25.4						
	4881	19.352	27.3	22.1		30 45.62	+ 0 52.08	+0.86	....	38.56
	4917	11.382	27.0	23.3						
	4961	27.653	19.8	31.6		21 12.84	+10 27.22	−1.88	....	38.18
	5033	12.263	24.2	28.3						
	5076	29.602	29.5	23.4		20 30.38	+11 08.38	+0.46	....	39.22
	5131	30.058	22.0	31.4						
	5181	10.158	30.4	24.0		18 52.17	+12 47.11	−0.69	....	38.59
	5321	9.788	28.0	27.3	(*)					
	5341	29.641	36.2	19.1		44 20.55	−12 45.30	+4.07	....	39.32
	5434	9.940	25.8	30.0						
	5459	31.007	37.0	19.0		45 07.22	−13 32.10	+3.20	....	38.32
	5473	15.461	26.3	29.8						
	5503	22.063	38.7	17.8		35 48.76	− 4 14.50	+3.93	....	38.19
	5541	16.523	28.0	29.0						
	5549	26.609	35.9	21.1		38 02.98	− 6 28.79	+3.20	......	37.39
	5596	29.107	24.0	33.0						
	5619	10.424	40.2	17.0		43 33.12	−12 00.19	+3.28	....	36.21
	5643	17.006	39.0	18.3						
	5703	22.006	21.0	36.8		28 22.76	+ 3 12.75	+1.13	....	36.64
	5747	28.234	29.0	29.0						
	5776	13.219	30.4	28.2		21 59.29	+ 9 38.79	+0.51	....	38.59
	5842	19.412	25.0	34.0						
	5853	19.910	33.5	25.5		31 57.88	− 0 19.19	−0.23	....	38.46
	5871	22.994	32.3	27.1						
	5895	5.349	26.0	33.4		42 56.61	−11 20.18	−0.51	....	35.92
	5937	23.739	25.2	34.8						
	5962	14.154	34.7	25.4		37 48.42	− 6 09.49	−0.02	....	38.91
	6082	24.688	26.3	34.1						
	6109	11.600	31.0	29.7		41 23 16.00	+ 8 24.52	−1.50	....	41 31 39.02

* The star observed seems to have been R. C.

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1873.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
June 27.	6203	19.611	31.6	29.8	(*)					
	6218	22.012	28.2	33.2	(*)	41 30 04.94	+ 1 32.55	−0.72	+0.11	41 31 36.88
	6311	22.496	26.0	35.6						
	6322	18.122	37.9	24.1		34 25.71	− 2 48.61	+0.97	......	38.07
	6470	20.042	35.7	27.0						
	6491	19.503	31.9	30.4		31 57.18	− 0 20.77	+2.36	......	38.77
	6520	10.511	44.0	18.5						
	6556	29.080	25.7	36.8		19 39.14	+11 55.80	+3.33	......	38.27
	6650	27.544	32.1	31.0						
	6772	10.380	31.9	31.7		42 38.45	−11 01.68	+0.30	......	37.07
June 29.	4741	13.610	21.3	29.0						
	4747	26.791	30.3	20.0		23 09.49	+ 8 28.10	+0.66	......	38.25
	4804	32.807	30.9	21.8	(*)					
	4820	11.505	22.0	30.9		45 17.44	−13 41.15	+0.05	......	36.34
	4863	21.257	20.0	33.2						
	4881	19.870	30.2	23.2		30 45.90	+ 0 53.46	−1.44	......	37.92
	4917	10.888	26.0	28.6						
	4961	27.160	22.6	32.8		21 13.16	+10 27.26	−2.96	......	37.46
	5033	11.957	25.8	29.8						
	5076	29.327	30.2	25.3		20 30.74	+11 09.57	+0.21	......	40.52
	5131	30.165	22.6	33.5						
	5181	10.249	31.9	24.9		18 52.54	+12 47.72	−0.90	......	39.36
	5248	20.107	28.7	28.3						
	5302	22.012	22.9	24.1	Probably 10 d. error.	30 26.16	+ 1 13.44	−0.19	......	39.41
	5321	9.743	27.0	30.0						
	5341	29.490	25.4	31.6	(*)	44 20.97	−12 41.21	−0.53	......	39.23
	5434	7.771	26.1	30.9						
	5459	28.750	26.2	31.0		45 07.66	−13 28.71	−2.22	......	36.73
	5541	15.810	27.1	30.1						
	5549	25.750	26.6	31.0		38 03.46	− 6 23.17	−1.71	......	38.58
	5596	27.975	30.0	28.0						
	5619	9.409	24.4	34.2		40 33.60	−11 55.69	−1.81	......	36.10
	5643	16.476	26.7	32.3						
	5703	21.562	29.9	29.9		28 23.24	+ 3 16.06	−1.30	......	38.00
	5747	27.246	23.1	36.6						
	5776	12.187	32.9	27.2		21 59.81	+ 9 40.49	−1.81	......	38.49
	5842	19.062	26.8	33.5						
	5853	19.602	34.0	26.4		41 31 58.42	− 0 20.81	+0.21	......	41 31 37.82

* Observed off line of collimation.

Observations and computations—Continued.

GREEN RIVER STATION, WYOMING.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
		t.	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
1873. June 29.	5871	23.297	33.3	27.1						
	5895	5.613	23.8	37.0	(*)	41 42 57.17	—11 21.68	—1.62	+0.33	41 31 34.20
	5937	23.595	31.5	29.6						
	5962	13.946	28.0	33.3		37 48.98	— 6 11.95	—0.79	....	36.24
	6082	25.540	29.1	33.3						
	6109	12.477	30.6	32.1		23 16.58	+ 8 23.56	—1.32	....	38.82
	6203	19.998	35.0	28.5						
	6218	21.392	26.3	37.3		30 05.54	+ 1 32.28	—1.04	....	36.78
	6311	21.253	32.8	31.0						
	6322	16.880	29.9	34.1		34 26.29	— 2 48.57	—0.56	....	37.16

* Observed off line of collimation.

Discussion of latitude of Green River.

No. of pair.	No. of observations.	Mean of latitudes.	Corrections to micrometer corrections.	Corrected latitude.
		° ′ ″	″	″
1	2	41 31 38.32	—0.60	37.72
2	4	37.20	+0.98	38.18
3	4	38.53	—0.06	38.47
4	5	38.61	—0.76	37.85
5	6	38.78	—0.80	37.98
6	7	39.76	—0.92	38.84
7	7	37.85	—0.09	37.76
8	8	38.48	+0.91	39.39
9	7	38.18	+0.97	39.15
10	8	38.07	+0.30	38.37
11	7	38.03	+0.46	38.49
12	8	36.85	+0.86	37.71
13	8	37.61	—0.23	37.38
14	10	39.11	—0.70	38.41
15	10	37.68	+0.02	37.70
16	7	35.44	+0.81	36.25
17	12	37.92	+0.45	38.37
18	10	39.76	—0.60	39.16
19	9	37.83	—0.12	37.71
20	10	37.14	+0.20	37.34
21	8	38.57	+0.02	38.53
22	8	38.84	—0.86	37.98
23	8	37.28	+0.79	38.07

Mean latitude .... 41° 31′ 38″.12
Sum of errors .... 12″.03
Probable error of one pair .... ±0″.452
Sum of squares .... 18″.48
Probable error of one pair .... ±0″.464
Probable error of final result from sum of errors .... ±0″.084
Probable error of final result from sum of squares .... ±0″.097

The pairs observed a greater number of times do not seem more accurate.

A correction indicated by the observations of —0″.072 for every minute in the micrometer-corrections, or —0″.0925 for every revolution, has been applied in the final result.

ASTRONOMICAL CO-ORDINATES OF GREEN RIVER, WYOMING.

Longitude .... $7^h\ 17^m\ 52^s.438 \pm 0^s.027$ or 109° 28′ 06″.57 ± 0″.40 west from Greenwich.
$2^h\ 09^m\ 40^s.312 \pm 0^s.027$ or 32° 25′ 04″.77 west from U. S. Naval Observatory, Washington, D. C.

Latitude .... 41° 31′ 38″.12 ± 0″.10 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY W. W. MARYATT AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF STATION AT WINNEMUCCA, NEVADA.

SEASON OF 1873.

COMPUTATIONS BY

PROF. T. H. SAFFORD AND JOHN H. CLARK.

WINNEMUCCA, NEVADA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, ...	117° 43′ 54″.16 ± 0″.22	west from Greenwich.
"	40° 40′ 52″.36	west from U. S. Naval Observatory, Washington, D. C.
Latitude, ...	40° 58′ 19″.97 ± 0″.17 north.	

Barometric altitude of observatory above sea-level, 4355.0 feet.

Winnemucca, a station of the Union Pacific Railroad, is a flourishing settlement on Humboldt River, Nevada, situated in a sandy valley, which is surrounded in the distance by high hills. The astronomical monument was located in the northeastern part of the town, in an open lot, on a small elevation, which lifted it into full view of the river and the railroad. It was connected by triangulation with seventeen prominent points of the neighboring mountains, and also by direct measurement with numerous objects in the town. Its position is 527 feet due west of the railroad-track, 1,538 feet from the depot, 507 feet from the mill, and 687 feet from the school-house.

The meteorological conditions at this place were very favorable for astronomical observations. With few exceptions, the weather continued clear. During the fourteen days of time-exchanges, there were but four cloudy nights at Winnemucca and one at Salt Lake City, while on four other nights the wires failed, leaving for the exchange of signals five days, July 11, 16, 18, 24, 25, and 26. The wind was moderate, and its general direction was northeast and southwest.

For a description of the observatory, instruments, and instrumentalities, see the report on the preceding station, Green River. The length of telegraphic circuit, by way of Ogden, at which point there was a repeater, was about 450 miles.

Observations for latitude at Winnemucca were made July 15, 16, 18, 19, 21, 23, 24, 25, 26, 27, 28, 29, and 30. W. W. Maryatt was observer here, and John H. Clark at Salt Lake City. All of Mr. Maryatt's observations were reduced by Prof. T. H. Safford; those of Mr. Clark were computed by himself.

Tabulation of stars used for determination of time at Winnemucca, Nevada, and Salt Lake City, Utah.

Name of star.	WINNEMUCCA.						SALT LAKE CITY.					
	July 11.	July 16.	July 18.	July 24.	July 25.	July 26.	July 11.	July 16.	July 18.	July 24.	July 25.	July 26.
α^2 Libræ			×									
β Ursæ Minoris		×	×									
β Bootis		×										
β Libræ		×	×		×							
μ Bootis		×										
γ Ursæ Minoris			×	×	×	×		×	×			
α Coronæ		×	×	×	×	×		×	×			
τ^6 Serpentis								×	×			
α Serpentis		×	×	×	×	×		×	×			
ϵ Serpentis		×	×	×	×	×		×	×			
ζ Ursæ Minoris		×	×	×	×	×						
ϵ Coronæ										×		×
δ Scorpii								×	×			
β^1 Scorpii		×	×		×	×		×	×	×		×
Groombr. 2320		×		×	×	×						
δ Ophiuchi								×	×	×	×	×
ϵ Ophiuchi				×								
τ Herculis				×	×	×		×	×	×	×	×
ω Herculis				×								
α Scorpii				×		×						
η Draconis								×	×	×	×	×
ζ Ophiuchi				×	×	×		×	×	×	×	×
η Herculis					×	×				×	×	×
Groombr. 2376										×	×	×
κ Ophiuchi	×									×	×	×
d Herculis	×									×	×	×
α^1 Herculis							×				×	
ν Serpentis							×				×	
π Herculis				×								
44 Ophiuchi	×	×		×								
β Draconis	×	×		×	×							
α Ophiuchi							×					
ω Draconis	×	×	×	×	×					×		
μ Herculis		×	×	×	×		×			×	×	
θ Herculis		×	×		×	×						
ψ_1 Draconis						×						
γ Draconis	×		×	×		×	×	×	×	×	×	
o Herculis	×	×	×	×	×	×						
72 Ophiuchi							×	×	×	×	×	×
μ^1 Sagittarii		×		×		×		×	×	×	×	×
δ Ursæ Minoris			×		×							
η Serpentis	×	×		×		×	×	×	×	×	×	×
109 Herculis		×	×	×		×						
Brad. 2313									×	×	×	×
1 Aquilæ	×	×	×			×	×	×	×	×	×	×
α Lyræ	×	×	×		×	×	×	×	×	×	×	×
ζ^1 Lyræ									×	×	×	×
ζ^2 Lyræ									×	×	×	×
β Lyræ	×	×	×		×	×	×	×	×			×
50 Draconis	×	×	×		×	×		×	×			×
ζ Aquilæ									×			
δ Draconis	×											
β Cygni	×											

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, JULY 11, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	α^1 Herculis	9 01 45.33	— 0.93	+ 0.04	— 0.08	9 01 44.36	17 08 53.39	+8 07 09.03
W.	ν Serpentis	06 35.85	— 1.66	+ 0.02	— 0.08	06 34.13	13 43.22	09.09
W.	α Ophiuchi	21 56.35	— 0.91	+ 0.01	— 0.08	21 55.37	29 04.39	09.02
W.	μ Herculis	34 22.88	— 0.51	— 0.03	— 0.09	34 22.25	41 31.39	09.14
W.	γ Draconis	46 32.39	+ 0.61	+ 0.05	— 0.13	46 32.92	53 42.02	09.10
W.	72 Ophiuchi	54 13.82	— 1.08	+ 0.07	— 0.08	54 12.73	18 01 21.80	09.07
E.	η Serpentis	10 07 38.60	— 1.40	+ 0.03	+ 0.08	10 07 37.31	14 46.41	09.10
E.	1 Aquilæ	21 12.27	— 1.54	+ 0.03	+ 0.08	21 10.84	28 19.95	09.11
E.	α Lyræ	25 31.30	— 0.10	+ 0.10	+ 0.10	25 31.40	32 40.54	09.14
E.	β Lyræ	38 16.77	— 0.32	+ 0.13	+ 0.10	38 16.68	45 25.62	+8 07 08.94
	Mean at 18h local sidereal time							+8 07 09.07

NORMAL EQUATIONS.

$$+10.00\,\delta t + 3.87\,a - 2.34\,c = -7.28 \qquad \delta t = +0^s.07$$
$$+3.87\,\delta t + 2.60\,a - 0.39\,c = -5.01 \qquad a = -2^s.026$$
$$-2.34\,\delta t - 0.39\,a + 13.19\,c = +1.65 \qquad c = +0^s.079$$

SALT LAKE CITY, UTAH, JULY 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	γ Ursæ Minoris	7 13 49.55	+ 3.06	— 0.03	+ 0.39	7 13 52.97	15 20 59.52	+8 07 06.55
E.	α Coronæ	22 13.96	— 0.48	+ 0.02	+ 0.13	22 13.63	29 20.30	06.67
E.	τ^6 Serpentis	28 04.44	— 0.77	+ 0.03	+ 0.12	28 03.82	35 10.46	06.64
E.	α Serpentis	30 56.64	— 1.00	+ 0.02	+ 0.12	30 55.78	38 02.41	06.63
E.	ε Serpentis	37 25.17	— 1.05	+ 0.02	+ 0.12	37 24.26	44 30.86	06.60
W.	δ Scorpii	45 46.62	— 1.71	+ 0.03	— 0.13	45 44.81	52 51.41	06.60
W.	β^1 Scorpii	51 00.20	— 1.64	+ 0.03	— 0.13	50 58.46	58 05.08	06.62
W.	δ Ophiuchi	8 00 37.96	— 1.25	+ 0.04	— 0.12	8 00 36.63	16 07 43.25	06.62
W.	τ Herculis	08 50.59	+ 0.27	+ 0.10	— 0.17	08 50.79	15 57.31	06.52
W.	η Draconis	15 11.12	+ 1.35	+ 0.16	— 0.25	15 12.38	22 19.03	06.65
W.	ζ Ophiuchi	23 06.78	— 1.41	+ 0.06	— 0.12	23 05.31	30 11.95	+8 07 06.64
	Mean at 16h local sidereal time							+8 07 06.63

NORMAL EQUATIONS.

$$+11.00\,\delta t + 2.59\,a - 0.28\,c = -8.97 \qquad \delta t = -0^s.37$$
$$+2.59\,\delta t + 7.34\,a - 5.44\,c = -14.63 \qquad a = -1^s.780$$
$$-0.28\,\delta t - 5.44\,a + 26.11\,c = +12.85 \qquad c = +0^s.118$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	γ Draconis	9 46 35.05	+ 0.50	— 0.05	— 0.20	9 46 35.30	17 53 41.97	+8 07 06.67
W.	72 Ophiuchi	54 16.44	— 0.89	— 0.03	— 0.12	54 15.40	18 01 21.80	06.40
W.	μ^1 Sagittarii	59 07.70	— 1.60	— 0.02	— 0.13	59 05.95	06 12.51	06.56
W.	η Serpentis	10 07 41.17	— 1.16	— 0.01	— 0.12	10 07 39.88	14 46.43	06.55
E.	1 Aquilæ	21 14.70	— 1.28	— 0.01	+ 0.12	21 13.53	28 19.98	06.45
E.	α Lyræ	25 33.74	— 0.08	— 0.01	+ 0.15	25 33.80	32 40.53	06.73
E.	β Lyræ	38 18.99	— 0.27	+ 0.03	+ 0.14	38 18.89	45 25.64	06.75
E.	50 Draconis	43 20.78	+ 3.75	+ 0.25	+ 0.48	43 25.26	50 31.76	+8 07 06.50
	Mean at 18h local sidereal time							+8 07 06.58

NORMAL EQUATIONS.

$$+8.00\,\delta t + 0.61\,a + 2.73\,c = -4.10 \qquad \delta t = -0^s.42$$
$$+0.61\,\delta t + 7.33\,a - 9.55\,c = -13.78 \qquad a = -1^s.690$$
$$+2.73\,\delta t + 9.55\,a + 25.39\,c = +18.00 \qquad c = +0^s.116$$

SALT LAKE CITY, UTAH, JULY 18, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	γ Ursæ Minoris	7 13 50.18	+ 3.18	— 0.03	+ 0.36	7 13 53.69	15 20 59.34	+8 07 05.65
E.	α Coronæ	22 14.81	— 0.50	— 0.01	+ 0.12	22 14.42	29 20.27	05.85
E.	τ^6 Serpentis	28 05.39	— 0.80	— 0.00	+ 0.11	28 04.70	35 10.44	05.74
E.	α Serpentis	30 57.57	— 1.04	+ 0.01	+ 0.11	30 56.65	38 02.39	05.74
E.	ε Serpentis	37 26.07	— 1.09	+ 0.01	+ 0.11	37 25.10	44 30.84	05.74
W.	δ Scorpii	45 47.62	— 1.78	+ 0.01	— 0.12	45 45.73	52 51.40	05.67
W.	β^1 Scorpii	51 01.18	— 1.70	+ 0.02	— 0.12	50 59.38	58 05.07	05.69
W.	δ Ophiuchi	8 00 38.96	— 1.30	+ 0.01	— 0.11	8 00 37.56	16 07 43.24	05.68
W.	τ Herculis	08 51.65	+ 0.28	+ 0.03	— 0.16	08 51.80	15 57.28	05.48
W.	η Draconis	15 11.87	+ 0.41	+ 0.04	— 0.23	15 12.09	22 18.97	05.88
W.	ζ Ophiuchi	23 07.71	— 1.46	+ 0.01	— 0.11	23 06.15	30 11.94	+8 07 05.79
	Mean at 16h.0 local sidereal time							+8 07 05.72

NORMAL EQUATIONS.

$$+11.00\,\delta t + 2.59\,a - 0.28\,c = -7.93 \qquad \delta t = -0^s.28$$
$$+2.59\,\delta t + 7.35\,a - 5.45\,c = -14.91 \qquad a = -1^s.850$$
$$-0.28\,\delta t - 5.45\,a + 26.11\,c = +13.02 \qquad c = +0^s.109$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 18, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	γ Draconis	9 46 35.72	+ 0.56	+ 0.08	− 0.22	9 46 36.14	17 53 41.95	+ 8 07 05.81
W.	72 Ophiuchi	54 17.18	− 0.99	+ 0.04	− 0.14	54 16.09	18 01 21.81	05.72
W.	μ^1 Sagittarii	59 08.80	− 1.79	+ 0.02	− 0.15	59 06.88	06 12.52	05.64
W.	η Serpentis	10 07 42.16	− 1.28	+ 0.02	− 0.14	10 07 40.76	14 46.44	05.68
W.	Brad. 2313	14 55.88	− 1.58	+ 0.01	− 0.14	14 54.17	21 59.87	05.70
E.	1 Aquilæ	21 15.52	− 1.41	− 0.01	+ 0.14	21 14.24	28 19.99	05.75
E.	α Lyræ	25 34.76	− 0.09	− 0.06	+ 0.18	25 34.79	32 40.53	05.74
E.	ζ_1 Lyræ	33 20.26	− 0.13	− 0.06	+ 0.18	33 20.25	40 26.13	05.88
E.	ζ_2 Lyræ	33 22.20	− 0.13	− 0.06	+ 0.18	33 22.19	40 27.98	05.79
E.	β Lyræ	38 20.00	− 0.30	− 0.07	+ 0.17	38 19.80	45 25.64	05.84
E.	50 Draconis	43 21.56	+ 4.15	− 0.22	+ 0.54	43 26.03	50 31.69	05.66
E.	ζ Aquilæ	52 31.52	− 0.87	− 0.06	+ 0.14	52 30.73	59 36.47	+ 8 07 05.74
	Mean at $18^h.5$ local sidereal time							+ 8 07 05.75

NORMAL EQUATIONS.

$$+ 12.00\,\delta t + 2.07\,a + 5.25\,c = - 6.17 \qquad \delta t = - 0^s.25$$
$$+ 2.07\,\delta t + 8.27\,a - 9.80\,c = - 17.29 \qquad a = - 1^s.864$$
$$+ 5.25\,\delta t - 9.80\,a + 30.69\,c = + 21.22 \qquad c = + 0^s.138$$

SALT LAKE CITY, UTAH, JULY 24, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	ε Coronæ	7 45 15.92	− 0.49	− 0.07	− 0.11	7 45 15.25	15 52 21.51	+ 8 07 06.26
W.	β^1 Scorpii	51 00.80	− 1.74	− 0.03	− 0.11	50 58.92	58 05.02	06.10
W.	δ Ophiuchi	8 00 38.44	− 1.32	− 0.02	− 0.10	8 00 37.00	16 07 43.19	06.19
W.	τ Herculis	08 50.91	+ 0.28	− 0.03	− 0.15	08 51.01	15 57.16	06.15
W.	η Draconis	15 11.37	+ 1.44	− 0.05	− 0.21	15 12.55	22 18.77	06.22
E.	ζ Ophiuchi	23 07.00	+ 1.49	+ 0.01	+ 0.10	23 05.62	30 11.89	06.27
E.	η Herculis	31 28.01	− 0.08	+ 0.02	+ 0.13	31 28.08	38 34.42	06.34
E.	Groombr. 2376	36 11.55	+ 0.08	+ 0.04	+ 0.14	36 11.81	43 17.88	06.07
E.	κ Ophiuchi	44 35.90	− 1.00	+ 0.04	+ 0.10	44 35.04	51 41.25	06.21
E.	d Herculis	49 50.80	− 0.28	+ 0.04	+ 0.12	49 50.68	56 56.81	+ 8 07 06.13
	Mean at $16^h.5$ local sidereal time							+ 8 07 06.19

NORMAL EQUATIONS.

$$+ 10.00\,\delta t + 2.44\,a - 0.89\,c = - 2.75 \qquad \delta t = + 0^s.19$$
$$+ 2.44\,\delta t + 2.92\,a + 1.39\,c = - 4.94 \qquad a = - 1^s.890$$
$$- 0.89\,\delta t + 1.39\,a + 17.02\,c = - 1.00 \qquad c = + 0^s.104$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 24, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	ω Draconis	9 30 35.55	+ 2.40	+ 0.17	+ 0.43	9 30 38.55	17 37 44.79	+8 07 06.24
E.	μ Herculis	34 25.34	− 0.46	+ 0.08	+ 0.18	34 25.14	41 31.33	06.19
E.	γ Draconis	46 34.71	+ 0.55	+ 0.08	+ 0.25	46 35.59	53 41.87	06.28
E.	72 Ophiuchi	54 16.34	− 0.98	+ 0.02	+ 0.16	54 15.54	18 01 21.83	06.29
W.	μ^1 Sagittarii	59 08.15	− 1.76	+ 0.04	− 0.17	59 06.26	06 12.52	06.26
W.	η Serpentis	10 07 41.59	− 1.28	+ 0.05	− 0.16	10 07 40.20	14 46.44	06.24
W.	Brad. 2313	14 55.38	− 1.57	+ 0.04	− 0.16	14 53.69	21 59.89	06.20
W.	1 Aquilæ	21 15.23	− 1.41	+ 0.03	− 0.16	21 13.69	28 19.99	06.30
W.	α Lyræ	25 34.38	− 0.09	+ 0.06	− 0.20	25 34.15	32 40.45	06.30
W.	ζ^1 Lyræ	33 20.18	− 0.13	+ 0.06	− 0.20	33 19.91	40 26.11	06.20
W.	ζ^2 Lyræ	33 21.94	− 0.13	+ 0.06	− 0.20	10 33 21.67	18 40 27.96	+8 07 06.29
	Mean at 18h local sidereal time							+8 07 06.25

NORMAL EQUATIONS.

$$-11.00\,\delta t + 2.60\,a + 1.40\,c = -2.30 \qquad \delta t = +0^s.25$$
$$+2.60\,\delta t + 4.81\,a - 6.84\,c = -9.31 \qquad a = -1^s.850$$
$$-1.40\,\delta t - 6.84\,a + 21.61\,c = +15.66 \qquad c = +0^s.155$$

SALT LAKE CITY, UTAH, JULY 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	δ Ophiuchi	8 00 38.37	− 1.30	− 0.03	− 0.12	8 00 36.92	16 07 43.18	+8 07 06.26
W.	τ Herculis	08 51.00	+ 0.28	− 0.07	− 0.18	08 51.03	15 57.13	06.10
W.	η Draconis	15 11.39	+ 1.41	− 0.13	− 0.25	15 12.42	22 18.74	06.32
W.	ζ Ophiuchi	23 07.27	− 1.46	− 0.05	− 0.12	23 05.64	30 11.88	06.24
E.	η Herculis	31 28.04	− 0.07	+ 0.01	+ 0.15	31 28.13	38 34.40	06.27
E.	Groombr. 2376	36 11.28	+ 0.07	+ 0.01	+ 0.16	36 11.52	43 17.87	06.35
E.	κ Ophiuchi	44 35.80	− 0.98	+ 0.01	+ 0.12	44 34.95	51 41.24	06.29
E.	d Herculis	49 50.92	− 0.98	+ 0.01	+ 0.14	49 50.79	56 56.80	06.01
E.	a^1 Herculis	9 01 47.80	− 0.85	0.00	+ 0.12	9 01 47.07	17 08 53.32	06.25
E.	ν Serpentis	10 06 38.38	− 1.52	0.00	+ 0.12	06 36.98	13 43.19	+8 07 06.21
	Mean at 16h.5 local sidereal time							+8 07 06.23

NORMAL EQUATIONS.

$$+10.00\,\delta t + 2.54\,a + 1.32\,c = -2.26 \qquad \delta t = +0^s.23$$
$$+2.54\,\delta t + 2.89\,a + 2.36\,c = -4.55 \qquad a = -1^s.855$$
$$+1.32\,\delta t + 2.36\,a + 16.74\,c = -2.12 \qquad c = +0^s.117$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 25, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	μ. Herculis	9 34 25.36	— 0.45	— 0.01	+ 0.18	9 34 25.08	17 41 31.32	+8 07 06.24
E.	γ Draconis	46 34.94	+ 0.54	— 0.01	+ 0.26	46 35.73	53 41.85	06.12
E.	72 Ophiuchi	54 16.32	— 0.95	+ 0.01	+ 0.16	54 15.54	18 01 21.83	06.29
E.	μ^1 Sagittarii	59 07.87	— 1.70	+ 0.01	+ 0.17	59 06.35	06 12.51	06.16
W.	η Serpentis	10 07 41.73	— 1.24	+ 0.03	— 0.16	10 07 40.36	14 46.43	06.07
W.	Bradl. 2313	14 55.34	— 1.52	+ 0.04	— 0.17	14 53.69	21 59.89	06.20
W.	1 Aquilæ	21 15.33	— 1.36	+ 0.05	— 0.16	21 13.86	28 20.00	06.14
W.	α Lyræ	25 34.40	— 0.09	+ 0.07	— 0.21	25 34.17	32 40.50	06.33
W.	ζ^1 Lyræ	33 20.18	— 0.12	+ 0.06	— 0.21	33 19.91	40 26.10	06.19
W.	ζ^2 Lyræ	10 33 22.06	— 0.12	+ 0.06	— 0.21	10 33 21.79	18 40 27.96	+8 07 06.17
	Mean at $18^h.0$ local sidereal time							+8 07 06.19

NORMAL EQUATIONS.

$$+10.00\,\delta t + 3.92\,a - 2.03\,c = -5.45 \qquad \delta t = +0^s.19$$
$$+3.92\,\delta t + 3.12\,a - 1.21\,c = -5.10 \qquad a = -1^s.790$$
$$-2.03\,\delta t - 1.21\,a + 13.94\,c = +4.07 \qquad c = +0^s.163$$

SALT LAKE CITY, UTAH, JULY 26, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	ε Coronæ	7 45 16.02	— 0.46	— 0.05	— 0.19	7 45 15.32	15 52 21.48	+8 07 06.16
W.	β^1 Scorpii	51 00.74	— 1.62	— 0.03	— 0.18	51 58.91	58 05.00	06.09
W.	δ Ophiuchi	8 00 38.64	— 1.23	— 0.07	— 0.17	8 06 37.17	16 07 43.17	06.00
W.	τ Herculis	08 51.29	+ 0.26	— 0.17	— 0.25	08 51.13	15 57.11	05.98
E.	η Draconis	15 11.09	+ 1.34	— 0.22	+ 0.36	15 12.57	22 18.69	06.12
E.	ζ Ophiuchi	23 07.10	— 1.39	— 0.08	+ 0.18	23 05.81	30 11.87	06.06
E.	η Herculis	31 28.31	— 0.07	— 0.14	+ 0.22	31 28.32	38 34.40	06.08
E.	Groombr. 2376	36 11.67	+ 0.07	— 0.13	+ 0.23	36 11.84	43 17.86	06.02
E.	κ Ophiuchi	44 36.03	— 0.93	— 0.09	+ 0.17	44 35.18	51 41.25	06.07
E.	d Herculis	8 49 51.12	— 0.26	— 0.12	+ 0.20	8 49 50.94	16 56 56.78	+8 07 05.84
	Mean at $15^h.5$ local sidereal time							+8 07 06.04

NORMAL EQUATIONS.

$$+10.00\,\delta t + 2.44\,a + 3.35\,c = -3.30 \qquad \delta t = +0^s.04$$
$$+2.44\,\delta t + 2.92\,a - 1.81\,c = -5.37 \qquad a = -1^s.760$$
$$+3.35\,\delta t - 1.81\,a + 17.01\,c = +6.24 \qquad c = +0^s.172$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 26, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	72 Ophiuchi	9 54 16.55	— 0.84	— 0.10	+ 0.08	9 54 15.69	18 01 21.84	+8 07 06.15
E.	μ^1 Sagittarii	59 08.02	— 1.51	— 0.05	+ 0.08	59 06.54	06 12.51	05.97
E.	η Serpentis	10 07 41.46	— 1.10	— 0.04	+ 0.08	10 07 40.40	14 46.43	06.03
E.	Brad. 2313	14 55.19	— 1.35	— 0.02	+ 0.08	14 53.90	21 59.89	05.99
E.	1 Aquilæ	21 15.17	— 1.21	— 0.02	+ 0.08	21 14.02	28 20.00	05.98
W.	α Lyræ	25 34.44	— 0.08	+ 0.03	— 0.10	25 34.29	32 40.50	06.21
W.	ζ^1 Lyræ	33 20.24	— 0.11	+ 0.04	— 0.10	33 20.07	40 26.10	06.03
W.	ζ^2 Lyræ	33 22.15	— 0.11	+ 0.06	— 0.10	33 22.00	40 27.95	05.95
W.	β Lyræ	38 19.89	— 0.25	+ 0.07	— 0.09	38 19.62	45 25.62	06.00
W.	50 Draconis	43 21.91	+ 3.55	+ 0.24	— 0.30	10 43 25.40	18 50 31.40	+8 07 06.00
	Mean at $18^h.5$ local sidereal time							+8 07 06.03

NORMAL EQUATIONS.

$$
\begin{aligned}
+10.00\,\delta\ \ + 1.90\,a - \ \ 3.81\,c &= -\ \ 2.99 & \delta t &= +0^s.03\\
-\ \ 1.90\,\delta t + \ \ 7.96\,a + 12.27\,c &= -11.68 & a &= -1^s.590\\
-\ \ 3.81\,\delta t + 12.27\,a + 27.02\,c &= -17.55 & c &= +0^s.077
\end{aligned}
$$

Observations and reductions for time taken at sending station.

WINNEMUCCA, NEVADA, JULY 11, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
W.	κ Ophiuchi	16 51 56.98	+ 0.51	— 0.13	+ 0.03	16 51 57.39	16 51 41.31	— 16.08
W.	d Herculis	57 13.06	+ 0.14	— 0.20	+ 0.03	57 13.03	56 56.94	16.09
W.	44 Ophiuchi	17 18 54.48	+ 0.95	— 0.12	+ 0.03	17 18 55.34	17 18 39.21	16.13
W.	β Draconis	27 52.74	+ 0.31	— 0.44	+ 0.04	27 52.03	27 36.24	15.79
W.	ω Draconis	38 02.64	— 1.24	— 0.74	+ 0.07	38 00.73	37 45.16	15.57
E.	γ Draconis	53 58.60	— 0.28	— 0.45	— 0.04	53 57.83	53 41.92	15.91
E.	o Herculis	18 02 53.34	— 0.23	— 0.23	— 0.03	18 02 53.31	18 02 37.43	15.88
E.	η Serpentis	15 01 48	+ 0.67	— 0.09	— 0.03	15 02.03	14 46.47	15.56
E.	1 Aquilæ	28 35.14	+ 0.73	— 0.11	— 0.03	28 35.73	28 19.95	15.78
E.	α Lyræ	32 56.78	+ 0.05	— 0.23	— 0.03	32 56.57	32 40.55	16.02
E.	β Lyræ	45 41.80	+ 0.15	— 0.30	— 0.03	45 41.62	45 25.60	16.02
E.	50 Draconis	50 51.78	— 2.13	— 0.85	— 0.10	50 48.70	50 31.87	16.83
W.	δ Draconis	19 12 51.76	— 1.11	— 0.63	+ 0.07	19 12 50.09	19 12 34.44	15.65
W.	β Cygni	25 53.70	+ 0.25	— 0.30	+ 0.03	19 25 53.68	19 25 38.13	— 15.55

NORMAL EQUATIONS.

$$a_0 = +1^s.07 \qquad c_0 = -0^s.15 \qquad \triangle T_0 = -15^s.84$$

$$
\begin{aligned}
0 &= +0.344 + 3.090\,da + \ \ 0.926\,dc + 2.704\,d\triangle T & da &= -0^s.112 & \text{Weight of } a &= \ \ 2.17\\
0 &= -1.630 + 0.926\,da + 14.000\,dc + 0.388\,d\triangle T & dc &= +0^s.125 & c &= 13.69\\
0 &= +0.611 + 2.704\,da + \ \ 0.388\,dc + 8.437\,d\triangle T & d\triangle T &= -0^s.042 & \triangle T &= \ \ 6.06
\end{aligned}
$$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
W.	β Ursæ Minoris	14 51 21.42	+ 1.43	+ 0.02	+ 0.64	14 51 23.51	14 51 08.45	— 15.06
W.	β Bootis	57 25.86	0.00	+ 0.01	+ 0.23	57 26.10	57 11.28	14.82
W.	β Libræ	15 10 27.12	— 0.53	0.00	+ 0.17	15 10 26.76	15 10 11.97	14.79
W.	μ Bootis	19 57.84	— 0.05	0.00	+ 0.22	19 58.01	19 43.19	14.82
W.	α Coronæ	29 35.04	— 0.18	0.00	+ 0.19	29 35.05	29 20.29	14.76
E.	α Serpentis	38 17.86	— 0.39	0.00	— 0.17	38 17.30	38 02.42	14.88
E.	ε Serpentis	44 46.24	— 0.40	0.00	— 0.17	44 45.67	44 30.84	14.83
E.	ζ Ursæ Minoris	48 55.42	+ 2.01	— 0.02	— 0.83	48 56.58	48 42.09	14.49
E.	β¹ Scorpii	58 20.72	— 0.63	0.00	— 0.18	58 19.91	58 05.08	14.83
E.	Groombr. 2320	16 06 16.10	+ 0.84	— 0.01	— 0.53	16 06 16.40	16 06 01.59	— 14.81

NORMAL EQUATIONS.

$a_0 = -0^s.69 \quad c_0 = -0^s.05 \quad \triangle T_0 = -14^s.86 - 0^s.02\,(T - 16^h.8)$

$0 = -0.019 + 2.947\,da + 0.453\,dc + 2.536\,d\triangle T \qquad da = +0^s.008 \qquad$ Weight of $a = 1.86$
$0 = +1.209 + 0.453\,da + 10.000\,dc - 0.179\,d\triangle T \qquad dc = -0^s.120 \qquad c = 9.85$
$0 = -0.159 + 2.536\,da - 0.179\,dc + 6.082\,d\triangle T \qquad d\triangle T = +0^s.019 \qquad \triangle T = 3.87$

WINNEMUCCA, NEVADA, JULY 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
E.	44 Ophiuchi	17 18 54.96	— 0.81	0.00	— 0.13	17 18 54.02	17 18 39.21	— 14.81
E.	β Draconis	28 50.96	+ 0.27	+ 0.01	— 0.19	28 51.05	27 36.17	14.88
E.	ω Draconis	37 59.46	+ 1.05	+ 0.03	— 0.32	38 00.22	37 45.01	15.21
E.	μ Herculis	41 46.64	— 0.21	+ 0.02	— 0.13	41 46.32	41 31.37	14.95
E.	θ Herculis	52 11.04	— 0.07	+ 0.02	— 0.15	52 10.84	51 56.03	14.81
W.	ο Herculis	18 02 52.48	— 0.20	+ 0.05	+ 0.13	18 02 52.46	18 02 37.29	15.17
W.	μ Sagittarii	06 28.18	— 0.77	+ 0.02	+ 0.13	06 27.56	06 12.52	15.04
W.	η Serpentis	15 01.78	— 0.56	+ 0.02	+ 0.12	15 01.36	14 46.48	14.88
W.	109 Herculis	18 34.18	— 0.29	+ 0.01	+ 0.13	18 34.03	18 19.29	14.74
W.	ι Aquilæ	28 35.44	— 0.62	— 0.02	+ 0.12	28 34.92	28 19.98	14.94
W.	α Lyræ	32 55.24	— 0.04	— 0.06	+ 0.15	32 55.29	32 40.54	14.75
W.	β Lyræ	45 40.50	— 0.13	— 0.08	+ 0.15	45 40.44	45 25.61	14.83
W.	50 Draconis	8 50 44.58	+ 1.81	— 0.23	+ 0.46	18 50 46.62	18 50 31.74	— 14.88

NORMAL EQUATIONS.

$a_0 = -0^s.69 \quad c_0 = -0^s.05 \quad \triangle T_0 = -14^s.86 - 0^s.02\,(T - 16^h.8)$

$0 = +0.313 + 3.463\,da - 1.952\,dc + 3.552\,d\triangle T \qquad da = -0^s.125 \qquad$ Weight of $a = 1.96$
$0 = +0.635 - 1.952\,da + 13.000\,dc - 3.034\,d\triangle T \qquad dc = -0^s.068 \qquad c = 11.69$
$0 = +0.270 + 3.552\,da - 3.034\,dc + 8.606\,d\triangle T \qquad d\triangle T = -0^s.004 \qquad \triangle T = 4.87$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 18, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
E.	α^2 Libræ	14 44 06.86	+ 0.36	0.00	+ 0.11	14 44 07.11	14 43 52.64	— 14.47
E.	β Ursæ Minoris	56 24.26	— 0.88	+ 0.01	— 0.42	56 22.97	51 08.31	14.66
E.	β Libræ	15 10 26.20	+ 0.32	— 0.01	— 0.11	15 10 26.40	15 10 11.95	14.45
E.	γ Ursæ Minoris	21 15.00	— 0.71	— 0.05	— 0.36	21 13.88	20 59.60	14.28
E.	α Coronæ	29 34.62	+ 0.11	— 0.03	— 0.12	29 34.58	29 20.26	14.32
W.	α Serpentis	38 16.46	+ 0.23	— 0.03	+ 0.11	38 16.77	38 02.40	14.37
W.	ε Serpentis	44 44.94	+ 0.25	— 0.04	+ 0.11	44 45.26	44 30.83	14.43
W.	ζ Ursæ Minoris	48 57.50	— 1.24	— 0.20	+ 0.54	48 56.60	48 41.90	14.70
W.	β^1 Scorpii	15 58 19.04	+ 0.39	— 0.02	+ 0.12	15 58 19.53	15 58 05.07	— 14.46

NORMAL EQUATIONS.

$a_0 = +\,0^s.41 \qquad c_0 = -\,0^s.13 \qquad \triangle T_0 = -\,14^s.49 - 0^s.020\,(T - 16^h.8)$

$0 = -\,0.139 + 3.700\,da - 0.652\,dc + 3.307\,d\triangle T \qquad da = +\,0^s.009 \qquad$ Weight of $a = 1.73$

$0 = -\,0.187 - 0.652\,da + 9.000\,dc + 0.273\,d\triangle T \qquad dc = +\,0^s.020 \qquad c = 8.63$

$0 = -\,0.241 + 3.307\,da + 0.273\,dc + 5.770\,d\triangle T \qquad d\triangle T = +\,0^s.035 \qquad \triangle T = 2.73$

WINNEMUCCA, NEVADA, JULY 18, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s	h. m. s.	h. m. s.	s.
W.	ω Draconis	17 37 59.52	— 0.45	— 0.04	+ 0.53	17 37 59.56	17 37 44.94	— 14.62
W.	μ Herculis	41 45.46	+ 0.09	— 0.02	+ 0.22	41 45.75	41 31.36	14.39
W.	θ Herculis	52 10.14	+ 0.03	— 0.02	+ 0.24	52 10.39	51 56.01	14.38
W.	γ Draconis	53 56.46	— 0.10	— 0.03	+ 0.31	53 56.64	53 41.85	14.79
W.	o Herculis	18 02 51.68	+ 0.08	— 0.04	+ 0.22	18 02 51.94	18 02 37.42	14.52
E.	δ Ursæ Minoris	13 54.12	— 4.13	— 0.54	— 3.25	13 46.20	13 33.06	13.14
E.	109 Herculis	18 33.96	+ 0.12	— 0.05	— 0.21	18 33.82	18 19.29	14.53
E.	1 Aquilæ	28 34.52	+ 0.26	— 0.04	— 0.20	28 34.54	28 19.99	14.55
E.	α Lyræ	32 55.44	+ 0.02	— 0.08	— 0.25	32 55.13	32 40.54	14.59
E.	β Lyræ	45 40.36	+ 0.06	— 0.07	— 0.23	45 40.12	45 25.61	14.51
E.	50 Draconis	18 50 48.02	— 0.76	— 0.20	— 0.76	18 50 46.30	18 50 31.69	— 14.61

NORMAL EQUATIONS.

$a_0 = +\,0^s.41 \qquad c_0 = -\,0^s.13 \qquad \triangle T_0 = -\,14^s.49 - 0^s.020\,(T - 16^h.8)$

$0 = +\,0.143 + 1.885\,da + 0.130\,dc + 1.172\,d\triangle T \qquad da = -\,0^s.066 \qquad$ Weight of $a = 1.65$

$0 = +\,0.708 + 0.130\,da + 11.000\,dc + 0.308\,d\triangle T \qquad dc = -\,0^s.063 \qquad c = 10.98$

$0 = +\,0.151 + 1.172\,da + 0.308\,dc + 5.923\,d\triangle T \qquad d\triangle T = -\,0^s.009 \qquad \triangle T = 5.19$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 24, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
W.	γ Ursæ Minoris....	15 21 14.08	— 0.92	— 0.23	+ 0.33	15 21 13.26	15 20 59.22	— 14.04
W.	α Coronæ	29 33.96	+ 0.14	— 0.09	+ 0.11	29 34.12	29 20.18	13.94
W.	α Serpentis	38 15.96	+ 0.30	— 0.06	+ 0.10	38 16.30	38 02.34	13.96
W.	ε Serpentis	44 44.48	+ 0.32	— 0.06	+ 0.10	44 44.84	44 30.77	14.07
W.	ζ Ursæ Minoris....	48 57.34	— 1.59	— 0.30	+ 0.48	48 55.93	48 41.31	14.62
E.	Groombr. 2320...	16 06 16.12	— 0.66	— 0.17	— 0.27	16 06 15.02	16 06 01.22	13.80
E.	ε Ophiuchi	11 51.66	+ 0.38	— 0.05	— 0.10	11 51.89	11 37.89	14.00
E.	τ Herculis	16 11.54	— 0.08	— 0.10	— 0.14	16 11.22	15 57.22	14.00
E.	ω Herculis	19 49.02	+ 0.25	— 0.06	— 0.10	19 49.11	19 34.93	14.18
E.	α Scorpii..........	21 53.08	+ 0.55	— 0.03	— 0.11	21 53.49	21 39.39	14.10
E.	ζ Ophiuchi.	16 30 25.60	+ 0.43	— 0.04	— 0.10	16 30 25.89	16 30 11.90	— 13.99

NORMAL EQUATIONS.

$a_0 = +0^s.45 \qquad c_0 = 0^s.00 \qquad \Delta T_0 = -13^s.99$ [rate assumed $= 0$]

$0 = +0.042 + 3.739\,da + 2.042\,dc + 3.576\,d\Delta T$	$da = +0^s.088$	Weight of $a = 1.80$
$0 = +0.986 + 2.042\,da + 11.000\,dc + 1.519\,d\Delta T$	$dc = -0^s.099$	$c = 9.84$
$0 = +0.177 + 3.576\,da + 1.519\,dc + 7.224\,d\Delta T$	$d\Delta T = -0^s.047$	$\Delta T = 3.78$

WINNEMUCCA, NEVADA, JULY 24, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
E.	π Herculis	17 10 53.48	+ 0.03	— 0.06	+ 0.05	17 10 53.50	17 10 39.49	— 14.01
E.	44 Ophiuchi........	18 52.76	+ 0.37	— 0.02	+ 0.04	18 53.15	18 39.19	13.96
E.	β Draconis........	27 50.32	— 0.12	— 0.10	+ 0.07	27 50.17	27 36.03	14.14
E.	ω Draconis........	37 59.42	— 0.49	— 0.20	+ 0.11	37 58.84	37 44.73	14.11
E.	μ^1 Herculis	41 45.22	+ 0.10	— 0.10	+ 0.05	41 45.27	41 31.32	13.95
W.	γ Draconis........	53 56.02	— 0.11	— 0.17	— 0.06	53 55.68	53 41.76	13.92
W.	ο Herculis	18 02 51.50	+ 0.09	— 0.13	— 0.05	18 02 51.41	18 02 37.39	14.02
W.	μ Sagittarii	06 26.36	+ 0.36	— 0.06	— 0.04	06 26.62	06 12.52	14.10
W.	η Serpentis	15 00.40	+ 0.26	— 0.10	— 0.04	15 00.52	14 46.49	14.03
W.	109 Herculis	18 33.30	+ 0.13	— 0.14	— 0.04	18 33.25	18 19.28	— 13.97

NORMAL EQUATIONS.

$a_0 = +0^s.45 \qquad c_0 = 0^s.00 \qquad \Delta T_0 = -13^s.99$ [rate assumed $= 0$]

$0 = +0.318 + 2.585\,da - 1.395\,dc + 2.692\,d\Delta T$	$da = -0^s.073$	Weight of $a = 1.37$
$0 = -0.523 - 1.395\,da + 10.000\,dc - 0.792\,d\Delta T$	$dc = +0^s.040$	$c = 9.14$
$0 = +0.408 + 2.692\,da - 0.792\,dc + 6.646\,d\Delta T$	$d\Delta T = -0^s.027$	$\Delta T = 3.80$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
W.	β Libræ	15 10 25.10	+ 0.42	— 0.03	+ 0.09	15 10 25.58	15 10 11.87	— 13.71
W.	γ Ursæ Minoris	22 13.68	— 0.92	— 0.33	+ 0.29	22 12.72	20 59.15	13.57
W.	α Coronæ	29 33.72	+ 0.15	— 0.17	+ 0.10	29 33.80	29 20.16	13.64
W.	α Serpentis	38 15.76	+ 0.31	— 0.14	+ 0.09	38 16.02	38 02.33	13.69
W.	ε Serpentis	44 44.26	+ 0.32	— 0.13	+ 0.09	44 44.54	44 30.76	13.78
W.	ζ Ursæ Minoris	48 57.28	— 1.60	— 0.62	+ 0.43	48 55.49	48 41.21	14.28
E.	β¹ Scorpii	58 18.42	+ 0.50	— 0.08	— 0.09	58 18.75	58 05.01	13.74
E.	Groombr. 2320	16 06 16.14	— 0.66	— 0.37	— 0.24	16 06 14.87	16 06 01.17	13.70
E.	τ Herculis	16 11.34	— 0.08	— 0.22	— 0.13	16 10.91	15 57.21	13.70
E.	ζ Ophiuchi	30 25.38	+ 0.43	— 0.09	— 0.09	30 25.63	30 11.88	13.75
E.	η Herculis	16 38 48.38	+ 0.02	— 0.17	— 0.11	16 38 48.12	16 38 34.43	— 13.69

NORMAL EQUATIONS.

$a_0 = -0^s.44 \qquad c_0 = -0^s.08 \qquad \triangle T_0 = -13^s.72$ [rate assumed $= 0$]

$0 = -0.354 + 3.526\,da + 0.098\,dc + 3.205\,d\triangle T \qquad da = +0^s.101 \qquad$ Weight of $a = 2.04$
$0 = +0.075 + 0.098\,da + 11.000\,dc - 0.615\,d\triangle T \qquad dc = -0^s.008 \qquad c = 10.87$
$0 = -0.328 + 3.205\,da - 0.615\,dc + 6.951\,d\triangle T \qquad d\triangle T = 0^s.000 \qquad \triangle T = 3.99$

WINNEMUCCA, NEVADA, JULY 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
E.	β Draconis	17 27 50.24	— 0.09	— 0.16	— 0.11	17 27 49.88	17 27 36.01	— 13.87
E.	ω Draconis	37 59.32	— 0.37	— 0.25	— 0.19	37 58.51	37 44.69	13.82
E.	μ Herculis	41 45.06	+ 0.08	— 0.12	— 0.08	41 44.94	41 31.32	13.62
E.	θ Herculis	52 09.84	+ 0.02	— 0.16	— 0.09	52 09.61	51 55.95	13.66
W.	ο Herculis	18 02 51.22	+ 0.07	— 0.16	+ 0.08	18 02 51.21	18 02 37.39	13.82
W.	δ Ursæ Minoris	13 48.70	— 3.49	— 1.93	+ 1.17	13 44.45	13 31.23	13.22
W.	α Lyræ	32 54.26	+ 0.02	— 0.23	+ 0.09	32 54.14	32 40.51	13.63
W.	β Lyræ	45 39.44	+ 0.05	— 0.21	+ 0.09	45 39.37	45 25.60	13.77
W.	50 Draconis	18 50 46.14	— 0.64	— 0.59	+ 0.27	18 50 45.18	18 50 31.44	— 13.74

NORMAL EQUATIONS.

$a_0 = +0^s.44 \qquad c_0 = -0^s.08 \qquad \triangle T_0 = -13^s.72$ [rate assumed $= 0$]

$0 = +0.246 + 1.718\,da + 1.236\,dc + 0.066\,d\triangle T \qquad da = -0^s.151 \qquad$ Weight of $a = 1.57$
$0 = +0.075 + 1.236\,da + 10.000\,dc - 0.215\,d\triangle T \qquad dc = +0^s.011 \qquad c = 9.09$
$0 = +0.007 + 0.066\,da - 0.215\,dc + 4.060\,d\triangle T \qquad d\triangle T = +0^s.001 \qquad \triangle T = 4.06$

Observations and reductions for time taken at sending station—Continued.

WINNEMUCCA, NEVADA, JULY 26, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
W.	γ Ursæ Minoris....	15 21 13.38	— 1.33	— 0.39	+ 0.32	15 21 11.98	15 20 59.09	— 12.89
W.	α Coronæ	29 33.24	+ 0.21	— 0.15	+ 0.11	29 33.41	29 20.15	13.26
W.	α Serpentis........	38 15.30	+ 0.44	— 0.12	+ 0.10	38 15.72	38 02.31	13.41
W.	ε Serpentis........	44 43.66	+ 0.46	— 0.11	+ 0.10	44 44.11	44 30.75	13.36
W.	ζ Ursæ Minoris....	48 57.08	— 2.30	— 0.55	— 0.48	48 53.75	48 41.11	13.64
E.	β^1 Scorpii	58 17.74	+ 0.72	— 0.07	— 0.10	58 18.29	58 05.00	13.29
E.	Groombr. 2320 ...	16 06 15.98	— 0.95	— 0.34	— 0.26	16 06 14.43	16 06 01.11	13.32
E.	τ Herculis	16 10.98	— 0.11	— 0.18	— 0.14	16 10.55	15 57.19	13.36
E.	α Scorpii	21 51.96	+ 0.80	— 0.05	— 0.11	21 52.60	21.39.37	13.23
E.	ζ Ophiuchi........	30 24.82	+ 0.62	— 0.06	— 0.10	30 25.28	30 11.88	13.40
E.	η Herculis	16 38 48.02	+ 0.03	— 0.11	— 0.13	16 38 47.81	16 38 34.41	— 13.40

NORMAL EQUATIONS.

$a_0 = +0^s.75 \qquad c_0 = -0^s.10 \qquad \triangle T_0 = -13^s.39$ [rate assumed $= 0$]

$0 = -0.292 + 3.790\, da + 1.784\, dc + 3.276\, d\triangle T$	$da = +0^s.028$	Weight of $a = 2.07$
$0 = -0.142 + 1.784\, da + 11.000\, dc + 1.271\, d\triangle T$	$dc = +0^s.002$	$c = 10.14$
$0 = -0.471 + 3.276\, da + 1.271\, dc + 6.781\, d\triangle T$	$d\triangle T = +0^s.055$	$\triangle T = 3.95$

WINNEMUCCA, NEVADA, JULY 26, 1873.

Clamp.	Name of star.	T′.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
E.	ψ^1 Draconis, pr....	17 44 30.06	— 1.35	+ 0.11	— 0.19	17 44 28.63	17 44 15.22	— 13.41
E.	θ Herculis	52 09.20	+ 0.06	+ 0.06	— 0.07	52 09.25	51 55.95	13.30
E.	γ Draconis.	53 55.36	— 0.23	+ 0.08	— 0.09	53 55.12	53 41.73	13.39
E.	o Herculis	18 02 50.50	+ 0.19	+ 0.03	— 0.07	18 02 50.65	18 02 37.38	13.27
E.	μ^1 Sagittarii	06 25.10	+ 0.75	+ 0.08	— 0.06	06 25.87	06 12.52	13.35
W.	η Serpentis	14 59.26	+ 0.55	— 0.01	+ 0.06	14 59.86	14 46.49	13.37
W.	109 Herculis	18 32.30	+ 0.28	— 0.02	+ 0.06	18 32.62	18 19.27	13.35
W.	1 Aquilæ*........	28 32.58:	+ 0.61	— 0.04	+ 0.06	28 33.21:	28 20.00	[13.21]
W.	α Lyræ	32 53.68	+ 0.04	— 0.07	+ 0.08	32 53.73	32 40.50	13.23
W.	β Lyræ	45 38.74	+ 0.13	— 0.06	+ 0.07	45 38.88	45 25.59	13.29
W.	50 Draconis.......	18 50 46.60	— 1.77	— 0.17	+ 0.23	18 50 44.89	18 50 31.40	— 13.49

* 1 Aquilæ noted as doubtful in original book.

NORMAL EQUATIONS.

$a_0 = +0^s.75 \qquad c_0 = -0^s.10 \qquad \triangle T_0 = -13^s.39$ [rate assumed $= 0$]

$0 = -0.204 + 2.060\, da - 0.177\, dc + 1.790\, d\triangle T$	$da = +0^s.046$	Weight of $a = 1.52$
$0 = -0.386 - 0.177\, da + 10.000\, dc - 0.267\, d\triangle T$	$dc = +0^s.041$	$c = 9.98$
$0 = -0.461 + 1.790\, da - 0.267\, dc + 5.987\, d\triangle T$	$d\triangle T = +0^s.065$	$\triangle T = 4.43$

The following tables give the corrections and rates of the chronometers used at Winnemucca and Salt Lake City:

CHRONOMETER AT WINNEMUCCA.—NEGUS, No. 1499.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*s.* *s*	*s.*
July 11	18.0	— 15.882 ± 0.028	0.000
July 16	16.8	— 14.852 ± 0.023	— 0.020
July 18	16.8	— 14.477 ± 0.025	— 0.020
July 24	17.0	— 14.027 ± 0.025	0.000
July 25	17.0	— 13.720 ± 0.024	0.000
July 26	17.0	— 13.330 ± 0.024	0.000

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*h.* *m.* *s.*	*s.*
July 11	18.0	+ 8 07 09.07	— 0.026
July 16	17.0	06.60	— 0.019
July 18	17.25	05.72	— 0.013
July 24	17.25	06.22	0.000
July 25	17.25	06.21	— 0.004
July 26	17.5	+ 8 07 06.04	— 0.007

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
July 11, 1873:		*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*	*m.* *s.*	*s.*	*m.* *s.*
Salt Lake City.	Salt Lake City.	8 36 55.75	+8 07 09.10	16 44 04.85			
	Winnemucca ..	16 21 00.00	—0 00 15.88	16 20 44.12	23 20.73		
Winnemucca ..	Salt Lake City.	8 43 55.86	+8 07 09.10	16 51 04.96			
	Winnemucca ..	16 28 00.12	—0 00 15.88	16 27 44.24	23 20.72	....	23 20.725
July 16, 1873:							
Salt Lake City.	Salt Lake City.	9 14 46.66	+8 07 06.59	17 21 53.25			
	Winnemucca ..	16 58 47.46	—0 00 14.86	16 58 32.30	23 20.95		
Winnemucca ..	Salt Lake City.	9 20 19.45	+8 07 06.59	17 27 26.04			
	Winnemucca ..	17 04 20.15	—0 00 14.86	17 04 05.29	23 20.75	....	23 20.850
July 18, 1873:							
Salt Lake City.	Salt Lake City.	9 22 17.62	+8 07 05 72	17 29 23.34			
	Winnemucca ..	17 06 17.14	—0 00 14.49	17 06 02.65	23 20.69		
Winnemucca ..	Salt Lake City.	9 28 00.60	+8 07 05.71	17 35 06.31			
	Winnemucca ..	17 12 00.05	—0 00 14.49	17 11 45.56	23 20.75	....	23 20.720

Final results of longitude—Continued.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
July 24, 1873:		h. m. s.	h. m. s.	h. m. s.	m. s.	s.	m. s.
Salt Lake City.	Salt Lake City.	9 02 39.59	+8 07 06.22	17 09 45.81			
	Winnemucca ..	16 46 39.12	−0 00 14.03	16 46 25.09	23 20.72		
Winnemucca ..	Salt Lake City.	9 08 30.68	+8 07 06.22	17 15 36.90			
	Winnemucca ..	16 52 30.14	−0 00 14.03	16 52 16.11	23 20.79	....	23 20.755
July 25, 1873:							
Salt Lake City.	Salt Lake City.	9 18 25.97	+8 07 06.21	17 25 32.18			
	Winnemucca ..	17 02 25.20	−0 00 13.72	17 02 11.48	23 20.70		
Winnemucca ..	Salt Lake City.	9 24 30.91	+8 07 06.21	17 31 37.12			
	Winnemucca ..	17 08 30.01	−0 00 13.72	17 08 16.29	23 20.83	....	23 20.765
July 26, 1873:							
Salt Lake City.	Salt Lake City.	9 36 13.04	+8 07 06.04	17 43 19.08			
	Winnemucca ..	17 20 11.79	−0 00 13.33	17 19 58.46	23 20.62		
Winnemucca ..	Salt Lake City.	9 40 01.41	+8 07 06.04	17 47 07.45			
	Winnemucca ..	17 24 00.02	−0 00 13.33	17 23 46.69	23 20.76	....	23 20.690

Winnemucca west of Salt Lake City .... $0^h\ 23^m\ 20^s.751 \pm 0^s.015$

Not including personal equation, probable error of one night .... $\pm\ 0^s.026$

Mean places of stars for 1873.0 *used for determination of latitude of Winnemucca, Nevada.*

No. of pair.	No. in B. A. C.	Right ascension.	Declination.	No. of pair.	No. in B. A. C.	Right ascension.	Declination.
		h. m. s.	° ′ ″			h. m. s.	° ′ ″
1........	5131	15 27 48	31 47 19.92	13........	6771	19 39 42	37 02 54.92
	5164	31 26	50 07 14.80		6779	41 00	44 49 18.34
2........	5515	16 22 27	32 58 59.81	14........	6810	19 45 36	22 17 19.19
	5535	26 37	49 14 19.28		6818	46 00	59 05 58.60
3........	6013	17 39 20	44 08 26.90	15........	6830	19 48 23	47 36 17.52
	6082	51 54	37 16 06.96		6851	51 32	34 44 49 86
4........	6162	18 03 39	43 26 50.64	16........	6868	19 54 19	17 10 15.48
	6193	08 51	38 44 20.84		6905	20 00 08	64 27 55.40
5........	6224	18 13 10	64 21 15.20	17........	6932	20 03 31	61 37 37.32
	6245	17 17	17 45 51.28		6941	05 28	20 45 28.82
6........	6289	18 22 03	58 43 39.52	18........	6966	20 09 53	25 12 19.36
	6322	27 29	23 31 25.08		6976	10 27	56 10 46.56
7........	6364	18 35 27	40 49 11.90	19........	7158	20 34 54	40 07 53.90
	6404	42 09	41 18 23.16		7174	37 21	41 15 46.96
8........	6476	18 51 26	48 42 05.20	20........	7188	20 39 23	24 49 02.94
	6491	59 12	32 31 00.00		7215	42 12	57 07 29.40
9*........	6553	19 02 37	32 18 11.08	21........	7361	21 06 13	22 33 45.16
	6579	08 48	49 37 10.80		7377	08 34	59 27 52.84
10........	6642	19 18 40	16 41 31.54	22........	7417	21 15 45	58 05 12.46
	6662	20 01	65 28 12.04		7437	18 15	23 43 46.66
11........	6673	19 23 12	29 11 34.00	23........	7453	21 20 36	36 07 10.34
	6687	24 19	52 03 43.60		7469	22 51	45 51 51.76
12........	6698	19 27 03	34 11 03.32				
	6721	31 03	47 53 20.08				

* Mr. Maryatt observed the *following* component of B. A. C. 6579. The Catalogue of 981 Stars gives the *preceding*. The computer has, therefore, added + 7″.7 to the declination according to Argelander (Bonn Observations, vol. vii, p. 93).

Observations and computations for latitude.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
1873. July 15	6013	7.173	29.2	23.0						
	6082	32.067	22.8	29.8		40 42 19.26	+15 59.60	−0.19	......	40 58 18.67
	6162	24.895	38.7	14.0						
	6193	13.529	15.0	37.8		41 05 37.52	− 7 18.14	+0.44	......	19.82
	6224	30.034	39.7	13.6						
	6245	21.852	14.0	39.8		03 34.30	− 5 15.41	+0.07	......	18.96
	6289	27.697	38.3	15.7						
	6322	13.293	19.1	35.5		07 33.36	− 9 15.26	+1.43	......	19.53
	6364	15.442	22.9	32.0						
	6404	24.095	44.3	11.2		41 03 48.58	− 5 33.55	+5.56	......	20.59
	6476	3.117	29.6	26.6						
	6491	36.962	28.7	27.3		40 36 33.06	+21 44.65	+1.02	......	18.73
	6553	20.142	26.0	30.1						
	6579	19.222	38.7	19.1		40 57 41.23	+ 0 35.47	+3.59	......	20.29
	6642	13.833	31.3	26.0						
	6662	24.034	30.1	27.2		41 04 51.24	− 6 33.24	+1.90	......	19.90
	6673	34.373	25.0	32.2						
	6687	2.178	34.1	23.2		40 37 38.46	+20 41.05	+0.86	......	20.37
	6698	16.912	27.5	30.0						
	6721	22.995	35.7	21.7		41 02 11.26	− 3 54.48	+2.66	......	19.44
	6771	24.074	26.9	30.7						
	6779	20.698	46.7	11.1		40 56 05.98	+ 2 10.91	+7.36	......	24.25
	6810	30.817	27.1	30.4						
	6818	4.903	22.0	35.7		40 41 38.04	+16 38.95	−3.24	......	13.75
	6830	29.222	27.1	30.7						
	6851	10.073	28.0	29.8		41 10 32.78	−12 18.15	−1.25	......	13.38
	6868	25.878	30.5	27.3						
	6905	11.437	32.5	25.6		40 49 04.24	+ 9 16.69	+2.34	......	23.27
	6932	34.131	33.7	24.6						
	6941	13.570	15.0	43.3		41 11 31.85	−13 12.60	−4.44	......	14.81
	6966	31.742	29.7	28.6						
	6976	5.621	31.1	27.0		40 41 31.63	+16 46.93	+1.20	......	19.76
	7158	32.364	26.8	31.5						
	7174	6.691	36.2	22.3		41 48.56	+16 29.63	+2.13	......	20.32
	7188	19.107	27.0	31.8						
	7215	19.060	38.7	20.1		40 58 14.17	+ 0 01.81	+0.88	......	16.86
	7361	16.853	22.0	32.1						
	7377	20.789	53.0	6.3		41 00 46.65	− 2 31.73	+8.47	......	40 58 23.39

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
July 15	7417	15.920	32.9	26.3						
	7437	21.912	22.9	36.3		40 54 26.24	+ 3 50.99	−1.57	....	40 58 15.66
	7453	19.778	26.7	32.7						
	7469	21.656	41.4	17.7		59 28.34	− 1 12.40	+4.10	....	20.04
July 16	6642	13.500	23.7	24.0						
	6662	23.661	24.2	23.3		41 04 51.50	− 6 27.84	+0.09	....	23.75
	6673	34.068	22.0	25.8						
	6687	2.656	32.9	15.0		40 37 38.76	+20 41.71	+3.26	....	23.73
	6698	17.094	20.6	27.2						
	6721	23.152	36.0	11.9		41 02 11.56	− 3 53.52	+4.05	....	22.09
	6771	23.923	21.8	26.1						
	6779	20.502	34.4	13.6		40 56 06.29	+ 2 11.88	+3.82	....	21.99
	6810	32.083	22.0	26.1						
	6818	6.952	12.7	35.5		41 38.34	+16 47.31	−6.23	+0.19	19.61
	6868	25.982	25.7	22.9						
	6905	11.480	14.9	34.0		40 49 04.52	+ 9 19.04	−3.77	+0.04	19.83
	6932	34.685	25.3	23.5						
	6941	14.207	12.2	36.7		41 11 32.15	−13 09.40	−5.26	....	17.49
	6966	31.498	24.5	24.6						
	6976	5.269	15.5	33.6		40 41 31.94	+16 51.08	−4.21	....	18.81
	7158	34.428	20.1	29.7						
	7174	8.646	31.1	19.0		41 48.89	+16 33.83	+0.58	....	23.30
	7188	18.996	23.3	27.1						
	7215	18.752	19.6	31.0		40 58 14.49	+ 0 09.40	−3.52	+0.08	20.45
	7361	15.656	23.9	27.0						
	7377	19.307	11.9	39.1		41 00 46.96	− 2 20.74	−7.01	....	19.21
	7417	16.697	29.5	21.8						
	7437	22.882	4.7	46.7		40 54 26.51	+ 3 58.42	−7.94	....	16.99
	7453	19.171	24.5	26.8						
	7469	20.873	22.0	29.3		40 59 28.66	− 1 05.61	−2.22	....	20.83
July 18	6642	14.065	22.0	31.5						
	6662	24.282	32.5	21.0		41 04 52.17	− 6 33.85	+0.46	....	18.78
	6673	34.237	27.8	25.7						
	6687	2.170	22.7	31.0		40 37 39.35	+20 36.12	−1.44	....	14.03
	6698	18.908	27.8	26.3						
	6721	24.957	33.8	20.0		41 02 12.16	− 3 53.17	+3.54	....	22.53
	6771	25.978	26.0	27.3						
	6779	22.425	34.3	19.1		40 56 06.90	+ 2 16.96	+3.22	....	40 58 27.08

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
July 19	6162	24.101	24.2	21.3						
	6193	12.753	19.0	26.3		41 05 38.56	− 7 17.44	−1.02	......	40 58 20.10
	6224	29.139	39.8	5.2						
	6245	21.039	6.1	38.6		03 35.27	− 5 12.25	+0.49	......	23.51
	6289	27.963	42.3	2.1						
	6322	13.537	3.3	40.9		41 07 34.40	− 9 16.10	+0.66	......	18.96
	6673	34.195	17.8	27.1						
	6687	2.033	32.9	11.7		40 37 39.65	+20 39.78	+2.75	......	22.18
	6698	16.318	23.2	21.3						
	6721	22.320	19.7	25.0		41 02 12.46	− 3 51.36	−0.79	......	20.31
	6771	23.552	17.5	27.2						
	6779	20.174	25.7	19.1		40 56 07.21	+ 2 10.21	−0.72	......	16.70
	6810	30.955	26.0	18.8						
	6818	4.965	25.7	19.1		40 41 39.22	+16 41.88	+3.20	......	24.30
	6830	28.322	26.1	18.4						
	6851	9.273	15.8	28.3		41 10 34.03	−12 14.30	−1.11	......	18.62
	6868	26.433	20.3	23.4						
	6905	12.206	53.0	−9.		40 49 05.39	+ 9 08.45	+9.31	......	23.15
	6932	30.877	25.3	18.5						
	6941	9.267	23.6	20.2		41 11 33.05	−13 14.49	+2.36	......	20.92
	6966	31.543	21.5	22.0						
	6976	5.544	18.7	24.8		40 41 32.84	+16 42.22	−1.53	......	13.53
July 21	6162	25.196	22.7	24.7						
	6163	13.758	30.3	17.0		41 05 39.06	− 7 20.91	+2.62	......	20.77
	6224	28.267	23.7	23.4						
	6245	20.003	29.1	18.0		03 35.74	− 5 18.57	+2.64	......	19.81
	6289	26.989	27.9	19.1						
	6322	12.573	18.0	28.7		41 07 34.90	− 9 16.10	−0.21	......	18.59
July 23	6013	5.622	19.3	29.1						
	6082	30.551	27.0	22.0		40 42 21.16	+16 00.95	−1.11	......	21.00
	6162	24.463	26.9	23.7						
	6193	13.100	19.0	32.2		41 05 39.55	− 7 18.02	−2.32	......	19.21
	6224	28.313	22.9	29.0						
	6245	20.150	25.1	26.9		03 36.20	− 5 14.67	−1.83	......	19.70
	6289	26.125	27.0	25.6						
	6322	11.737	16.7	36.3		07 35.40	− 9 14.64	−4.21	......	16.55
	6364	14.454	26.5	26.9						
	6404	23.011	24.5	29.0		41 03 50.64	− 5 29.85	−1.13	......	40 58 19.66

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
July 23	6476	2.684	27.0	27.1						
	6491	36.585	19.0	35.3		40 36 35.30	+21 46.81	—3.80	......	40 58 18.31
	6553	19.952	23.4	31.1						
	6579	18.984	20.0	35.1		40 57 43.55	+ 0 37.32	—5.28	......	15.59
	6642	14.002	25.2	30.4						
	6662	24.215	30.0	25.7		41 04 53.52	— 6 33.70	—0.21	......	19.61
	6673	34.819	23.8	32.0						
	6687	2.666	29.0	27.0		40 37 40.80	+20 39.43	—1.44	......	18.79
	6698	16.462	22.1	33.7						
	6721	22.498	32.2	23.8		41 02 13.65	— 3 52.67	—0.74	......	20.24
	6771	23.969	24.8	31.3						
	6779	20.546	30.3	26.0		40 56 08.42	+ 2 11.95	—0.51	......	19.86
	6810	31.626	26.7	29.8						
	6818	5.693	27.0	29.7		40 41 40.38	+16 39.68	—1.34	+0.03	18.75
	6830	29.080	30.4	26.0						
	6851	9.991	13.2	43.6		41 10 35.26	—12 15.84	—4.77	......	14.65
	6868	27.203	27.1	29.9						
	6905	12.800	25.5	31.8		40 49 06.53	+ 9 15.23	—2.11	......	19.65
	6932	31.239	32.3	25.1						
	6941	10.669	45.2	12.2		41 11 34.22	—13 12.95	+9.31	......	30.58
	6966	31.157	29.7	27.8						
	6976	5.010	20.2	37.3		40 41 34.06	+16 47.92	—3.52	......	18.46
	7158	32.616	28.0	31.5						
	7174	6.968	44.3	15.1		40 41 51.12	+16 28.67	+5.95	......	25.74
	7188	18.801	25.0	34.5						
	7215	18.708	44.7	14.5		40 58 16.65	+ 0 03.58	+4.79	......	25.02
	7361	15.617	26.2	33.4						
	7377	19.495	32.0	27.7		41 00 49.12	— 2 29.49	—0.67	+0.13	19.09
	7417	15.906	29.6	30.2						
	7437	21.895	31.3	28.4		40 54 28.44	+ 3 50.87	+0.53	......	19.84
	7453	18.627	26.8	33.2						
	7469	20.468	36.3	23.8		40 59 30.92	— 1 10.97	+1.41	......	21.36
July 24	6364	15.033	23.8	27.0						
	6404	23.600	25.7	25.5		41 03 50.90	— 5 30.23	—0.69	......	19.98
	6476	2.384	28.6	23.0						
	6491	36.262	15.0	36.8		40 36 35.58	+21 45.92	—3.75	......	17.75
	6553	20.250	27.0	25.4						
	6579	19.253	21.4	31.5		40 57 43.83	+ 0 38.43	—1.97	......	40 58 20.29

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
July 24	6642	12.938	23.5	29.2						
	6662	23.124	26.8	26.1		41 04 53.78	− 6 32.66	−1.16	......	40 58 19.96
	6673	34.844	22.6	29.8						
	6687	2.670	29.7	22.8		40 37 41.09	+20 40.24	−0.07	......	21.26
	6698	16.874	21.9	30.0						
	6721	22.899	27.2	24.5		41 02 13.94	− 3 52.25	−1.25	......	20.44
	6771	23.744	24.2	27.0						
	6779	20.323	32.3	19.1		40 56 08.72	+ 2 11.88	+2.41	......	23.01
	6810	30.880	23.9	27.2						
	6818	4.922	25.9	25.0		40 41 40.67	+16 40.65	−0.56	......	20.76
	6830	28.775	23.5	27.2						
	6851	9.691	23.9	27.0		41 10 35.56	−12 15.65	−1.57	......	18.34
	6868	26.517	20.6	30.0						
	6905	12.111	25.3	26.0		40 49 06.81	+ 9 15.35	−2.34	......	19.82
	6932	30.212	27.2	24.2						
	6941	9.626	18.1	33.4		41 11 34.52	−13 13.56	−2.85	......	18.11
	6966	31.532	21.9	29.8						
	6976	5.432	34.5	17.2		40 41 34.36	+16 46.11	+2.18	......	22.65
	7158	33.183	25.9	25.4						
	7174	7.466	41.3	10.6		40 41 51.44	+16 31.33	+7.22	......	29.99
	7188	18.611	26.2	25.0						
	7215	18.467	22.2	29.3		40 58 16.96	+ 0 05.55	−1.37	......	21.14
July 25	6553	20.573	24.8	27.3						
	6579	19.625	29.6	22.0		40 57 44.11	+ 0 36.54	+1.18	......	21.83
	6642	14.000	23.8	26.9						
	6662	24.217	24.6	25.0		41 04 54.05	− 6 33.85	−1.04	......	19.16
	6673	33.982	27.0	23.0						
	6687	1.827	20.0	29.8		40 37 41.37	+20 39.51	−1.34	......	19.54
	6698	17.173	26.0	23.3						
	6721	23.197	22.1	27.0		41 02 14.24	− 3 52.21	−0.51	......	21.52
	6771	23.940	22.3	26.0						
	6779	20.545	29.3	19.1		40 56 09.02	+ 2 10.57	+1.50	......	21.39
	6810	33.107	24.5	24.2						
	6818	7.171	22.3	26.5		40 41 40.96	+16 39.80	−0.90	......	19.86
	6830	29.072	21.1	27.8						
	6851	9.949	17.9	31.2		41 10 35.86	−12 17.15	−4.63	+0.16	14.24
	6868	26.105	25.0	24.0						
	6905	11.749	23.3	26.6		40 49 07.10	+ 9 13.42	−0.51	......	40 58 20.01

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
1873. July 25	6932	31.123	28.5	21.9						
	6941	10.520	17.3	33.2		41 11 34.81	—13 14.22	—2.15	....	40 58 18.44
	6966	31.827	17.9	32.9						
	6976	5.721	31.7	19.1		40 41 34.66	+16 46.34	—0.56	....	20.44
	7158	32.860	22.1	28.9						
	7174	7.150	23.0	28.0		40 41 51.76	+16 31.06	—2.73	....	20.09
	7188	18.622	24.3	26.3						
	7215	18.503	22.8	28.0		40 58 17.27	+ 0 04.59	—1.67	....	20.19
	7361	16.603	23.3	27.8						
	7377	20.510	25.0	26.5		41 00 49.74	— 2 30.61	—1.39	+0.10	17.84
	7417	15.807	25.7	26.3						
	7437	21.834	18.0	34.0		40 54 29.00	+ 3 52.34	—3.84	....	17.50
	7453	19.722	23.1	29.0						
	7469	21.540	39.9	12.6		40 59 31.56	— 1 10.08	+4.95	....	26.43
July 26	6553	19.945	22.8	27.0						
	6579	19.041	41.2	9.1		40 57 44.39	+ 0 34.85	+6.46	....	25.70
	6642	14.467	19.0	31.6						
	6662	24.606	23.5	27.0		41 04 54.31	— 6 30.85	—3.73	....	19.73
	6673	34.340	25.2	27.2						
	6687	2.121	32.1	18.6		40 37 41.65	+20 41.98	+2.20	....	25.83
	6698	17.226	24.0	26.0						
	6721	23.136	16.0	34.7		41 02 14.53	— 3 47.82	—4.93	....	21.78
	6771	23.441	29.7	20.0						
	6779	20.010	18.2	31.2		40 56 09.31	+ 2 12.26	—0.76	....	20.81
	6810	31.358	19.0	30.1						
	6818	5.397	26.8	22.5		40 41 41.24	+16 40.76	—1.57	....	20.43
	6830	29.032	30.2	19.1						
	6851	9.949	15.2	33.2		41 10 36.16	—12 15.61	—1.60	....	18.95
	6868	26.403	17.5	32.0						
	6905	12.012	31.0	18.9		40 49 07.38	+ 9 14.77	—0.56	....	21.59
	6932	30.942	23.4	26.7						
	6941	10.122	25.5	24.6		41 11 35.10	—13 22.58	—0.56	....	11.96
	6966	32.960	20.3	29.7						
	6976	6.822	20.1	30.0		40 41 34.96	+16 47.57	—4.47	....	18.06
	7158	34.118	24.0	25.9						
	7174	8.473	38.6	11.4		40 41 52.08	+16 28.55	+5.86	....	26.49
	7188	18.922	23.9	26.1						
	7215	18.821	28.9	22.0		40 58 17.57	+ 0 03.89	+1.09	....	40 58 22.55

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
July 26	7361	17.371	22.5	26.9						
	7377	21.247	26.9	22.6		41 00 50.05	− 2 29.42	−0.02	....	40 58 20.61
	7417	15.812	24.0	25.5						
	7437	21.794	22.4	26.1		40 54 29.28	+ 3 58.31	−1.20	....	26.39
	7453	19.161	23.3	26.2						
	7469	21.076	26.9	22.8		40 59 31.88	− 1 13.82	+0.28	....	18.34
July 27	6162	24.480	30.1	19.0						
	6193	13.032	14.1	33.9		41 05 40.51	− 7 21.29	−2.01	....	17.21
	6224	29.457	31.2	19.0						
	6245	21.231	19.0	31.7		41 03 37.10	− 5 17.10	−0.12	....	19.88
	6289	27.683	27.2	23.1						
	6322	13.232	22.0	30.0		41 07 36.36	− 9 17.07	−0.90	....	18.39
	6932	29.927	30.2	23.8						
	6941	9.282	25.0	28.6		41 11 35.38	−13 15.84	+0.65	....	20.19
	6966	32.237	25.7	27.2						
	6976	6.191	30.0	23.0		40 41 35.26	+16 44.03	+1.27	....	20.56
July 28	6162	24.809	26.7	23.4						
	6193	13.349	19.0	31.0		41 05 40.74	− 7 21.76	−2.01	....	16.97
	6224	28.937	30.4	20.1						
	6245	20.688	21.9	29.0		41 03 37.31	− 5 17.99	+0.74	....	20.06
	6289	29.326	28.7	21.9						
	6322	14.860	26.1	24.6		41 07 36.59	− 9 17.65	+1.92	....	20.86
	6364	15.351	31.0	30.0						
	6464	23.967	32.2	19.0		41 03 51.96	− 5 32.12	+3.29	....	23.13
	6476	2.801	27.8	24.3						
	6491	36.612	25.0	27.1		40 36 36.64	+21 43.34	+0.33	....	20.31
	6553	19.770	23.0	29.8						
	6579	18.846	30.0	23.6		40 57 44.93	+ 0 35.62	−0.12	....	20.43
	6642	18.702	23.9	30.2						
	6662	24.028	45.0	9.0		41 04 54.82	− 6 38.05	+6.88	....	23.65
	6673	34.628	23.9	30.2						
	6687	2.550	40.1	13.9		40 37 42.21	+20 36.54	+4.61	....	23.36
	6698	16.704	27.0	26.9						
	6721	22.805	31.5	22.5		41 02 15.12	− 3 55.18	+2.11	....	22.05
	6771	24.413	23.9	30.8						
	6779	21.132	32.9	22.0		40 56 09.90	+ 2 05.48	+0.93	....	17.31
	6810	31.510	23.6	31.4						
	6818	5.654	36.1	19.0		40 41 41.80	+16 36.71	+2.15	+0.05	40 58 20.71

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
July 28	6830	29.377	32.3	23.0						
	6851	10.284	13.1	42.0		41 10 36.76	—12 15.99	—4.54	......	40 58 16.23
	6868	27.022	22.7	32.8						
	6905	12.693	36.8	19.1		40 49 07.94	+ 9 12.38	+1.76	......	22.08
	6932	30.770	27.1	28.8						
	6941	10.101	27.5	28.6		41 11 35.67	—13 16.76	—0.65	......	18.26
	6966	32.522	30.7	25.5						
	6976	6.464	25.3	31.0		40 41 35.56	+16 44.49	—0.12	.....	19.93
	7158	33.314	33.3	24.1						
	7174	7.683	32.1	25.1		40 41 52.71	+16 28.01	+3.75	......	24.47
	7188	18.400	27.6	30.1						
	7215	18.331	29.8	27.3		40 58 18.18	+ 0 02.66	—0.14	......	20.70
	7361	16.587	26.0	31.5						
	7377	20.486	31.3	26.1		41 00 50.66	— 2 30.30	—0.07	......	20.29
	7417	16.930	29.9	27.4						
	7437	22.900	26.1	31.2		40 54 29.85	+ 3 50.14	—0.66	......	19.33
	7453	19.166	30.1	27.0						
	7469	21.000	25.8	31.3		40 59 32.53	— 1 10.70	—0.56	......	58 21.27
July 29	5131	20.521	17.9	22.7						
	5164	20.393	22.4	18.0		40 57 24.50	+ 0 04.93	—0.09	......	57 29.34
	5515	12.280	26.0	20.0						
	5535	25.417	24.0	22.0		41 06 46.16	— 8 26.41	+0.93	+0.21	58 20.89
	6013	5.887	23.0	23.7						
	6082	30.702	23.1	24.0		40 42 22.47	+15 56.56	—0.37	......	18.66
	6162	24.416	26.1	21.1						
	6193	12.948	22.0	26.0		41 05 40.97	— 7 22.07	+0.23	......	19.13
	6224	28.417	23.0	25.8						
	6245	20.137	21.8	27.3		41 03 37.52	— 5 19.18	—1.92	......	16.42
	6289	27.263	28.0	22.0						
	6322	12.772	25.0	25.5		41 07 36.82	— 9 18.61	+1.27	+0.01	19.49
	6364	15.710	24.7	26.8						
	6404	24.328	38.7	13.2		41 03 52.20	— 5 32.20	+5.40	......	25.40
	6476	3.543	28.8	23.9						
	6491	37.301	24.2	28.2		40 36 36.90	+21 41.30	+0.21	+0.08	18.49
	6553	20.857	26.7	26.2						
	6579	19.953	38.5	15.0		40 57 45.21	+ 0 34.85	+5.56	......	25.62
	6642	13.541	25.1	29.0						
	6662	23.823	40.2	13.0		41 04 55.08	— 6 36.36	+1.23	......	40 58 19.95

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
July 29	6673	34.570	27.0	27.1						
	6687	2.500	29.8	24.6		40 37 48.48	+20 36.24	+ 1.18	......	40 58 19.00
	6698	16.398	25.3	28.6						
	6721	22.476	25.0	29.3		41 02 15.40	— 3 54.29	— 1.76	......	19.35
	6771	21.865	25.9	29.8						
	6779	18.526	33.0	22.7		40 56 10.19	+ 2 08.71	+ 1.48	......	20.38
	6810	31.066	26.2	29.7						
	6818	5.196	29.9	26.2		40 41 42.08	+16 37.25	+ 0.05	+0.02	19.40
	6830	29.396	32.9	23.2						
	6851	10.220	26.7	29.8		41 10 37.05	—12 19.19	+ 1.53	......	19.39
	6868	25.858	23.2	33.1						
	6905	11.538	42.0	15.0		40 49 08.21	+ 9 12.03	+ 3.96	......	24.20
	6932	30.402	32.2	25.0						
	6941	9.741	25.0	32.3		41 11 35.96	—13 16.45	— 0.02	......	19.49
	6966	32.006	26.0	31.3						
	6976	5.990	38.3	19.1		40 41 35.86	+16 42.87	+ 3.22	+0.21	22.16
July 30	6013	5.883	38.4	14.9						
	6082	30.720	37.9	16.1		40 42 22.68	+15 57.40	+11.64	......	31.72
	6162	23.935	25.9	28.0						
	6193	12.501	29.8	24.0		41 05 41.20	— 7 20.76	+ 0.86	......	21.30
	6224	28.672	35.9	17.9						
	6245	20.410	9.0	44.7		41 03 37.74	— 5 18.49	— 4.10	......	15.15
	6289	27.622	26.0	27.8						
	6322	13.150	28.0	25.9		41 07 37.05	— 9 17.88	+ 0.07	......	19.24
	6364	15.138	27.0	27.0						
	6404	23.752	26.3	28.0		41 03 52.46	— 5 32.05	— 0.39	......	20.02
	6476	2.927	26.0	29.1						
	6491	36.732	22.0	33.3		40 36 37.16	+21 43.11	— 3.32	......	16.95
	6553	20.437	23.8	32.1						
	6579	19.535	32.9	23.6		40 57 45.47	+ 0 34.77	+ 0.23	......	20.47
	6642	12.398	21.2	35.6						
	6662	22.674	45.6	11.3		41 04 55.34	— 6 36.13	+ 4.61	......	23.82
	6673	34.509	27.0	30.0						
	6687	2.470	52.5	4.0		40 37 42.76	+20 35.04	+10.53	......	28.33
	6698	16.550	27.9	29.1						
	6721	22.658	38.1	19.0		41 02 15.70	— 3 55.45	+ 4.14	......	24.39
	6810	32.188	24.6	33.3						
	6818	6.333	44.2	14.0		40 41 42.36	+16 36.68	+ 4.98	+0.06	40 58 24.08

Observations and computations—Continued.

WINNEMUCCA, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
July 30	6830	28.624	32.0	26.1						
	6851	9.478	23.9	34.2		41 10 37.34	−12 18.04	+1.02	......	40 58 20.33
	6868	26.973	26.9	30.8						
	6905	12.663	33.9	23.7		40 49 08.49	+ 9 11.64	+1.46	......	21.59
	6932	30.906	30.3	27.0						
	6941	10.225	27.7	29.3		41 11 36.24	−13 17.22	−0.39	......	18.63
	6966	31.768	25.8	31.1						
	6976	5.767	34.1	22.9		40 41 36.16	+16 42.29	+1.37	......	40 58 19.82

Discussion of latitude of Winnemucca, Nevada.

Number of pair.	Number of obs.	Mean level.	Latitude.	Corr. of microm. corr.	Resulting latitude.	Dates excluded.
		″	° ′ ″	″	° ′ ″	
1	1	− 0.1	40 57 32.34	0.00	40 57 32.34	
2	1	+ 0.9	58 20.89	+ 0.38	58 21.27	
3	3	− 0.6	19.44	− 0.72	18.72	July 30.
4	8	− 0.4	19.31	+ 0.33	19.64	
5	7	0.0	19.78	+ 0.24	20.02	July 30.
6	7	+ 0.5	19.15	+ 0.42	19.57	July 23.
7	4	+ 0.3	20.70	+ 0.25	20.95	July 15, 29.
8	6	− 1.5	18.42	− 0.98	17.44	
9	6	+ 0.3	20.54	− 0.03	20.51	July 23, 26, 29.
10	8	− 0.2	20.11	+ 0.29	20.40	July 28, 30.
11	9	+ 0.7	20.63	− 0.93	19.70	July 28, 30.
12	8	+ 0.4	20.74	+ 0.18	20.92	July 16, 26, 30.
13	9	+ 1.3	20.95	− 0.10	20.85	July 15.
14	8	− 0.3	19.74	− 0.75	18.99	July 16, 30.
15	6	− 0.5	18.17	+ 0.55	18.72	July 23, 25, 28.
16	9	0.0	21.34	− 0.41	20.93	July 19.
17	8	− 0.5	18.25	+ 0.59	18.84	July 15, 16, 23.
18	9	+ 0.4	19.65	− 0.76	18.89	July 16, 26.
19	4	+ 0.9	22.04	− 0.74	21.30	July 23, 24, 26.
20	6	− 0.8	21.98	0.00	21.98	July 23.
21	4	− 0.5	19.46	+ 0.11	19.57	July 15, 16.
22	5	− 1.3	19.34	− 0.18	19.16	July 16.
23	4	− 0.2	20.45	+ 0.05	20.50	July 15, 25.

Mean of 22 pairs, excluding pair 1	40° 58′ 19″.97
Sum of errors	20″.39
Probable error of 1 pair	± 0″.81
Probable error of result	± 0″.17
Omitting level corrections entirely:	
Approximate mean of 22 pairs	40° 58′ 20″.02
Sum of errors	15″.6
Probable error of 1 pair	± 0″.62
Probable error of result	± 0″.14

Excluded pairs at Winnemucca, Nevada.

Pair.	Date.	Result with level-correction.	Result without level-correction.	Correction of micrometer-correction.	Pair.	Date.	Result with level-correction.	Result without level-correction.	Correction of micrometer-correction.
		° ′ ″	° ′ ″	″			° ′ ″	° ′ ″	″
3	July 30	40 58 31.72	40 58 20.08	— 0.72	15	July 23	40 58 14.65	40 58 19.42	+ 0.55
5	July 30	15.15	19.25	+ 0.24		July 25	14.24	18.87	+ 0.55
6	July 23	16.55	20.76	+ 0.42		July 28	16.23	20.77	+ 0.55
7	July 15	20.59	15.93	+ 0.25	16	July 19	23.15	13.84	— 0.41
	July 29	25.40	20.00	+ 0.25	17	July 15	14.81	19.25	+ 0.59
9	July 23	15.59	10.87	— 0.03		July 16	17.49	22.75	+ 0.59
	July 26	25.70	19.24	— 0.03		July 23	30.58	21.27	+ 0.59
	July 29	25.62	20.06	— 0.03	18	July 16	18.81	23.02	— 0.76
10	July 28	23.65	21.77	+ 0.29		July 26	18.06	22.53	— 0.76
	July 30	23.82	19.21	+ 0.29	19	July 23	25.74	19.79	— 0.74
11	July 28	23.36	18.75	— 0.93		July 24	20.99	22.77	— 0.74
	July 30	28.33	17.80	— 0.93		July 26	26.49	20.63	— 0.74
12	July 16	22.09	18.04	+ 0.18	20	July 53	25.02	20.23	0.00
	July 26	21.78	26.71	+ 0.18	21	July 15	23.39	14.92	+ 0.11
	July 30	24.39	20.25	+ 0.18		July 16	19.21	26.22	+ 0.11
13	July 15	24.25	16.89	— 0.10	22	July 16	16.99	24.93	— 0.18
14	July 16	19.61	25.84	— 0.75	23	July 15	24.04	19.94	+ 0.05
	July 30	40 58 24.08	40 58 19.10	— 0.75		July 25	40 58 26.43	40 58 21.48	+ 0.05

REMARKS.

Mean of results *with* level correction of 36 observations .... 40° 58′ 21″.82
Sum of errors .... 142″.8
Probable error of one observation .... ± 3″.40
Probable error of result .... ± 0″.57
Mean of results *without* level correction of 36 observations .... 40° 58′ 20″.02
Sum of errors .... 83″.4
Probable error of one observation .... ± 1″.99
Probable error of result .... ± 0″.33
Mean of results, including correction to micrometer-correction ...... 40° 58′ 19″ 95
Sum of errors .... 84″.6
Probable error of one observation .... ± 2″.01
Probable error of result .... ± 0″.33

ASTRONOMICAL CO-ORDINATES OF WINNEMUCCA, NEVADA.

Longitude.. 7^h 50^m $55^s.611$ ± $0^s.015$ or 117° 43′ 54″.16 ± 0″.22 west from Greenwich.
2^h 42^m $43^s.491$ or 40° 40′ 52″.36 west from U. S. Naval Observatory, Washington, D. C.

Latitude.............................. 40° 58′ 19″.97 ± 0″.17 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY W. W. MARYATT AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF STATION AT VIRGINIA CITY, NEVADA.

SEASON OF 1873.

COMPUTATIONS BY

Prof. T. H. SAFFORD and JOHN H. CLARK.

VIRGINIA CITY, NEVADA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . 119° 39′ 06″.35 ± 0″.36 west from Greenwich.
Longitude, 42° 36′ 04″.55 west from U. S. Naval Observatory, Washington, D. C.
Latitude, . . 39° 17′ 35″.92 ± 0″.10 north.
Barometric altitude of observatory above sea-level, 6,339.0 feet.

The monument at this station is located on a prominent hill near the main road which connects Gold Hill and Virginia City, and in full view of both of these places. It is connected by triangulation with eight of the principal mountain peaks in the vicinity, and also to the stone monument on Mount Butler, and the flag-staff on Mount Davidson. Direct measurements have been made from it to the center of the air-shaft of the Imperial mine, which is 544.1 feet distant, and also to two prominent rocks near by. The first of these is 399.8 feet from the center of the monument in a direction north 48° 47′ east; the other is south 21° west, and 79 feet away. On account of the inconvenient conformation of the surrounding country, neither the north nor south meridian-mark could be established, but a due east line was found and marked.

METEOROLOGY—EXCHANGES—MISCELLANEOUS.

The weather was very good, and favorable for astronomical observations. An hourly meteorological record was kept, the results of which will be found in the report on meteorology.

Exchanges were made with Salt Lake City, John H. Clark, observer, on the nights of August 15, 18, 20, 25, 27, and 28. The observations for latitude were made by W. W. Maryatt on August 13, 16, 18, 22, 25, 27, 28, and 29. The notes of Mr. Maryatt were reduced by Prof. T. H. Safford. The methods of this reduction will be found in the reports on Green River

(1873) and Santa Fé (1873). The length of circuit from Virginia City to Salt Lake is about 675 miles.

Except on two nights, when the old "overland" wire was used, the route was by way of Diamond Springs and Corinne, at which stations there were repeaters. By the "overland" wire the circuit was independent of the Corinne repeater.

Other information in relation to this place is the same as given in the report on Green River.

Tabulation of stars used for determination of time.

Name of star.	VIRGINIA CITY, NEVADA.						SALT LAKE CITY, UTAH.					
	August 15.	August 18.	August 20.	August 25.	August 27.	August 28.	August 15.	August 18.	August 20.	August 25.	August 27.	August 28.
δ Ophiuchi	×	......	×	......	......	......	......	......	......	......	......	......
ε Ophiuchi	×	......	......	......	......	......	......	......	......	......	......	......
τ Herculis	×	......	......	......	......	×	......	......	......	......	......	......
α Scorpii	×	......	......	......	......	......	......	......	......	......	......	......
η Draconis	......	......	×	......	×	×	......	......	......	......	......	......
σ Herculis	......	......	×	......	×	......	......	......	......	......	......	......
η Herculis	×	×	×	......	×	×	......	......	......	......	......	......
Groombr. 2377	×	......	......	......	......	......	......	......	......	......	......	......
κ Ophiuchi	......	......	×	......	×	×	......	......	......	......	......	......
d Herculis	×	×	×	......	......	......	......	......	......	......	......	......
Groombr. 2415	×	......	......	......	......	......	......	......	......	......	......	......
α Herculis	×	×	×	×	×	×	×	......	×	......	......	......
π Herculis	......	......	......	×	×	×	......	......	......	......	......	......
ν Serpentis	......	......	......	......	......	......	×	×	......	......	......	......
44 Ophiuchi	×	×	×	×	×	×	......	......	......	......	......	......
Groombr. 966, S. P.	......	......	......	......	......	......	×	......	×	......	......	......
β Draconis	×	×	×	×	×	×	......	......	......	......	......	......
α Ophiuchi	......	......	......	......	......	×	×	×	×	......	......	......
f Draconis	......	......	......	×	......	......	......	......	......	......	......	......
ω Draconis	......	×	×	......	×	......	×	×	×	×	......	......
μ^1 Herculis	......	......	×	×	×	×	×	×	×	×	×	......
88 Herculis	......	......	......	......	......	......	......	......	×	×	×	×
89 Herculis	......	......	......	......	......	......	......	......	×	×	×	×
γ Draconis	......	×	......	......	×	×	×	×	×	×	×	×
γ Sagittarii	......	......	......	......	×	......	......	......	......	......	......	......
72 Ophiuchi	......	......	......	......	......	......	×	×	×	×	×	×
ο Herculis	......	×	......	......	×	×	......	......	......	......	......	......
u^1 Sagittarii	......	×	......	......	×	×	×	×	......	×	×	×
Groombr. 2533	......	×	......	......	×	×	......	......	......	......	......	......
η Serpentis	......	×	......	......	......	×	×	×	×	×	×	×
109 Herculis	......	......	......	×	×	×	......	......	......	......	......	......
Brad. 2313	......	......	......	......	......	......	×	×	×	×	×	×
τ Draconis	......	......	......	×	......	×	......	......	......	......	......	......
1 Aquilæ	......	......	......	×	×	×	×	×	......	×	×	×
α Lyræ	......	......	......	......	......	×	......	......	×	×	×	×
ε Lyræ	......	×	×	......	......	×	......	......	......	......	......	......
ζ^1 Lyræ	......	......	......	......	......	......	......	......	......	×	×	×
ζ^2 Lyræ	......	......	......	......	......	......	......	......	......	×	×	×
β Lyræ	......	......	×	......	......	......	......	......	......	×	×	×

Tabulation of stars used for determination of time—Continued.

Name of star.	Virginia City, Nevada. August 15.	August 18.	August 20.	August 25.	August 27.	August 28.	Salt Lake City, Utah. August 15.	August 18.	August 20.	August 25.	August 27.	August 28.
50 Draconis	......	......	×	......	......	......	......	......	......	×	×	×
ζ Aquilæ	......	×	×	......	......	......	......	......	......	......	......	......
ι Lyræ	......	×	×	×	......	......	......	......	......	......	......	......
d Sagittarii	......	......	×	......	......	......	......	......	......	......	......	......
δ Draconis	......	×	......	×	......	......	......	......	......	......	......	......
τ Draconis	......	......	×	×	......	......	......	......	×	......	......	......
α Vulpeculæ	......	......	......	......	......	......	......	......	×	......	......	......
β Cygni	......	×	×	×	×	......	......	......	......	......	......	......
μ Aquilæ	......	......	......	......	......	......	......	......	×	......	......	......
κ Aquilæ	......	×	......	×	......	×	......	......	×	......	......	......
θ Cygni	×	×	×	×	×	×	......	......	×	......	......	......
γ Aquilæ	......	×	×	×	×	×	......	......	×	......	......	......
α Aquilæ	......	×	×	×	×	×	......	......	×	......	......	......
ε Draconis	......	×	......	×	×	×	......	......	×	......	......	......
β Aquilæ	......	......	......	......	......	......	......	×	......	......	......	......
ψ Cygni	......	......	......	×	......	......	......	......	......	......	......	......
τ Aquilæ	×	......	......	×	......	......	......	......	......	......	......	......
θ Aquilæ	×	......	......	×	......	......	......	×	......	......	×	×
α^2 Capricorni	......	......	......	......	......	......	......	×	......	......	×	×
β Capricorni	......	......	......	......	......	......	......	......	......	......	×	×
γ Cygni	×	......	......	......	......	......	......	......	......	......	......	......
π Capricorni	×	......	......	......	......	......	......	×	......	......	×	×
ω Cygni	......	......	......	......	......	......	......	......	......	......	×	×
ε Delphini	×	......	......	......	......	......	......	×	......	......	×	×
Groombr. 3241	×	......	......	......	......	......	......	......	......	×	......	......
α Cygni	×	......	......	......	......	......	......	×	......	×	×	×
ε Aquarii	......	......	......	......	......	......	......	......	......	×	×	×
ε Cygni	×	......	......	......	......	......	......	......	......	......	......	......
μ Aquarii	×	......	......	......	......	......	......	×	......	×	×	×
ν Cygni	......	......	......	......	......	......	......	×	......	×	×	×
61 Cygni	......	......	......	......	......	......	......	......	......	×	......	......
ζ Cygni	......	......	......	......	......	......	......	......	......	×	......	......
α Cephei	......	......	......	......	......	......	......	......	......	×	......	......
β Aquarii	......	......	......	......	......	......	......	......	......	×	......	......

Observations and reductions for time taken at sending station.

VIRGINIA CITY, NEVADA, AUGUST 15, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
W.	δ Ophiuchi	16 08 24.22	+ 0.39	— 0.01	+ 0.20	16 08 24.80	16 07 42.96	— 41.84
W.	ε Ophiuchi	12 19.04	+ 0.39	— 0.01	+ 0.20	12 19.62	11 37.64	41.98
W.	τ Herculis	16 38.40	— 0.11	— 0.01	+ 0.29	16 38.57	15 56.71	41.86
W.	α Scorpii..........	22 20.34	+ 0.57	0.00	+ 0.22	22 21.13	21 39.12	42.01
W.	η Herculis	39 15.64	0.00	+ 0.00	+ 0.25	39 15.89	38 34.02	41.87
W.	Groombr. 2377...	43 36.94	— 0.32	+ 0.01	+ 0.36	43 36.99	42 54.89	42.10
E.	d Herculis	57 38.50	+ 0.07	+ 0.01	— 0.24	57 38.34	56 56.46	41.88
E.	Groombr. 2415...	17 04 21.92	— 0.02	+ 0.02	— 0.26	17 04 21.66	17 03 39.57	42.09
E.	α Herculis	09 34.98	+ 0.25	+ 0.02	— 0.20	09 35.05	08 53.10	41.95
E.	44 Ophiuchi	19 20.56	+ 0.55	+ 0.01	— 0.22	19 20.90	18 39.00	41.90
E.	β Draconis.......	17 29 17.86	— 0.21	+ 0.02	— 0.32	17 29 17.35	17 28 35.50	— 41.85

NORMAL EQUATIONS.

$a_0 = + 0^s.60 \qquad c_0 = - 0^s.14 \qquad \triangle T_0 = - 41^s.98$ (assumed rate = 0)

$0 = - 0.075 + 2.907\,da - 0.691\,dc + 3.073\,d\triangle T$	$da = - 0^s.034$	Weight of $a =$ 1.66
$0 = + 0.640 - 0.691\,da + 11.000\,dc - 0.820\,d\triangle T$	$dc = - 0^s.057$	$c = 10.83$
$0 = - 0.277 + 3.073\,da - 0.820\,dc + 7.574\,d\triangle T$	$d\triangle T = + 0^s.045$	$d\triangle T =$ 4.32

VIRGINIA CITY, NEVADA, AUGUST 15, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
E.	θ Cygni	19 33 46.74	— 0.14	— 0.03	— 0.13	19 33 46.44	19 33 04.30	— 42.14
E.	τ Aquilæ..........	58 40.22	+ 0.27	— 0.02	— 0.08	58 40.39	57 58.46	41.93
E.	θ Aquilæ..........	20 05 29.20	+ 0.32	— 0.04	— 0.08	20 05 29.40	20 04 47.51	41.89
E.	γ Cygni	18 24.66	— 0.02	— 0.14	— 0.11	18 24.39	17 42.50	41.89
E.	π Capricorni	21 47.38	+ 0.44	— 0.07	— 0.09	21 47.66	20 05.71	41.95
W.	ε Delphini	27 52.78	+ 0.24	— 0.12	+ 0.08	27 52.98	27 11.04	41.94
W.	Groombr. 3241...	31 18.44	— 0.87	— 0.41	+ 0.27	31 17.43	30 35.53	41.90
W.	α Cygni	38 50.46	— 0.07	— 0.12	+ 0.12	38 50.39	37 08.46	41.93
W.	ε Cygni	41 48.48	+ 0.06	— 0.06	+ 0.10	41 48.58	41 06.69	41.89
W.	μ Aquarii	20 46 32.32	+ 0.37	— 0.03	+ 0.08	20 46 32.74	20 45 50.69	— 42.05

NORMAL EQUATIONS.

$a_0 = + 0^s.60 \qquad c_0 = - 0^s.14 \qquad \triangle T_0 = - 41^s.98$ (assumed rate = 0)

$0 = + 0.126 + 2.564\,da + 1.059\,dc + 2.915\,d\triangle T$	$da = - 0^s.106$	Weight of $a = 1.30$
$0 = - 0.481 + 1.059\,da + 10.000\,dc + 0.534\,d\triangle T$	$dc = + 0^s.058$	$c = 9.44$
$0 = + 0.071 + 2.915\,da + 0.534\,dc + 7.115\,d\triangle T$	$d\triangle T = + 0^s.029$	$\triangle T = 3.75$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA CITY, NEVADA, AUGUST 18, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m s.*	*s.*
W.	η Herculis	16 38 49.48	+ 0.01	— 0.02	— 0.03	16 38 49.44	16 38 33.97	— 15.47
W.	d Herculis	57 12.06	— 0.04	— 0.02	— 0.03	57 12.05	56 56.40	15.65
W.	a Herculis	17 09 08.52	+ 0.14	— 0.01	— 0.03	17 09 08.62	17 08 53.06	15.56
W.	44 Ophiuchi........	18 54.34	+ 0.32	— 0.01	— 0.03	18 54.62	18 38.96	15.65
W.	β Draconis	27 51.08	— 0.12	— 0.02	— 0.04	27 50.90	27 35.42	15.48
W.	ω Draconis	38 59.46	— 0.44	— 0.03	— 0.07	38 58.92	37 43.53	15.39
E.	γ Draconis	53 56.98	— 0.11	— 0.01	+ 0.04	53 56.90	53 41.22	15.68
E.	o Herculis	18 02 52.58	+ 0.07	— 0.01	+ 0.03	18 02 52.67	18 02 37.11	15.56
E.	μ Sagittarii	06 27.44	+ 0.30	— 0.01	+ 0.03	06 27.76	06 12.37	15.39
E.	Groombr. 2533...	11 58.96	— 0.02	— 0.02	+ 0.04	11 58.96	11 43.35	15.61
E.	η Serpentis........	18 15 01.70	+ 0.22	— 0.01	+ 0.03	18 15 01.94	18 14 46.34	— 15.60

NORMAL EQUATIONS.

$a_0 = +0^s.34 \qquad c_0 = +0^s.05 \qquad \triangle T_0 = -15^s.56$ (assumed rate $= 0$)

$$0 = +0.062 + 2.065\,da + 0.773\,dc + 2.459\,d\triangle T \qquad da = -0^s.017 \qquad \text{Weight of } a = 1.62$$
$$0 = +0.271 + 0.773\,da + 11.000\,dc - 0.285\,d\triangle T \qquad dc = -0^s.023 \qquad c = 10.55$$
$$0 = +0.035 + 2.459\,da - 0.285\,dc + 7.140\,d\triangle T \qquad d\triangle T = 0^s.000 \qquad \triangle T = 4.68$$

VIRGINIA CITY, NEVADA, AUGUST 18, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
E.	ε Lyræ, pr	18 40 25.40	0.00	— 0.04	+ 0.16	18 40 25.52	18 40 09.80	— 15.72
E.	ζ Aquilæ..........	59 51.80	+ 0.19	— 0.04	+ 0.13	59 52.08	59 36.42	15.66
E.	ι Lyræ	19 03 03.60	+ 0.03	— 0.05	+ 0.15	19 03 03.73	19 02 48.24	15.49
E.	δ Draconis	12 49.32	— 0.52	— 0.12	+ 0.33	12 49.01	12 33.60	15.41
E.	β Cygni	25 53.48	+ 0.10	— 0.07	+ 0.14	25 53.65	25 38.11	15.54
W	κ Aquilæ..........	30 21.34	— 0.30	— 0.05	— 0.13	30 21.46	30 05.87	15.59
W.	θ Cygni...........	33 20.28	— 0.12	— 0.11	— 0.19	33 19.86	33 04.24	15.62
W.	γ Aquilæ..........	40 31.20	+ 0.21	— 0.07	— 0.13	40 31.21	40 15.56	15.65
W.	a Aquilæ..........	44 52.90	+ 0.22	— 0.07	— 0.13	44 52.92	44 37.50	15.42
W.	ε Draconis	19 48 55.18	— 0.63	— 0.19	— 0.36	19 48 54.00	19 48 38.29	— 15.71

NORMAL EQUATIONS.

$a_0 = +0^s.34 \qquad c_0 = +0^s.05 \qquad \triangle T_0 = -15^s.56$ (assnmed rate $= 0$)

$$0 = -0.045 + 1.771\,da - 0.812\,dc + 1.872\,d\triangle T \qquad da = +0^s.083 \qquad \text{Weight of } a = 1.18$$
$$0 = -0.689 - 0.812\,da + 10.000\,dc - 0.129\,d\triangle T \qquad dc = +0^s.075 \qquad c = 9.51$$
$$0 = -0.003 + 1.872\,da - 0.129\,dc + 6.588\,d\triangle T \qquad d\triangle T = -0^s.022 \qquad \triangle T = 4.55$$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA CITY, NEVADA, AUGUST 20, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
W.	δ Ophiuchi	16 07 59.40	+ 0.10	— 0.02	— 0.17	16 07 59.31	16 07 42.88	— 16.43
W.	η Draconis	22 34.48	— 0.12	— 0.02	— 0.36	22 33.98	22 17.75	16.23
W.	σ Herculis	30 18.46	— 0.01	— 0.04	— 0.23	30 18.18	30 01.86	16.32
W.	η Herculis	38 50.58	0.00	— 0.02	— 0.22	38 50.34	38 33.92	16.42
W.	κ Ophiuchi	51 57.52	+ 0.07	0.00	— 0.17	51 57.42	51 40.93	16.49
W.	d Herculis	57 13.14	+ 0.02	+ 0.01	— 0.20	57 12.97	56 56.36	16.61
E.	α Herculis	17 09 09.22	+ 0.06	+ 0.03	+ 0.17	17 09 09.48	17 08 53.03	16.45
E.	44 Ophiuchi	18 54.92	+ 0.14	+ 0.02	+ 0.19	18 55.27	18 38.93	16.34
E.	β Draconis	27 51.54	— 0.05	+ 0.09	+ 0.28	27 51.86	27 35.35	16.51
E.	ω Draconis	37 59.42	— 0.20	+ 0.14	+ 0.47	37 59.83	37 43.41	16.42
E.	μ Herculis	17 41 47.22	+ 0.03	+ 0.07	+ 0.19	17 41 47.51	17 41 30.99	— 16.52

NORMAL EQUATIONS.

$a_0 = +0^s.16 \qquad c_0 = +0^s.12 \qquad \Delta T_0 = -16^s.47 - 0^s.020\,(T - 18^h.1)$

$0 = +0^s.038 + 2.173\,da - 0.038\,dc + 2.102\,d\Delta T \qquad da = -0^s.014 \qquad$ Weight of $a = 1.53$

$0 = -0^s.546 - 0.038\,da + 11.000\,dc - 1.061\,d\Delta T \qquad dc = +0^s.049 \qquad c = 10.79$

$0 = +0^s.100 + 2.102\,da - 1.061\,dc + 7.080\,d\Delta T \qquad d\Delta T = -0^s.002 \qquad \Delta T = 4.95$

VIRGINIA CITY, NEVADA, AUGUST 20, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
E.	ε Lyræ, pr	18 40 25.84	0.00	+ 0.12	+ 0.18	18 40 26.14	18 40 09.77	— 16.37
E.	β Lyræ	45 41.46	+ 0.02	+ 0.13	+ 0.17	45 41.78	45 25.38	16.40
E.	50 Draconis	50 46.34	— 0.44	+ 0.41	+ 0.56	50 46.87	50 29.97	16.90
E.	ζ Aquilæ	59 52.58	+ 0.09	+ 0.15	+ 0.15	59 52.97	59 36.39	16.58
E.	ι Lyræ	19 03 04.30	+ 0.01	+ 0.21	+ 0.18	19 03 04.70	19 02 48.21	16.49
E.	d Sagittarii	10 30.84	+ 0.17	+ 0.08	+ 0.15	10 31.24	10 14.71	16.53
W.	τ Draconis	18 18.60	— 0.37	+ 0.28	— 0.49	18 18.02	18 01.50	16.52
W.	β Cygni	25 54.56	+ 0.04	+ 0.09	— 0.16	25 54.53	25 38.09	16.44
W.	θ Cygni	33 20.90	— 0.05	+ 0.11	— 0.22	33 20.74	33 04.21	16.53
W.	γ Aquilæ	40 32.14	+ 0.09	+ 0.06	— 0.14	40 32.15	40 15.54	16.61
W.	α Aquilæ	19 44 53.96	+ 0.10	+ 0.06	— 0.14	19 44 53.98	19 44 37.49	— 16.49

NORMAL EQUATIONS.

$a_0 = +0^s.16 \qquad c_0 = +0^s.12 \qquad \Delta T_0 = -16^s.47 - 0^s.020\,(T - 18^h.1)$

$0 = -0^s.052 + 2.154\,da + 0.402\,dc + 2.090\,d\Delta T \qquad da = +0^s.031 \qquad$ Weight of $a = 1.53$

$0 = -0^s.245 + 0.402\,da + 11.000\,dc + 0.796\,d\Delta T \qquad dc = +0^s.022 \qquad c = 10.89$

$0 = -0^s.005 + 2.090\,da + 0.796\,dc + 7.080\,d\Delta T \qquad d\Delta T = -0^s.011 \qquad \Delta T = 5.04$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA CITY, NEVADA, AUGUST 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T.′	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
W.	α Herculis	17 09 11.34	+ 0.10	+ 0.02	— 0.10	17 09 11.36	17 08 52.96	— 18.40
W.	π Herculis	10 57.36	+ 0.01	+ 0.02	— 0.12	10 57.27	10 38.93	18.34
W.	44 Ophiuchi	18 57.26	+ 0.23	+ 0.01	— 0.10	18 57.40	18 38.86	18.54
W.	β Draconis	27 53.74	— 0.09	+ 0.03	— 0.15	27 53.53	27 35.20	18.33
W.	f Draconis	32 48.30	— 0.30	+ 0.05	— 0.25	32 47.80	32 29.74	18.06
E.	μ Herculis	41 48.94	+ 0.05	+ 0.02	+ 0.11	41 49.12	41 30.90	18.22
E.	109 Herculis	18 18 37.16	+ 0.07	+ 0.02	+ 0.10	18 18 37.35	18 18 18.98	18.37
E.	b Draconis	22 23.40	— 0.15	+ 0.04	+ 0.18	22 23.47	22 04.86	18.61
E.	1 Aquilæ	18 28 37.88	+ 0.17	+ 0.01	+ 0.09	18 28 38.15	18 28 19.82	— 18.33

NORMAL EQUATIONS.

$a_0 = +0^s.17 \qquad c_0 = +0^s.03 \qquad \triangle T_0 = -18^s.31 + 0^s.050\,(T - 18^h.7)$

$$
\begin{array}{lll}
0 = -0^s.002 + 2.049\,da - 1.550\,dc + 1.950\,d\triangle T & da = +0^s.061 & \text{Weight of } a = 1.17 \\
0 = -0^s.477 - 1.550\,da + 9.000\,dc - 0.339\,d\triangle T & dc = +0^s.063 & c = 7.50 \\
0 = -0^s.025 + 1.950\,da - 0.339\,dc + 5.814\,d\triangle T & d\triangle T = -0^s.012 & \triangle T = 3.79
\end{array}
$$

VIRGINIA CITY, NEVADA, AUGUST 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
E.	ι Lyræ	19 03 06.24	+ 0.01	+ 0.01	+ 0.05	19 03 06.31	19 02 48.13	— 18.18
E.	δ Draconis	12 51.72	— 0.14	+ 0.01	+ 0.11	12 51.70	12 33.31	18.39
E.	τ Draconis	18 19.66	— 0.21	— 0.02	+ 0.15	18 19.58	18 01.21	18.37
E.	β Cygni	25 56.08	+ 0.02	— 0.02	+ 0.05	25 56.13	25 38.03	18.10
E.	κ Aquilæ	30 24.02	+ 0.08	— 0.01	+ 0.04	30 24.13	30 05.83	18.30
E.	θ Cygni	33 22.48	— 0.03	— 0.02	+ 0.07	33 22.50	33 04.12	18.38
W.	γ Aquilæ	40 33.66	+ 0.05	— 0.01	— 0.04	40 33.66	40 15.51	18.15
W.	α Aquilæ	44 55.68	+ 0.06	— 0.01	— 0.04	44 55.69	44 37.46	18.23
W.	ε Draconis	48 56.66	— 0.16	— 0.02	— 0.13	48 56.35	48 38.01	18.34
W.	ψ Cygni	52 41.18	— 0.04	— 0.01	— 0.07	52 41.06	52 22.86	18.20
W.	τ Aquilæ	58 16.68	+ 0.06	— 0.01	— 0.04	58 16.69	57 58.41	18.28
W.	θ Aquilæ	20 05 05.72	+ 0.07	0.00	— 0.04	20 05 05.75	20 04 47.47	— 18.28

NORMAL EQUATIONS.

$a_0 = +0^s.17 \qquad c_0 = +0^s.03 \qquad \triangle T_0 = -18^s.31 + 0^s.050\,(T - 18^h.7)$

$$
\begin{array}{lll}
0 = +0^s.124 + 2.652\,da - 1.675\,dc + 2.338\,d\triangle T & da = -0^s.060 & \text{Weight of } a = 1.76 \\
0 = -0^s.236 - 1.675\,da + 12.000\,dc - 0.917\,d\triangle T & dc = +0^s.013 & c = 10.88 \\
0 = -0^s.033 + 2.338\,da - 0.917\,dc + 7.495\,d\triangle T & d\triangle T = +0^s.025 & \triangle T = 5.40
\end{array}
$$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA, CITY, NEVADA, AUGUST 27, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*s.*
W.	η Draconis	16 22 35.76	— 0.22	— 0.12	— 0.04	16 22 35.38	16 22 17.43	— 17.95
W.	σ Herculis	30 20.26	— 0.02	— 0.08	— 0.03	30 20.13	30 01.68	18.45
W.	η Herculis	38 52.26	0.00	— 0.08	— 0.03	38 52.15	38 33.76	18.39
W.	κ Ophiuchi	51 59.24	+ 0.13	— 0.06	— 0.02	51 59.29	51 40.82	18.47
W.	α Herculis*	17 09 11.34	+ 0.12	— 0.06	— 0.02	17 09 11.38	17 08 52.92	[18.46]
W.	π Herculis	10 57.40	+ 0.01	— 0.09	— 0.03	10 57.29	10 38.88	18.41
E.	44 Ophiuchi	18 57.04	+ 0.26	— 0.04	+ 0.02	18 57.28	18 38.82	18.46
E.	β Draconis	27 53.78	— 0.10	— 0.12	+ 0.03	27 53.59	27 35.13	18.46
E.	ω Draconis	38 01.68	— 0.37	— 0.17	+ 0.06	38 01.20	37 43.00	18.20
E.	μ Herculis	41 49.30	+ 0.06	— 0.09	+ 0.02	41 49.29	41 30.86	18.43
E.	γ Draconis	53 59.56	— 0.09	— 0.14	+ 0.03	53 59.36	53 40.96	18.40
E.	γ Sagittarii	57 59.28	+ 0.29	— 0.04	+ 0.02	57 59.55	57 41.29	18.26
E.	ο Herculis	18 02 55.40	+ 0.06	— 0.11	+ 0.02	18 02 55.43	18 02 36.96	18.47
E.	μ Sagittarii	06 30.44	+ 0.25	— 0.05	+ 0.02	06 30.66	06 12.26	18.40
E.	Groombr. 2533	12 01.84	— 0.02	— 0.15	+ 0.03	12 01.70	11 43.15	18.55
E.	109 Herculis	18 37.42	+ 0.09	— 0.13	+ 0.02	18 37.40	18 18.95	18.45
E.	1 Aquilæ	28 38.18	+ 0.20	— 0.09	+ 0.02	28 38.31	28 19.80	18.51
W.	β Cygni	19 25 56.78	+ 0.06	— 0.24	— 0.02	19 25 56.58	19 25 38.01	18.51
W.	θ Cygni	33 23.08	— 0.08	— 0.35	— 0.03	33 22.62	33 04.07	18.55
W.	γ Aquilæ	40 34.12	+ 0.13	— 0.20	— 0.02	40 34.03	40 15.50	18.53
W.	α Aquilæ	44 55.98	+ 0.14	— 0.20	— 0.02	44 55.90	44 37.44	18.46
W.	ε Draconis	19 48 57.40	— 0.40	— 0.58	— 0.06	19 48 56.36	19 48 37.93	— 18.43

* Marked doubtful by Mr. Maryatt; rejected.

NORMAL EQUATIONS.

$a_0 = +0^s.14 \qquad c_0 = +0^s.06 \qquad \triangle T_0 = -18^s.42 - 0^s.030\,(T - 17^h.9)$

$$
\begin{array}{lll}
0 = -0.419 + 4.716\,da + 2.547\,dc + 4.464\,d\triangle T & da = +0^s.128 & \text{Weight of } a = 3.01 \\
0 = +0.513 + 2.547\,da + 21.000\,dc + 1.109\,d\triangle T & dc = -0^s.039 & c = 19.44 \\
0 = -0.266 + 4.464\,da + 1.109\,dc + 13.520\,d\triangle T & d\triangle T = -0^s.020 & \triangle T = 9.21
\end{array}
$$

Observations and reductions for time taken at sending station—Continued.

VIRGINIA CITY, NEVADA, AUGUST 28, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	s.
W.	τ Herculis	16 16 15.24	− 0.02	− 0.01	− 0.12	16 16 15.09	16 15 56.20	− 18.89
W.	η Draconis	22 36.06	− 0.09	− 0.01	− 0.17	22 35.79	22 17.39	18.40
W.	η Herculis	38 52.56	0.00	+ 0.02	− 0.10	38 52.48	38 33.73	18.75
W.	κ Ophiuchi	51 59.72	+ 0.06	+ 0.03	− 0.08	51 59.73	51 40.80	18.93
W.	θ Herculis	17 09 11.70	+ 0.05	+ 0.04	− 0.08	17 09 11.71	17 08 52.90	18.81
W.	π Herculis	10 57.56	+ 0.01	+ 0.09	− 0.10	10 57.56	10 38.85	18.71
E.	44 Ophiuchi	18 57.30	+ 0.11	+ 0.02	+ 0.09	18 57.52	18 38.81	18.71
E.	β Draconis	27 53.70	− 0.04	+ 0.08	+ 0.13	27 53.87	27 35.10	18.77
E.	α Ophiuchi	29 22.54	+ 0.05	+ 0.04	+ 0.08	29 22.71	29 03.95	18.76
E.	μ Herculis	41 49.30	+ 0.03	+ 0.06	+ 0.09	41 49.48	41 30.84	18.64
E.	γ Draconis	53 59.60	− 0.04	+ 0.09	+ 0.13	53 59.78	53 40.93	18.85
E.	o Herculis	18 02 55.50	+ 0.02	+ 0.08	+ 0.09	18 02 55.69	18 02 36.94	18.75
E.	μ Sagittarii	06 30.80	+ 0.11	+ 0.04	+ 0.08	06 31.03	06 12.25	18.78
E.	Groombr. 2533...	12 01.94	− 0.01	+ 0.10	+ 0.11	12 02.14	11 43.13	19.01
E.	η Serpentis	15 04.80	+ 0.08	+ 0.06	+ 0.08	15 05.02	14 46.23	18.79
E.	109 Herculis	18 37.52	+ 0.04	+ 0.08	+ 0.09	18 37.73	18 18.93	18.80
E.	b Draconis	22 23.50	− 0.07	+ 0.14	+ 0.15	22 23.72	22 04.75	18.97
E.	1 Aquilæ	28 38.50	+ 0.09	+ 0.05	+ 0.08	28 38.72	28 19.79	18.93
E.	α Lyræ	32 58.52	0.00	+ 0.09	+ 0.08	32 58.69	32 40.03	18.66
E.	ε Lyræ	40 28.26	0.00	+ 0.09	+ 0.10	40 28.45	40 09.61	18.84
W.	κ Aquilæ	19 30 24.62	+ 0.08	+ 0.02	− 0.08	19 30 24.64	19 30 05.81	18.83
W.	θ Cygni	33 23.08	− 0.03	+ 0.05	− 0.12	33 22.98	33 04.05	18.93
W.	γ Aquilæ	40 34.26	+ 0.06	+ 0.03	− 0.08	40 34.27	40 15.49	18.78
W.	α Aquilæ	44 56.24	+ 0.06	+ 0.03	− 0.08	44 56.25	44 37.44	18.81
W.	ε Draconis	19 48 57.08	− 0.17	+ 0.08	− 0.23	19 48 56.76	19 48 37.88	− 18.88

NORMAL EQUATIONS.

$a_0 = +0^s.06 \qquad c_0 = 0 \qquad \triangle T_0 = -18^s.80 - 0^s.030(T - 18^h.0)$

$0 = -0^s.447 + 5.032\,da + 2.017\,dc + 5.679\,d\triangle T \qquad da = +0^s.056 \qquad \text{Weight of } a = 3.11$

$0 = -2^s.102 + 2.017\,da + 25.000\,dc + 2.906\,d\triangle T \qquad dc = +0^s.079 \qquad c = 24.15$

$0 = -0^s.564 + 5.679\,da + 2.906\,dc + 17.136\,d\triangle T \qquad d\triangle T = +0^s.001 \qquad \triangle T = 10.71$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 20, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	α^1 Herculis	9 01 47.71	— 0.68	— 0.15	— 0.09	9 01 46.79	17 08 53.02	+ 8 07 6.23
W.	Groom. 966, S. P.	15 44.77	— 5.14	+ 0.27	+ 0.35	15 40.25	5 22 46.52	6.27
W.	α Ophiuchi	21 58.84	— 0.71	— 0.14	— 0.09	21 57.90	17 29 04.07	6.17
W.	ω Draconis	30 36.00	+ 1.92	— 0.42	— 0.25	30 37.25	37 43.50	6.25
W.	μ Herculis	34 25.43	— 0.37	— 0.19	— 0.10	34 24.77	41 31.00	6.23
W.	88 Herculis	39 39.72	+ 0.30	— 0.25	— 0.14	39 39.63	46 45.72	6.09
W.	89 Herculis	43 14.02	— 0.41	— 0.18	— 0.10	43 13.33	50 19.53	6.20
W.	γ Draconis	46 34.74	+ 0.44	— 0.27	— 0.14	46 34.77	53 41.27	6.50
E.	72 Ophiuchi	54 15.99	— 0.78	— 0.09	+ 0.09	54 15.21	18 01 21.59	6.38
E.	η Serpentis	57 41.03	— 1.02	— 0.07	+ 0.09	57 40.03	04 46.28	6.25
E.	Brad. 2313	10 14 54.73	— 1.26	— 0.03	+ 0.09	10 14 53.53	21 59.75	6.22
E.	α Lyræ	10 25 33.72	— 0.07	+ 0.05	+ 0.12	10 25 33.82	18 32 40.18	+ 8 07 6.36
	Mean at $18^h.0$ local sidereal time							+ 8 07 6.26

NORMAL EQUATIONS.

$$
\begin{aligned}
+ 12.00\,\delta t + 5.26\,a - 2.01\,c &= - 4.80 & \delta t &= + 0^s.26 \\
+ 5.26\,\delta t + 15.92\,a + 18.37\,c &= - 20.59 & a &= - 1^s.479 \\
- 2.01\,\delta t + 18.37\,a + 36.72\,c &= - 24.48 & c &= + 0^s.088
\end{aligned}
$$

SALT LAKE CITY, UTAH, AUGUST 20, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	τ Dracouis	11 10 51.18	+ 3.68	— 0.15	+ 0.61	11 10 55.32	19 18 01.57	+ 8 07 6.25
E.	α Vulpeculæ	16 21.54	— 0.62	— 0.08	+ 0.20	16 21.04	23 27.35	6.31
E.	μ Aquilæ	20 49.89	— 1.12	— 0.10	+ 0.18	20 48.85	27 55.30	6.45
E.	κ Aquilæ	23 00.89	— 1.50	— 0.10	+ 0.18	22 59.47	30 05.86	6.39
E.	θ Cygni	25 57.18	+ 0.50	— 0.31	+ 0.28	25 57.65	33 04.27	6.62
W.	γ Aquilæ	33 10.36	— 1.04	— 0.17	— 0.18	33 08.97	40 15.53	6.56
W.	α Aquilæ	37 32.32	— 1.08	— 0.16	— 0.18	37 30.90	44 37.46	6.56
W.	ϵ Draconis	11 41 30.07	+ 2.84	— 0.47	— 0.52	11 41 31.92	19 48 38.12	+ 8 07 6.20
	Mean at $19^h.5$ local sidereal time							+ 8 07 6.42

NORMAL EQUATIONS.

$$
\begin{aligned}
+ 8.00\,\delta t - 0.83\,a + 3.17\,c &= + 5.57 & \delta t &= + 0^s.42 \\
+ 0.83\,\delta t + 7.09\,a - 1.99\,c &= - 14.00 & a &= - 1^s.999 \\
+ 3.17\,\delta t - 1.99\,a + 28.14\,c &= + 10.29 & c &= + 0.^s178
\end{aligned}
$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 27, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	μ Herculis	9 34 27.32	− 0.41	+ 0.05	− 0.17	9 34 26.79	17 41 30.87	+8 07 04.08
W.	88 Herculis	39 41.34	+ 0.32	+ 0.08	− 0.22	39 41.52	46 45.53	04.01
W.	89 Herculis	43 16.05	− 0.45	+ 0.08	− 0.17	43 15.51	50 19.42	03.91
W.	γ Draconis	46 36.47	+ 0.49	+ 0.16	− 0.24	46 36.88	53 41.06	04.18
W.	72 Ophiuchi	54 18.44	− 0.86	+ 0.09	− 0.15	54 17.52	18 01 21.54	04.02
W.	μ Sagittarii	59 09.94	− 1.54	+ 0.06	− 0.16	59 08.30	06 12.26	03.96
E.	η Serpentis	10 07 43.06	− 1.12	+ 0.08	+ 0.15	10 07 42.17	14 46.19	04.02
E.	Brad. 2313	14 56.84	− 1.38	+ 0.06	+ 0.15	14 55.67	21 59.67	04.00
E.	1 Aquilæ	21 16.78	− 1.23	+ 0.08	+ 0.15	21 15.78	28 19.80	04.02
E.	α Lyræ	25 35.59	− 0.08	+ 0.18	+ 0.19	25 35.88	32 40.06	04.18
E.	ζ^1 Lyræ	33 21.22	− 0.11	+ 0.20	+ 0.19	33 21.50	40 25.70	04.20
E.	ζ^2 Lyræ	33 23.08	− 0.11	+ 0.23	+ 0.19	33 23.39	40 27.54	04.15
E.	β Lyræ	38 21.03	− 0.26	+ 0.22	+ 0.19	38 21.18	45 25.28	04.10
E.	50 Draconis	10 43 20.71	+ 3.61	+ 0.61	+ 0.59	10 43 25.52	18 50 29.46	+8 07 03.94
	Mean at $18^h.3$ local sidereal time							+8 07 04.06

NORMAL EQUATIONS.

$$+14.00\,\delta t + 1.93\,a + 4.55\,c = -\ 1.67 \qquad \delta t = +0^s.06$$
$$+\ 1.93\,\delta t + 8.24\,a - 7.40\,c = -14.35 \qquad a = -1^s.620$$
$$+\ 4.55\,\delta t - 7.40\,a + 34.42\,c = +17.42 \qquad c = +6^s.149$$

SALT LAKE CITY, UTAH, AUGUST 27, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	θ Aquilæ	11 57 44.17	− 1.20	+ 0.05	+ 0.21	11 57 41.23	20 04 47.44	+8 07 04.21
E.	α Capricorni	12 03 59.96	− 1.49	+ 0.04	+ 0.21	12 03 58.72	11 02.96	04.24
E.	β Capricorni	06 52.14	− 1.55	+ 0.04	+ 0.21	06 50.84	13 55.04	04.20
E.	π Capricorni	13 02.89	− 1.64	+ 0.04	+ 0.22	13 01.51	20 05.69	04.18
E.	ω Cygni	16 06.60	+ 0.40	+ 0.12	+ 0.31	16 07.43	23 11.62	04.19
E.	ε Delphini	20 07.43	− 0.92	+ 0.07	+ 0.21	20 06.79	27 11.01	04.22
W.	α Cygni	30 04.12	+ 0.16	+ 0.07	− 0.29	30 04.06	37 08.38	04.32
W.	ε Aquarii	33 47.90	− 1.42	+ 0.02	− 0.21	33 46.29	40 50.54	04.25
W.	μ Aquarii	38 48.24	− 1.40	+ 0.00	− 0.21	38 46.63	45 50.70	04.07
W.	ν Cygni	12 45 24.70	− 0.00	+ 0.00	− 0.27	12 45 24.43	20 52 28.58	+8 07 04.15
	Mean at $20^h.5$ local sidereal time							+8 07 04.20

NORMAL EQUATIONS.

$$+10.00\,\delta t + 5.04\,a + 1.91\,c = -6.64 \qquad \delta t = +0^s.20$$
$$+\ 5.04\,\delta t + 4.26\,a + 2.09\,c = -6.25 \qquad a = -1^s.796$$
$$+\ 1.91\,\delta t + 2.09\,a + 13.40\,c = -0.62 \qquad c = +0^s.206$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 28, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s*	*h. m. s.*	*h. m. s.*
W.	88 Herculis	9 39 41.30	+ 0.28	+ 0.10	− 0.25	9 39 41.43	17 46 45.50	+8 07 04.07
W.	89 Herculis	43 16.02	− 0.50	+ 0.07	− 0.18	43 15.41	50 19.40	03.99
W.	γ Draconis	46 36.45	+ 0.53	+ 0.11	− 0.27	46 36.82	53 41.03	04.21
W.	72 Ophiuchi	54 18.53	− 0.94	+ 0.06	− 0.17	54 17.48	18 01 21.53	04.05
W.	μ^1 Sagittarii	59 10.02	− 1.69	+ 0.04	− 0.18	59 08.19	06 12.25	04.06
W.	η Serpentis	10 07 43.17	− 1.23	+ 0.05	+ 0.17	10 07 42.16	14 46.18	04.02
W.	Brad. 2313	14 56.94	− 1.51	+ 0.04	+ 0.17	14 55.64	21 59.66	04.02
W.	1 Aquilæ	21 16.91	− 1.35	+ 0.05	+ 0.17	21 15.78	28 19.79	04.01
W.	α Lyræ	25 35.66	− 0.09	+ 0.09	+ 0.21	25 35.87	32 40.04	04.17
W.	ζ^1 Lyræ	33 21.41	− 0.12	+ 0.09	+ 0.21	33 21.59	40 25.67	04.08
W.	ζ^2 Lyræ	33 23.18	− 0.12	+ 0.09	+ 0.21	33 23.33	40 27.52	04.16
W.	β Lyræ	38 21.02	− 0.28	+ 0.08	+ 0.20	38 21.02	45 25.26	04.24
W.	50 Draconis	10 43 20.54	+ 3.97	+ 0.22	+ 0.65	10 43 25.38	18 50 29.38	+8 07 04.00
	Mean at 18h.0 local sidereal time							+8 07 04.08

NORMAL EQUATIONS.

$$+13.00\,\delta t + 1.68\,a + 5.68\,c = -1.03 \qquad \delta t = +0^s.08$$
$$+1.68\,\delta t + 8.18\,a - 7.10\,c = -15.59 \qquad a = -1^s.780$$
$$+5.68\,\delta t - 7.10\,a + 33.14\,c = +18.55 \qquad c = +0^s.166$$

SALT LAKE CITY, UTAH, AUGUST 28, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	θ Aquilæ	11 57 44.36	− 1.25	+ 0.04	+ 0.20	11 57 43.35	20 04 47.43	+8 07 04.08
E.	α^2 Capricorni	12 04 00.09	− 1.55	+ 0.03	+ 0.20	12 03 58.77	11 02.95	04.18
E.	β Capricorni	06 52.40	− 1.61	+ 0.03	+ 0.20	06 51.02	13 55.04	04.02
E.	π Capricorni	13 03.08	− 1.70	+ 0.03	+ 0.21	13 01.52	20 05.69	04.07
E.	ω Cygni	16 06.66	+ 0.41	+ 0.08	+ 0.30	16 07.45	23 11.61	04.16
E.	ε Delphini	20 07.55	− 0.95	+ 0.04	+ 0.20	20 06.84	27 11.00	04.16
W.	α Cygni	30 04.14	+ 0.17	+ 0.12	− 0.27	30 04.16	37 08.37	04.21
W.	ε Aquarii	33 47.99	− 1.48	+ 0.08	− 0.20	33 46.39	40 50.54	04.15
W.	μ Aquarii	38 48.24	− 1.46	+ 0.06	− 0.20	38 46.64	45 50.70	04.06
W.	ν Cygni	12 45 24.71	− 0.00	+ 0.10	− 0.26	12 45 24.55	20 52 28.57	+8 07 04.02
	Mean at 20h.5 local sidereal time							+8 07 04.11

NORMAL EQUATIONS.

$$+10.00\,\delta t + 5.04\,a + 1.91\,c = -7.93 \qquad \delta t = +0^s.11$$
$$+5.04\,\delta t + 4.26\,a + 2.09\,c = -7.07 \qquad a = -1^s.871$$
$$+1.91\,\delta t + 2.09\,a + 13.40\,c = -1.07 \qquad c = +0^s.195$$

NOTE.—The observations taken at Salt Lake City August 15 and 18 are printed in the report on Fort Union; those of August 25 in the report on Labran.

The following tables give the corrections and rates of the chronometers used at Virginia City and Salt Lake City:

CHRONOMETER AT VIRGINIA CITY.—NEGUS, No. 1499.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*s.* *s.*	*s.*
Aug. 15	18.5	— 41.943 ± 0.019	0.000
Aug. 18	18.5	— 15.571 ± 0.018	0.000
Aug. 20	18.1	— 16.476 ± 0.017	— 0.020
Aug. 25	18.7	— 18.304 ± 0.018	+ 0.050
Aug. 27	17.9	— 18.440 ± 0.017	— 0.030
Aug. 28	18.0	— 18.799 ± 0.016	— 0.030

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*h.* *m.* *s.*	*s.*
Aug. 15	18.0	+ 8 07 06.40	— 0.011
Aug. 18	18.75	05.90	+ 0.003
Aug. 20	18.75	06.34	+ 0.002
Aug. 25	19.5	04.37	— 0.008
Aug. 27	19.4	04.13	— 0.003
Aug. 28	19.5	+ 8 07 04.10	0.000

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. m. s.	*h. m. s.*	*h. m. s.*	*m. s.*		*m. s.*
August 15, 1873:							
Salt Lake City.	Salt Lake City.	10 59 16.69	+ 8 07 06.39	19 06 23.08			
	Virginia City..	18 36 03.43	— 0 00 41.94	18 35 21.49	31 01.59		
Virginia City..	Salt Lake City.	11 04 43.63	+ 8 07 06.39	19 11 50.02			
	Virginia City..	18 41 30.24	— 0 00 41.94	18 40 48.30	31 01.72	....	31 01.655
August 18, 1873:							
Salt Lake City.	Salt Lake City.	10 46 28.69	+ 8 07 05.90	18 53 34.59			
	Virginia City..	18 22 48.73	— 0 00 15.57	18 22 33.16	31 01.43		
Virginia City..	Salt Lake City.	10 52 40.30	+ 8 07 05.90	18 59 46.20			
	Virginia City..	18 29 00.27	— 0 00 15.57	18 28 44.70	31 01.50	....	31 01.465
August 20, 1873:							
Salt Lake City.	Salt Lake City.	10 39 59.09	+ 8 07 06.34	18 47 05.43			
	Virginia City..	18 16 20.52	— 0 00 16.48	18 16 04.04	31 01.39		
Virginia City..	Salt Lake City.	10 50 38.60	+ 8 07 06.34	8 57 44.94			
	Virginia City..	18 26 59.82	— 0 00 16.48	18 26 43.34	31 01.60	....	31 01.495
August 25, 1873:							
Salt Lake City.	Salt Lake City.	11 07 48.10	+ 8 07 04.37	19 14 52.47			
	Virginia City..	18 44 09.32	— 0 00 18.30	18 43 51.02	31 01.45		
Virginia City..	Salt Lake City.	11 13 38.97	+ 8 07 04.37	19 20 43.34			
	Virginia City..	18 49 59.96	— 0 00 18.29	18 49 41.67	31 01.67	....	31 01.560
August 27, 1873:							
Salt Lake City.	Salt Lake City.	11 34 20.90	+ 8 07 04.13	19 41 25.03			
	Virginia City..	19 10 42.01	— 0 00 18.48	19 10 23.53	31 01.50		
Virginia City..	Salt Lake City.	11 40 08.93	+ 8 07 04.13	19 47 13.06			
	Virginia City..	19 16 29.97	— 0 00 18.48	19 16 11.49	31 01.57	....	31 01.535
August 28, 1873:							
Salt Lake City.	Salt Lake City.	11 34 06.19	+ 8 07 04.10	19 41 10.29			
	Virginia City..	19 10 27.46	— 0 00 18.84	19 10 08.62	31 01.67		
Virginia City..	Salt Lake City.	11 39 48.68	+ 8 07 04.10	19 46 52.78			
	Virginia City..	19 16 09.95	— 0 00 18.84	19 15 51.11	31 01.67	....	31 01.670

Virginia City west of Salt Lake City .... $0^h\ 31^m\ 01^s.563 \pm 0^s.025$ (by sums of errors).
$\pm 0^s.023$ (by sums of squares).

Salt Lake City west of Greenwich .... $7^h\ 27^m\ 34^s.86$.
Virginia City west of Greenwich........................ $7^h\ 58^m\ 36^s.423$, or $119^\circ\ 39'\ 06''.35$.
Virginia City west of Washington .... $2^h\ 50^m\ 24^s.303$, or $42^\circ\ 36'\ 04''.55$.

Mean places of stars for 1873.0 used for determination of latitude of Virginia City, Nevada.

No. of pair.	No. in B. A. C.	Right ascension.	Declination.	No. of pair.	No. in B. A. C.	Right ascension.	Declination.
		h. m. s.	° ′ ″			*h. m. s.*	° ′ ″
1	6021	17 41 29	27 47 47.24	20	6986	20 12 24	39 58 22.84
	6052	46 02	50 48 42.76		7001	14 20	38 36 27.10
2	6087	17 53 39	30 12 04.70	21	7008	20 15 39	39 00 13.62
	6129	59 50	48 27 33.02		7022	17 40	39 51 04.58
3	6185	18 07 56	54 14 56.46	22	7062	20 23 09	48 57 46.08
	6223	13 57	24 23 41.64		7067	24 12	29 56 45.58
4	6238	18 16 04	28 48 40.10	23	7164	20 35 54	31 51 23.90
	6252	17 56	49 39 50.26		7198	40 25	46 50 12.56
5	6349	18 31 07	38 47 32.54	24	7218	20 42 40	52 32 13.18
	6357	33 55	39 33 26.28		7246	46 42	26 37 21.94
6	6355	18 32 38	38 40 00.02	25	7277	20 52 26	40 40 44.48
	6390	40 08	39 32 18.98		7320	58 09	38 09 23.70
7	6404	18 42 09	41 18 23.16	26	7368	21 07 32	29 42 25.30
	6456	49 17	36 48 50.68		7411	15 06	48 58 25.82
8	6466	18 50 04	36 44 19.10	27	7450	21 20 33	18 49 34.90
	6473	50 48	41 26 28.68		7476	23 55	59 11 52.84
9	6497	18 55 13	31 58 08.16	28	7495	21 27 29	59 53 59.14
	6520	57 51	46 45 20.56		7520	31 49	18 44 54.76
10	6547	19 01 35	28 25 48.64	*29	7559	21 37 16	40 29 53.02
	6566	05 19	50 09 34.52		7566	38 10	37 42 10.92
11	6581	19 09 26	38 55 43.64	30	7598	21 42 06	48 43 20.68
	6624	14 43	40 07 38.44		7607	44 14	29 35 01.76
12	6656	19 19 56	43 08 30.58	31	7695	21 59 54	46 37 01.26
	6667	21 35	36 03 52.02		7721	22 03 36	32 33 10.36
13	6681	19 23 29	57 46 18.90	32	7742	22 05 43	15 24 56.48
	6695	26 31	20 39 39.60		7775	09 50	62 31 57.04
14	6718	19 30 33	42 08 08.36	33	8128	23 13 50	41 22 59.44
	6722	31 15	36 39 50.42		8136	14 46	37 29 21.22
15	6741	19 34 25	49 55 39.90	34	8195	23 25 03	38 32 19.46
	6740	34 22	29 51 42.58		8212	28 25	39 32 11.84
16	6754	19 36 55	45 13 29.92	35	8231	23 32 59	49 46 07.08
	6784	41 36	33 26 00.74		8256	37 36	28 39 29.74
17	6817	19 46 16	40 16 40.06	36	8284	23 43 14	28 08 08.52
	6849	51 19	38 09 01.08		8307	47 12	50 48 57.16
18	6896	19 58 13	16 45 56.90	37	8326	23 51 42	49 43 54.96
	6932	20 03 31	61 37 37.32		8374	0 00 01	28 19 14.46
19	6959	20 09 00	51 04 56.40				
	6973	10 30	27 25 33.24				

* Instead of B. A. C. 7566 the star Rümeker 9430 was twice used by accident; its position from the catalogue of 981 stars is AR = $21^h\ 38^m\ 21^s$, declination = 37° 43′ 28″.80. It is a well-determined star. The pair B. A. C. 7559 and Rümeker 9430 is designated as 29^a.

The pair formed from 6456 B. A. C. (pair 7), and 6473 B. A. C. (pair 8), is denoted by 7^a.

Observations and computations for latitude.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
August 13	6547	20.668	27.0	10.7						
	6566	20.986	15.0	22.7		39 17 49.21	— 0 12.26	+ 1.99	....	39 17 38.94
	6581	13.785	20.6	20.3						
	6624	35.880	12.8	28.3		31 48.88	— 14 11.71	— 3.52	....	33.65
	6656	35.670	29.0	29.8						
	6667	6.633	22.4	35.3		36 19.07	— 18 39.31	— 3.17	....	36.59
	6681	16.950	29.7	29.0						
	6695	24.002	22.3	35.1		13 06.44	+ 4 31.84	— 2.80	....	35.48
	6718	23.035	31.2	27.0						
	6722	12.850	22.0	36.2		24 07.08	— 6 32.61	— 2.31	....	32.16
	6754	24.629	31.5	26.7						
	6777	21.043	23.4	35.0		19 52.84	— 2 18.23	— 1.57	....	33.04
	6817	14.350	32.9	25.6						
	6849	21.542	31.7	26.8		12 58.14	+ 4 37.23	+ 2.82	....	38.19
	6896	25.043	28.0	30.3						
	6932	16.174	30.5	28.1		11 53.85	+ 5 41.89	+ 0.02	....	35.76
	6959	17.882	29.0	29.8						
	6973	21.335	34.5	24.2		15 22.06	+ 2 13.12	+ 2.20	....	37.38
	6986	28.657	25.1	33.4						
	7001	28.771	33.6	25.0		17 32.34	+ 0 04.39	+ 0.07	....	36.80
	7008	10.235	34.0	24.7						
	7022	22.977	24.0	34.7		25 46.46	— 8 11.17	— 0.32	....	34.97
	7062	28.794	29.0	29.8						
	7067	13.623	25.0	33.8		27 23.02	— 9 44.81	— 2.22	....	35.99
	7164	19.711	28.4	30.3						
	7198	24.914	34.3	24.8		20 55.30	— 3 20.56	+ 1.76	....	36.50
	7218	34.484	29.0	30.0						
	7246	7.698	30.3	28.7		34 47.92	— 17 12.55	+ 0.14	....	35.51
	7277	26.445	27.2	31.8						
	7320	14.670	30.4	28.7		25 11.08	— 7 33.90	— 0.67	....	36.51
	7368	22.717	33.2	25.3						
	7411	27.253	23.9	35.4		20 32.24	— 2 54.85	— 0.83	....	36.56
	7450	36.600	32.0	27.2						
	7476	10.567	27.9	31.2		00 50.25	+ 16 43.54	+ 0.35	....	34.14
	7495	20.311	29.6	29.4						
	7520	17.227	40.4	18.3		19 33.34	— 1 58.88	+ 5.16	....	39.62
	7559	15.847	31.0	28.0						
	7566	32.661	27.9	31.2		39 06 47.43	+ 10 48.14	— 0.07	....	39 17 35.50

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
1873. August 13	7598	15.359	32.2	26.8						
	7607	28.273	27.9	31.1		39 09 17.63	+ 8 17.81	+ 0.51	....	39 17 35.95
	7695	34.600	33.2	26.1						
	7721	7.183	23.9	36.0		39 35 11.98	− 17 36.86	− 1.16	....	33.96
	7742	32.912	32.7	26.9						
	7775	3.254	29.9	29.7		38 58 32.70	+ 19 03.29	+ 1.39	....	37.38
	8128	26.451	35.5	26.4						
	8136	32.943	17.9	44.0		39 26 15.55	− 8 40.70	− 3.73	....	31.12
	8195	35.651	30.0	31.3						
	8212	11.959	27.2	34.1		02 20.78	+ 15 13.27	− 1.90	......	32.15
	8231	16.941	30.1	31.0						
	8256	24.289	30.7	30.3		12 53.44	+ 4 43.25	− 0.12	....	36.57
	8284	10.973	26.5	34.3						
	8307	28.051	31.2	29.6		28 37.68	− 10 58.32	− 1.43	....	37.93
	8326	14.877	28.7	32.0						
	8374	39.724	28.7	32.0		01 39.57	+ 15 57.80	− 1.53	....	35.84
August 16	6087	16.180	23.0	29.0						
	6129	19.839	28.7	23.5		19 57.19	− 2 21.04	− 0.19	....	35.96
	6185	28.744	27.0	25.1						
	6223	25.842	25.1	27.0		19 27.23	− 1 51.87	− 0.00	....	35.36
	6238	21.769	21.8	30.3						
	6252	16.740	29.0	23.2		14 23.50	+ 3 13.86	− 0.63	....	36.73
	6349	20.267	21.1	31.2						
	6357	9.378	24.2	28.0		10 37.95	+ 6 59.74	− 3.22	....	34.47
	6355	20.117	25.3	26.8						
	6390	8.503	22.9	29.8		06 18.14	+ 11 18.98	− 1.94	....	35.18
	6404	5.503	29.8	22.9						
	6456	27.049	25.7	26.8		03 45.43	+ 13 51.89	+ 1.34	....	38.66
	6466	30.572	25.7	26.8						
	6473	11.762	24.7	28.0		05 32.41	+ 12 05.08	− 1.02	....	36.47
	6497	15.293	25.3	27.0						
	6520	21.943	25.5	26.9		21 52.74	− 4 16.34	− 0.72	....	35.68
	6547	20.709	29.6	23.0						
	6566	21.081	22.0	30.5		17 49.86	− 0 14.34	− 0.44	....	35.08
	6581	13.331	29.1	23.2						
	6624	25.479	28.2	24.4		31 49.56	− 14 13.75	+ 2.25	....	38.06
	6556	36.541	26.0	26.5						
	6667	7.416	28.0	24.7		39 36 19.76	− 18 42.70	+ 0.65	....	39 17 37.71

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
August 16	6681	17.393	25.1	26.3						
	6695	24.379	19.1	33.3		39 13 07.12	+ 4 29.29	− 3.33	......	39 17 33.08
	6718	22.800	27.0	25.3						
	6722	12.665	19.0	33.3		24 07.80	− 6 30.68	− 2.92	+0.06	34.26
	6741	30.378	26.2	26.1						
	6740	17.763	23.3	29.0		25 43.32	− 8 06.28	− 1.32	+0.35	36.07
	6817	14.430	25.9	26.7						
	6849	21.656	13.8	38.7		12 58.90	+ 4 38.54	− 5.93	......	31.51
	6896	23.870	27.0	25.3						
	6932	24.962	21.3	31.1		11 54.28	+ 5 43.39	− 1.88	......	35.79
	6959	17.659	27.0	25.3						
	6973	21.194	16.1	36.2		15 22.84	+ 2 16.28	− 4.26	......	34.86
	6986	28.548	29.1	23.3						
	7001	28.661	19.1	33.4		17 33.15	+ 0 04.36	− 1.97	......	35.54
	7008	10.136	19.1	33.3						
	7022	22 843	28.5	24.0		25 47.26	− 8 09.83	− 2.25	......	35.18
	7062	27 304	25.0	27.7						
	7067	12.080	22.7	30.0		27 23.84	− 9 46.85	− 2.32	......	34.67
	7164	20.888	22.7	30.0						
	7198	26.077	28.2	24.5		20 56.13	− 3 20.02	− 0.83	......	35.28
	7218	33.122	26.1	26.6						
	7246	6.323	29.8	23.0		34 48.81	− 17 13.05	+ 1.46	......	37.22
	7277	25.670	26.2	26.3						
	7320	13.854	23.0	29.8		25 11.94	− 7 35.48	− 1.60	......	34.86
	7368	22.113	26.9	25.9						
	7411	26.664	23.4	29.8		20 33.12	− 2 55.43	− 1.25	......	36.44
	7450	35.012	23.0	30.1						
	7476	8.890	25.0	28.3		00 51.10	+ 16 46.97	− 2.41	.....	35.66
	7495	21.043	30.1	23.2						
	7520	18.011	19.0	34.5		19 34.19	− 1 56.88	− 1.99	......	35.32
	7559	14.356	23.3	30.2						
	7566	31.141	30.7	23.0		06 48.34	+ 10 47.02	+ 0.19	......	35.55
	7598	15.726	27.0	26.6						
	7607	28.667	19.0	34.7		09 18.53	+ 8 18.85	− 3.54	......	33.84
	7695	33.687	27.1	27.1						
	7721	6.303	22.5	31.8		39 35 12.90	− 17 35.59	− 2.15	......	35.16
	7742	31.139	22.9	31.4						
	7775	1.484	32.9	21.6		38 58 33.52	+ 19 03.17	+ 0.65	......	39 17 37 34

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
August 16	8128	26.087	28.6	27.6						
	8136	12.581	22.5	33.4		39 26 16.26	− 8 40.63	− 2.28	......	39 17 33.55
	8195	35.067	26.2	29.4						
	8212	11.355	34.8	21.0		02 21.68	+ 15 14.04	+ 2.45	....	38.17
	8231	15.359	28.0	28.0						
	8256	22.689	27.5	28.5		12 54.32	+ 4 42.56	− 0.23	.... ..	36.65
	8284	10.147	26.0	30.0						
	8307	27.354	35.3	20.7		28 38.57	− 11 03.29	+ 2.45	....	37.73
	8326	4.300	26.1	29.9						
	8374	29.117	23.9	32.0		01 40.44	+ 15 56.64	− 2.76	....	34.32
August 18	6959	18.097	28.1	26.8						
	6973	21.523	20.7	34.2		15 23.35	+ 2 12.08	− 2.82	......	32.61
	7008	10.455	26.4	28.3						
	7022	23.292	34.3	20.8		25 47.79	− 8 14.83	+ 2.69	....	35.65
	7062	26.982	28.0	27.3						
	7067	11.672	28.0	27.3		27 24.36	− 9 50.16	+ 0.32	......	34.52
	7164	19.403	25.0	30.2						
	7198	24.612	30.5	24.9		20 56.68	− 3 20.79	+ 0.09	......	35.98
	7218	33.772	27.2	28.1						
	7246	6.820	39.7	15.8		34 49.35	− 17 18.94	+ 5.32	....	35.73
	7277	26.690	30.7	24.9						
	7320	14.856	26.6	28.9		25 12.50	− 7 36.17	+ 0.81	....	37.14
	7368	22.182	24.0	31.4						
	7411	26.877	37.8	17.9		20 33.70	− 3 00.98	+ 2.89	......	35.61
	7450	33.991	27.0	28.5						
	7476	7.879	24.7	31.0		00 51.66	+ 16 46.58	− 1.81	....	36.43
	7495	20.634	30.9	24.6						
	7520	17.600	19.0	36.3		19 34.75	− 1 56.96	− 2.55	....	35.24
	7559	14.445	36.3	19.1						
	7566	32.147	16.8	38.7		06 10.00	+ 11 22.37	− 1.09	......	31.28
	7598	16.021	38.5	16.9						
	7607	28.877	17.7	37.8		09 19.12	+ 8 15.58	− 0.35	......	34.35
	7695	32.691	38.7	17.0						
	7721	5.208	19.1	36.7		35 13.51	− 17 39.41	+ 0.95	......	35.05
	7742	32.337	26.9	28.9						
	7775	2.780	36.7	19.1		58 34.07	+ 18 59.40	+ 3.61	......	37.08
August 22	6349	20.582	24.7	29.8						
	6357	9.932	44.0	10.3		39 10 39.00	+ 6 50.53	+ 6.62	....	39 17 36.15

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
August 22	6355	26.452	24.9	29.5						
	6390	8.883	30.7	23.8		39 06 19.20	+ 11 17.36	+ 0.53	......	39 17 37.09
	6456	27.019	25.5	28.8						
	6473	9.773	27.2	27.2		07 49.33	+ 9 47.70	− 0.76	......	36.27
	6497	16.251	24.7	29.9						
	6520	22.967	31.5	23.0		21 53.92	− 4 18.89	+ 0.76	......	35.79
	6547	21.639	25.0	29.0						
	6566	22.016	26.4	28.0		17 51.05	− 0 14.53	− 1.30	......	35.22
	6581	14.583	21.0	33.2						
	6624	36.734	32.9	21.6		31 50.82	− 14 13.87	− 0.21	......	36.74
	6656	37.150	32.1	22.3						
	6667	8.009	19.0	35.7		36 21.06	− 18 43.31	− 1.60	......	36.15
	6681	18.440	39.8	15.0						
	6695	25.322	16.0	38.8		13 08.37	+ 4 25.29	+ 0.46	+0.83	34.95
	6718	23.434	37.2	17.6						
	6722	13.241	4.0	50.8		24 09.16	− 6 32.92	− 6.30	+0.03	29.97
	6734	29.109	45.8	9.0						
	6740	16.390	9.0	45.6		25 44.67	− 8 10.29	+ 0.05	+0.37	34.80
	6754	26.490	51.0	4.0						
	6777	22.902	4.0	51.0		19 54.94	− 2 18.31	− 0.00	......	36.63
	6959	18.789	32.1	23.3						
	6973	22.199	25.8	29.9		15 24.33	+ 2 11.45	+ 1.09	......	36.87
	6986	29.553	44.2	11.2						
	7001	29.527	17.1	38.2		17 34.68	− 0 01.00	+ 2.75	......	36.43
	7008	11.028	15.9	39.7						
	7022	23.846	43.0	12.3		25 48.82	− 8 14.10	+ 1.60	......	36.32
	7062	28.699	29.3	26.3						
	7067	13.375	18.1	37.4		27 25.40	− 9 46.85	− 4.93	......	33.62
	7164	20.925	24.6	31.1						
	7198	26.200	33.8	22.0		20 57.74	− 3 23.34	+ 1.23	......	35.63
	7218	33.834	29.4	26.2						
	7246	6.973	27.1	28.7		34 50.42	− 17 15.44	+ 0.37	......	35.35
	7277	26.769	30.0	25.9						
	7320	14.890	38.9	17.0		25 13.60	− 7 37.90	+ 6.02	......	41.72
	7368	22.650	27.2	28.6						
	7411	27.251	26.7	29.3		20 34.81	− 2 57.36	− 0.93	......	36.52
	7450	36.903	26.1	30.0						
	7476	10.871	31.1	25.0		39 00 52.74	+ 16 43.50	+ 0.51	......	39 17 36.75

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
August 22	7495	20.654	25.3	30.7						
	7520	17.640	27.9	28.1		39 19 35.86	— 1 56.19	— 1.30	......	39 17 38.37
	7598	13.558	22.0	34.0						
	7607	26.473	30.2	25.8		09 20.28	+ 8 17.85	— 1.76	......	36.37
	7695	33.430	35.3	26.0						
	7721	5.950	23.0	33.0		39 35 14.71	— 17 39.29	— 0.16	......	35.26
	7742	31.024	32.0	24.0						
	7775	1.385	26.3	29.8		38 58 35.17	+ 19 02.56	+ 1.04	......	38.77
August 25	7062	27.388	34.1	29.7						
	7067	11.987	35.2	28.6		39 27 26.14	— 9 53.67	+ 2.55	......	35.02
	7218	33.293	34.2	17.6						
	7246	6.510	12.0	39.9		34 51.20	— 17 12.43	— 2.62	......	35.15
	7277	25.513	38.7	13.1						
	7320	13.548	19.0	33.2		25 14.40	— 7 41.22	+ 2.64	......	35.82
	7368	22.163	23.2	29.0						
	7411	26.802	26.9	26.0		20 35.63	— 2 58.82	— 1.13	......	35.68
	7450	34.302	25.9	27.0						
	7476	8.269	29.0	23.8		00 53.54	+ 16 43.54	+ 0.95	......	38.03
	7495	21.214	31.3	21.2						
	7520	18.129	18.0	35.0		19 36.66	— 1 58.92	— 1.59	......	36.15
	7559	13.508	33.8	19.1						
	7566	31.250	18.0	35.0		06 12.02	+ 11 23.91	— 0.53	......	35.40
	7598	15.105	26.1	26.7						
	7607	27.961	25.9	27.0		09 21.15	+ 8 15.57	— 0.39	......	36.33
	7695	33.054	40.2	13.1						
	7721	5.571	11.1	42.2		39 35 15.60	— 17 39.41	— 0.93	......	35.26
	7742	29.603	26.8	26.8						
	7775	0.016	24.1	29.3		38 58 36.00	+ 19 00.55	— 1.20	+0.13	35.48
August 27	6959	17.597	26.6	24.3						
	6973	20.923	31.0	20.2		39 15 25.49	+ 2 08.21	+ 3.03	......	36.73
	6986	28.810	36.3	14.9						
	7001	28.790	18.3	33.0		17 35.88	— 0 00.77	+ 1.55	......	36.66
	7008	10.279	18.0	33.8						
	7022	23.126	36.8	15.0		25 50.04	— 8 15.22	+ 1.39	......	36.21
	7062	27.991	18.9	32.6						
	7067	12.630	34.0	17.6		27 26.63	— 9 52.14	+ 0.63	......	35.12
	7164	19.734	22.6	29.2						
	7198	25.011	31.2	21.0		39 20 59.03	— 3 23.42	+ 0.83	......	39 17 36.44

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		*t.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
August 27	7218	33.061	27.8	24.5						
	7246	6.140	27.9	24.7		39 34 51.70	− 17 17.76	+ 0.02	....	39 17 33.96
	7277	26.172	47.0	5.2						
	7320	14.240	7.6	44.9		25 14.92	− 7 39.95	+ 1.04	....	36.01
	7368	21.520	25.3	27.0						
	7411	26.232	34.0	18.3		20 36.17	− 3 01.64	+ 3.24	....	37.77
	7450	34.046	22.0	30.3						
	7476	8.460	36.4	15.9		00 54.66	+ 16 40.57	+ 2.82	....	37.45
	7495	20.501	25.9	26.7						
	7520	17.338	28.5	24.1		19 37.20	− 2 01.93	+ 0.83	....	36.10
	7559	14.707	28.5	24.1						
	7566	32.392	26.9	26.0		06 12.56	+ 11 21.44	+ 1.69	....	35.69
	7598	13.721	33.7	19.0						
	7607	26.538	21.0	32.0		09 21.72	+ 8 13.33	+ 0.66	....	35.71
	7695	32.841	34.3	19.0						
	7721	5.336	21.1	32.3		39 35 16.18	− 17 43.61	+ 3.06	....	35.63
	7742	31.490	25.9	28.0						
	7775	1.939	28.2	25.3		38 58 36.56	+ 18 59.17	+ 0.19	....	35.92
August 28	6896	24.793	14.2	25.8						
	6932	16.000	24.1	15.7		39 11 57.24	+ 5 38.96	− 0.74	......	35.46
	6959	17.654	26.7	29.8						
	6973	21.137	21.9	34.3		15 25.71	+ 2 14.26	− 3.59	....	36.38
	6986	27.800	27.2	29.0						
	7001	27.852	23.8	32.9		17 36.11	+ 0 02.00	− 0.21	....	37.90
	7062	27.417	29.9	27.0						
	7067	12.090	25.3	31.3		27 26.86	− 9 50.83	− 0.72	....	35.31
	7164	19.235	24.0	33.3						
	7198	24.472	31.0	26.9		20 59.28	− 3 21.88	− 1.20	....	36.20
	7218	32.384	34.0	23.9						
	7246	5.479	25.3	32.7		34 51.94	− 17 17.13	+ 0.63	....	35.44
	7277	25.912	39.0	19.1						
	7320	13.985	19.0	39.1		25 15.17	− 7 39.76	− 0.05	....	35.46
	7368	21.197	27.1	31.5						
	7411	25.907	47.0	12.1		20 36.44	− 3 01.56	+ 7.06	......	41.94
	7450	33.961	26.8	32.1						
	7416	7.953	33.3	25.4		00 54.31	+ 16 42.19	+ 0.66	......	37.16
	7495	19.574	36.3	22.4						
	7520	16.422	23.3	35.4		39 19 37.46	− 2 01.51	+ 0.42	....	39 17 36.37

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
August 28	7559	15. 535	40. 9	18. 0						
	7566	33. 213	21. 6	37. 2		39 06 12. 84	+ 11 21. 71	+ 1. 23	....	39 17 35. 78
	7598	12. 902	24. 7	34. 2						
	7607	25. 700	35. 4	23. 3		09 22. 00	+ 8 14. 06	+ 0. 86	....	36. 92
	7695	32. 289	38. 7	21. 0						
	7721	4. 697	27. 6	32. 1		39 35 16. 48	− 17 40. 26	+ 0. 95	....	37. 17
	7742	29. 751	26. 3	33. 3						
	7775	0. 240	38. 7	21. 0		38 58 36. 84	+ 18 57. 62	+ 2. 48	....	36. 94
	8128	26. 018	32. 0	30. 2						
	8135	12. 365	33. 0	29. 2		39 26 20. 08	− 8 46. 29	+ 1. 30	....	35. 09
	8195	33. 652	34. 7	27. 0						
	8212	10. 167	26. 2	35. 3		02 25. 25	+ 15 05. 29	+ 1. 99	....	32. 53
	8231	15. 648	28. 9	32. 3						
	8256	22. 784	40. 7	20. 3		12 57. 89	+ 4 35. 07	+ 3. 94	....	36. 90
	8284	9. 197	29. 7	31. 4						
	8307	26. 481	32. 9	28. 3		28 41. 98	− 11 06. 26	+ 0. 67	....	36. 39
	8326	4. 860	33. 4	27. 8						
	8374	29. 563	31. 0	30. 3		01 43. 88	+ 15 52. 25	+ 1. 45	....	37. 58
August 29	6021	18. 994	28. 1	27. 0						
	6052	20. 255	28. 7	26. 7		18 24. 45	− 0 48. 61	+ 0. 72	....	36. 56
	6087	16. 582	26. 0	29. 3						
	6129	20. 305	29. 7	25. 8		19 58. 79	− 2 23. 51	+ 0. 14	......	35. 42
	6238	21. 292	27. 1	28. 3						
	6252	16. 346	36. 6	19. 0		14 25. 34	+ 3 10. 66	+ 3. 80	....	39. 80
	6349	20. 656	26. 9	29. 0						
	6357	9. 937	43. 9	12. 0		10 40. 02	+ 6 53. 18	+ 6. 90	....	40. 11
	6355	26. 549	26. 9	29. 0						
	6390	9. 038	42. 6	13. 3		06 20. 28	+ 11 15. 01	+ 6. 29	....	41. 58
	6456	26. 961	22. 6	33. 7						
	6473	11. 750	35. 1	21. 0		07 50. 47	+ 9 46. 35	+ 0. 44	....	37. 26
	6497	15. 724	27. 0	29. 2						
	6520	22. 481	30. 9	25. 3		21 55. 12	− 4 20. 47	+ 0. 79	....	35. 44
	6547	20. 277	26. 8	30. 4						
	6566	20. 740	37. 1	19. 2		17 52. 28	− 0 17. 84	+ 3. 31	....	37. 75
	6581	14. 658	25. 7	30. 4						
	6624	36. 872	41. 0	15. 0		31 52. 14	− 14 16. 30	+ 4. 93	....	40. 77
	6656	36. 462	26. 3	29. 9						
	6667	7. 202	32. 2	24. 0		39 36 22. 43	− 18 47. 90	+ 1. 07	....	39 17 35. 60

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
		t.	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
1873. August 29	6681	17.043	33.8	22.5						
	6695	23.923	27.4	29.0		39 13 09.69	+ 4 25.21	+ 2.25	......	39 17 37.15
	6718	23.263	29.8	26.5						
	6722	12.993	41.8	14.8		24 10.58	− 6 35.89	+ 7.01	......	41.70
	6754	25.000	28.8	28.0						
	6777	21.376	26.9	30.2		19 56.41	− 2 19.69	− 0.58	......	36.14
	6817	15.122	32.0	25.2						
	6849	22.221	23.4	34.1		13 01.86	+ 4 33.65	− 0.90	......	34.61
	6896	24.268	27.1	30.7						
	6932	15.553	31.1	27.2		11 57.44	+ 5 35.96	+ 0.07	+0.01	33.48
	6959	17.393	30.6	27.8						
	6973	20.756	31.6	26.8		15 25.94	+ 2 09.64	+ 1.76	......	37.34
	6986	28.642	29.4	28.6						
	7001	27.622	31.2	27.0		17 36.34	− 0 00.77	+ 1.16	......	36.73
	7008	10.081	32.8	25.3						
	7022	22.953	32.8	25.3		25 50.51	− 8 16.18	+ 3.47	......	37.80
	7062	26.742	31.3	26.8						
	7067	11.370	31.0	27.2		27 27.10	− 9 52.56	+ 1.92	......	36.46
	7164	20.137	29.8	28.9						
	7198	25.418	34.5	24.0		20 59.52	− 3 23.57	+ 2.64	......	38.59
	7218	33.833	34.8	23.9						
	7246	6.901	26.1	32.3		34 52.19	− 17 18.17	+ 1.09	......	35.11
	7277	25.089	38.0	10.3						
	7320	13.140	23.7	34.6		25 15.42	− 7 40.60	+ 1.57	......	36.39
	7368	21.951	29.8	28.4						
	7411	26.681	32.0	26.6		20 36.70	− 3 02.33	+ 1.57	......	35.94
	7450	34.649	29.8	29.0						
	7476	8.690	31.4	27.3		00 54.56	+ 16 40.69	+ 1.13	......	36.38
	7495	20.495	28.5	30.4						
	7520	7.315	34.0	25.0		19 37.72	− 2 02.58	+ 1.64	......	36.78
	7559	13.893	29.4	29.5						
	7566	31.532	34.0	25.1		06 13.11	+ 11 19.94	+ 2.04	......	35.09
	7598	14.189	36.9	22.0						
	7607	26.952	26.0	33.0		09 22.28	+ 8 11.98	+ 1.83	......	36.09
	7695	34.101	35.1	23.8						
	7721	6.523	29.5	30.5		39 35 16.76	− 17 43.07	+ 2.62	......	36.31
	7742	30.271	29.0	31.0						
	7775	0.766	34.1	26.0		38 58 37.12	+ 18 57.39	+ 1.41	......	39 17 35.92

Observations and computations—Continued.

VIRGINIA CITY, NEVADA.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1873.		t.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
August 29	8128	26.898	33.0	28.2						
	8136	13.165	33.9	28.3		39 26 20.38	— 8 49.38	+ 2.20	+0.01	39 17 33.21
	8195	34.791	26.9	34.0						
	8212	11.183	45.0	15.7		02 25.55	+ 15 10.03	+ 5.14	....	40.72
	8231	15.143	30.8	29.7						
	8256	22.342	33.3	27.0		12 58.19	+ 4 37.50	+ 1.71	....	37.40
	8284	9.479	27.0	33.3						
	8307	26.771	35.3	25.0		39 28 42.26	— 11 06.57	+ 0.93	....	39 17 36.62

Discussion of latitude of Virginia City, Nevada.

No. of pair.	No. of observation.	Mean level.	Latitude.	Corrections of micrometer-correction.	Dates excluded.	No. of pair.	No. of observation.	Mean level.	Latitude.	Corrections of micrometer-correction.	Dates excluded.
		″	° ′ ″	″				″	° ′ ″	″	
1	1	+0.7	39 17 36.56	+ 0.01		20	6	+0.6	39 17 36.68	0.00	
2	2	0.0	35.69	+ 0.03		21	6	+1.1	36.02	+ 0.11	
3	1	0.0	35.36	+ 0.03		22	7	0.0	35.30	+ 0.14	Aug. 22.
4	2	+1.6	38.26	— 0.04		23	7	+0.6	36.37	+ 0.05	
5	1	—3.2	34.47	— 0.10	Aug. 22, 29.	24	7	+0.2	35.53	+ 0.24	
6	2	—0.7	36.14	— 0.16	Aug. 29.	25	7	+0.5	36.03	+ 0.11	Aug. 22.
7	1	+1.3	38.66	— 0.18		26	7	+0.5	36.36	+ 0.04	Aug. 28.
7ª	2	—0.2	36.78	— 0.14		27	8	+0.3	36.50	— 0.23	
8	1	—1.0	36.47	— 0.17		28	7	—0.6	36.33	+ 0.02	Aug. 13.
9	3	+0.3	35.64	+ 0.05		29ª	2	+0.1	*35.52	— 0.15	
10	4	+0.9	36.75	0.00		29	5	+0.7	34.65	— 0.16	
11	3	—0.5	36.15	+ 0.20	Aug. 29.	30	8	—0.3	35.70	— 0.12	
12	4	—0.8	36.51	+ 0.26		31	8	+0.4	35.48	+ 0.25	
13	4	—0.9	35.16	— 0.06		32	8	+1.2	36.85	— 0.27	
14	2	—2.6	33.21	+ 3.09	Aug. 22, 29.	33	4	—0.6	33.24	+ 0.12	
15	2	—0.6	35.44	+ 0.11		34	3	+0.8	34.28	— 0.21	Aug. 29.
16	3	—0.7	35.27	+ 0.03		35	4	+1.3	36.88	— 0.06	
17	2	+1.0	36.40	— 0.06	Aug. 16.	36	4	+0.7	37.17	+ 0.15	
18	4	—0.6	35.20	— 0.08		37	3	—0.9	39 17 35.25	— 0.22	
19	6	+0.3	39 17 36.22	— 0.03	Aug. 16.						

* Pair 29ª is composed of Rümcker 9430, which takes the place of B. A. C. 7566 from pair 29.

Excluding, as before, all observations whose level-correction exceeds 4″, we have:

Latitude from 13 pairs observed 1 or 2 times .... 39° 17′ 36″.02 ± 0″.24
Probable error of 1 such pair .... ± 0″.88
Latitude from 13 pairs observed 3, 4, or 5 times .... 39° 17′ 35″.55 ± 0″.24
Probable error of 1 such pair .... ± 0″.87
Latitude from 13 pairs observed 6, 7, or 8 times .... 39° 17′ 36″.13 ± 0″.075
Probable error of 1 such pair .... ± 0″.27
Finally, giving these results relative weights of 1, 2, 3, we get final latitude .... 39° 17′ 35″.92 ± 0″.097

Virginia City, Nevada.—Excluded pairs.

Number of pair.	Date.	Latitude with level-correction.	Latitude without level-correction.	Corr. to micr.-corr.
		° ′ ″	° ′ ″	″
5	August 22	39 17 36.15	39 17 29.53	— 0.10
	August 29	40.11	33.21	— 0.10
6	August 29	41.58	35.29	— 0.16
11	August 29	40.77	35.84	+ 0.20
14	August 22	29.97	36.27	+ 0.09
	August 29	41.63	34.62	+ 0.09
17	August 16	31.51	37.44	— 0.06
19	August 16	34.86	39.12	— 0.03
22	August 22	33.62	38.55	+ 0.14
25	Augvst 22	41.72	35.70	+ 0.11
26	August 28	41.94	34.88	+ 0.04
28	August 13	39.62	34.49	+ 0.02
34	August 29	39 17 40.72	39 17 35.58	— 0.21

Mean with level-correction, (13 observations)	39° 17′ 38″.02
Sum of errors	47″.9
Probable error of 1 observation	± 3″.24
Probable error of result	± 0″.90
Mean without level-corrections, (13 observations)	39° 17′ 35″.43
Sum of errors	21″.1
Probable error of 1 observation	± 1″.43
Probable error of result	± 0″.40

The introduction of the micrometer-correction produces no perceptible effect.

ASTRONOMICAL CO-ORDINATES OF VIRGINIA CITY, NEVADA.

Longitude . . $7^h\ 58^m\ 36^s.423 \pm 0^s.024$ or $119°\ 39'\ 06''.35 \pm 0''.36$ west from Greenwich.
" $2^h\ 50^m\ 24^s.303$ or $42°\ 36'\ 04''.55$ west from U. S. Naval Observatory, Washington, D. C.
Latitude .... $39°\ 17'\ 35''.92 \pm 0''.10$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.

GEO. M. WHEELER, LIEUT. OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF GEORGETOWN, COLORADO.

SEASON OF 1873.

COMPUTATIONS BY

DR. F. KAMPF AND JOHN H. CLARK.

GEORGETOWN, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . 105° 01′ 27″.64 ± 0″.05 west from Greenwich.
Latitude, . . . 39° 42′ 36″.36 ± 0″.06 north.
Barometric altitude of observatory above sea-level, 8587.8 feet.

Georgetown, the site of this astronomical station, is the principal town of Clear Creek County. Its inhabitants are chiefly interested in mines and mining business. Their number in 1873 was reported to exceed two thousand.

The astronomical camp was situated on the eastern side of the valley, at the foot of Griffith's Mountain, on a knoll overlooking the town. Opposite the camp, on the western side of the valley, Republican Mountain rises precipitously to a height exceeding 2,000 feet, and is succeeded in the north by the Democrat and Upper Empire Peaks. Above the camp, Alpine Creek flowed down, passing near the astronomical tent. In a southern direction, the Georgetown valley is closed by Leavenworth Mountain, which is bounded on either side by a great gulch, opening into the town, through which a brawling stream descends.

Owing to the rocky nature of the ground, it was found impossible to set the square stone pillar, which served as a meridian and latitude mark, with its faces in the plane of the meridian, and it was placed in a diagonal position, facing a little south of east.

METEOROLOGICAL CONDITIONS.

The condition of the atmosphere was unfavorable for work of this nature. The weather was stormy during the first days of occupation, and after the 26th of June large forests in the southwest were continually burning, and, when the wind was from that direction, the observer was compelled to relinquish his task, on account of the undulations with which the air was affected by the heat. In the daytime the temperature was very high, but at night the thermometer would sink to 40° or 35° F., and in one instance, the night of June 30th, snow fell to a depth of several inches. Owing to the inauspicious state of the weather and the sky, this was the most inconvenient station of the season, and it was with great trouble that the observations were accomplished at all.

The following table shows the general direction of the wind and the appearance of the sky:

Date.	Direction of wind.			Condition of the sky.
	12 p. m. to 8 a. m.	8 a. m. to 4 p. m.	4 p. m. to 12 p. m.	
1873.				
June 20	S.	N.	S.	Cloudy the whole day.
21	S.	S.	S. E.	Aurora borealis at 0.30 a. m.; clear.
22	S.	S. W.	S.	Cloudy at 3.30 a. m.
23	N.	N.	N.	Partly cloudy.
24	S. E.	S. W.	S.	Do.
25	S. E.	S.	S.	Clear.
26	S. W.	S. W.	S. W.	Clouding up at 5 p. m.
27	S.	N.	S. W.	Clear.
28	S. E.	S. E.	S.	Very heavy wind; partly cloudy.
29	S. E.	S.	N. W.	Heavy wind at 4 a. m.; very violent at 2.10 p. m., and bringing up clouds.
30	S.	N.	N.	Cloudy from 0 a. m.; wind very violent at 11.25 a. m.; at 7 p. m. commencing a rain-storm; continued until—
July 1	S.	S.	S.	0.30 a. m.; then snow-storm; flakes one-quarter of an inch in diameter.
2	S.	S. E.	S. E.	Cloudy; at 2.30 p. m. rain and thunder; clearing up at 9 p. m.
3	S. E.	S.	S.	Clear.
4	S.	N. W.	S. E.	In daytime partly cloudy; at night clear.
5	S.	S. E.	S.	Clear.

OBSERVATORY—TELEGRAPHIC COMMUNICATION.

In its arrangement, the observatory was similar to the one at Colorado Springs, described in the astronomical report of 1874. The president of the Western Union Telegraph Company granted authority for the use of their lines. The main wire was deflected, by means of a loop, into the observing tent, a distance of nearly 700 yards. In sending signals, assistance was rendered by Mr. John Jay, in charge of the Western Union office at Georgetown. The distance to Denver is about 40 miles; from Denver to Salt Lake City it is 690 miles; making a total circuit-length of 730 miles. The signals were sent directly to Cheyenne, and were there repeated to Salt Lake. The battery in use at the station was a small but effective instrument of two Grove cells belonging to the survey.

The astronomical and meteorological instruments were the same as those at Colorado Springs, with the same instrumental values for the reduction of observations.

CONNECTIONS—OBSERVERS—COMPUTERS.

The astronomical observations at Georgetown were conducted by Dr. F. Kampf, who arrived at this station on the 5th of June, but was unable to begin operations until the 20th of the same month, being retarded by a delay in the arrival of the instruments, and by their incomplete condition when they came. Further delay was then experienced by reason of difficulty in introducing the wires for telegraphic correspondence.

Exchanges for time were made with the station at Salt Lake City, Mr. John H. Clark in charge. In this exchange, signals were sent from Salt Lake City on the nights of June 23, 25, 27, and 28, and July 2 and 3, and from Georgetown on June 23 and 28, and July 2 and 3. Mr. Clark reduced his observations for time after returning to the office. Computations for the corresponding observations at Georgetown were made by Dr. Kampf, in the field. Observations for latitude were made by the latter on the nights of June 22, 26, and 27, and July 1, 2, 4, and 5, and were reduced by him in the office from the 20th to the 28th of January, 1874.

The meteorological records were kept with great care by C. D. Gedney, and privates J. Clancy and J. Meyer.

Tabulation of stars used for determination of time at Georgetown, Colorado, and Salt Lake City, Utah, 1873.

Name of star.	Georgetown, Colorado. June 23.	June 25.	June 26.	June 27.	June 28.	June 29.	July 1.	July 2.	July 3.	Salt Lake City, Utah. June 23.	June 25.	June 26.	June 27.	June 28.	July 1.	July 2.	July 3.
α Virginis	×	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
ζ Virginis	×	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
η Ursæ Majoris	×	×	×	×	....	....	....	....	....	....	....	....	....	....	....	....	....
η Bootis	×	×	×	×	....	....	....	....	×	....	....	....	....	....	....	....	....
τ Virginis	....	×	×	....	....	×	....	....	×	....	....	....	....	....	....	....	....
α Draconis	×	....	×	×	×	....	....	....	×	....	....	....	....	....	....	....	....
κ Virginis	....	....	×	×	×	×	....	....	....	....	....	....	....	....	....	....	....
α Bootis	×	×	×	×	×	×	....	....	×	×	×	....	....	....	....	....	....
θ Bootis	×	×	×	....	....	×	×	×	×	×	×	×	×	×	....	....	....
5 Ursæ Minoris	×	×	×	×	....	×	×	×	×	×	×	×	....	×	×	....	....
μ Virginis	....	....	....	....	....	....	....	....	....	×	×	×	×	....	×	×	×
ζ Bootis	....	×	×	×	....	×	×	×	×	....	....	....	....	....	....	....	....
ε Bootis	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	....	....
α^2 Libræ	....	....	....	....	....	....	....	....	....	×	×	×	×	×	×	×	....
β Ursæ Minoris	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	....
β Bootis	×	×	×	×	×	×	×	×	×	×	×	×	×	×	....	×	....
ψ Bootis	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
48 Cephei, L. C	....	....	....	....	....	....	....	....	....	×	×	×	×	×	×	×	....
3 Serpentis	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
β Libræ	....	....	....	....	....	....	×	....	×	×	....	×	×	×	×	×	....
o^2 Libræ	....	....	....	....	....	....	....	....	....	....	×	×	×	×	×	×	×
u^1 Bootis	....	....	....	....	....	....	....	....	....	....	×	×	×	×	×	×	×
ζ^3 Libræ	....	....	....	....	....	....	....	....	....	....	....	....	×	×	×	×	×
γ^2 Ursæ Minoris	....	....	....	....	....	×	×	×	×	....	....	....	....	....	....	....	....
α Coronæ	....	....	....	....	....	×	×	×	×	....	....	....	×	....	×	×	×
τ Serpentis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	×	×	×
α Serpentis	....	....	....	....	....	×	....	....	....	....	....	....	....	....	×	×	×
ε Serpentis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	×	×
β^1 Scorpii	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	×
η Draconis	....	....	....	....	....	....	....	....	....	....	....	....	×	....	....	....	....
A Draconis	....	....	....	....	....	....	....	....	....	....	....	....	×	....	....	....	....
ζ Ophiuchi	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	×
η Herculis	....	....	....	....	....	....	....	....	....	×	....	×	....	×	....	....	....
κ Ophiuchi	×	....	....	....	....	....	....	....	×	×	....	×	....	×	....	....	×
d Herculis	....	....	....	....	....	....	....	....	....	×	....	×	....	×	....	....	....
ε Ursæ Minoris	....	....	....	....	....	....	....	....	×	×	....	×	....	....	....	....	....
α^1 Herculis	....	....	....	....	....	....	....	....	×	×	....	×	×	×	....	....	×
44 Ophiuchi	....	....	....	....	....	....	....	....	×	....	....	....	....	....	....	....	....
Groombr. 966 L. C	....	....	....	....	....	....	....	....	....	....	....	....	×	....	....	....	×
β Draconis	×	....	....	....	....	....	....	....	×	×	....	....	....	....	....	....	....
α Ophiuchi	....	....	....	....	....	....	....	....	×	....	....	....	×	....	....	....	....
ω Draconis	×	×	....	....	....	....	....	....	×	×	....	....	×	....	....	....	×
μ Herculis	×	×	....	....	....	....	....	....	....	×	....	....	×	×	....	×	....
ψ^1 Draconis, pr	....	×	....	....	....	....	....	....	×	×	....	....	×	....	....	....	....
γ Draconis	×	×	....	....	....	....	....	....	×	×	....	....	×	×	....	....	....
γ^2 Sagittarii	....	....	....	....	....	....	....	....	×	....	....	....	....	....	....	....	....
72 Ophiuchi	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	×	×
o Herculis	....	×	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
μ^1 Sagittarii	×	....	....	....	....	....	....	....	×	....	....	....	....	....	....	....	....
η Serpentis	×	....	....	....	....	....	....	....	....	....	×	....	×	....	....	×	×
b Draconis	....	×	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
1 Aquilæ	....	×	....	....	×	....	....	....	....	....	×	....	×	....	....	....	....
α Lyræ	....	×	....	....	×	....	....	....	....	....	×	....	×	....	....	×	....
β Lyræ	....	....	....	....	×	....	....	....	....	....	×	....	....	....	....	....	....
σ Sagittarii	....	×	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
50 Draconis	....	....	....	....	×	....	....	....	....	....	×	....	....	....	....	....	....

Tabulation of stars, &c.—Continued.

Name of star.	GEORGETOWN, COLORADO.									SALT LAKE CITY, UTAH.							
	June 23.	June 25.	June 26.	June 27.	June 28.	June 29.	July 1.	July 2.	July 3.	June 23.	June 25.	June 26.	June 27.	June 28.	July 1.	July 2.	July 3.
ζ Aquilæ	....	....	....	....	×	....	....	....	....	....	×	....	....	....	....	....	....
d Sagittarii	....	....	....	....	×	....	....	....	....	....	×	....	....	....	....	×	....
τ Draconis	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
κ Aquilæ	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
γ Aquilæ	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
α Aquilæ	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
ε Draconis	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....

Observations and reductions for time taken at receiving station.

GEORGETOWN, COLORADO, JUNE 23, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Virginis	13 32 13.47	+ 0.23	— 0.01	— 0.66	13 32 13.03	13 18 31.32	— 13 41.71
W.	ζ Virginis	41 56.72	+ 0.19	— 0.06	— 0.65	41 56.20	28 14.50	41.70
W.	η Ursæ Majoris	56 16.74	— 0.08	— 0.12	— 1 00	56 15.54	42 33.82	41.72
W.	η Bootis	14 02 21.90	+ 0.11	— 0.07	— 0.69	14 02 21.25	48 39.62	41.63
W.	α Draconis	14 43.41	— 0.29	— 0.15	— 1.53	14 41.44	14 00 59.63	41.81
E.	α Bootis	23 34.54	+ 0.10	— 0.08	+ 0.69	23 35.25	09 53.54	41.71
E.	θ Bootis	34 35.41	— 0.10	— 0.19	+ 1.06	34 36.18	20 54.36	41.82
E.	5 Ursæ Minoris	41 33.89	— 0.73	— 0.47	+ 2.72	41 35.41	27 53.52	41.89
E.	ε Bootis	53 09.29	+ 0.07	— 0.20	+ 0.73	53 09.89	39 28.10	41.79
E.	β Ursæ Minoris	15 04 50.28	— 0.63	— 0.53	+ 2.44	15 04 51.56	51 10.10	41.46
E.	β Bootis	10 52.82	0.00	— 0.22	+ 0.85	10 43.45	14 57 11.63	— 13 41.82
	Mean at 14^h 15^m local sidereal time							— 13 41 73
	Exclusive of β Ursæ Minoris							— 13 41 76

NORMAL EQUATIONS.

$$0 = -\ 0.27 + 11.00\ \delta t - 3.97\ a + 6.14\ c \qquad \delta t = -\ 0^s.23$$
$$0 = +\ 6.62 - 3.97\ \delta t + 13.58\ a - 17.76\ c \qquad a = +\ 0^s.29$$
$$0 = -25.79 + 6.14\ \delta t - 17.76\ a + 50.02\ c \qquad c = +\ 0^s.65$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JUNE 23, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	κ Ophiuchi	17 05 22.71	+ 0.08	— 0.13	+ 0.65	17 05 23.31	16 51 41.32	— 13 41.99
E.	β Draconis	41 17.61	— 0.05	— 0.37	+ 1.05	41 18.24	17 27 36.31	41.93
E.	ω Draconis	51 26.32	— 0.23	— 0.32	+ 1.77	51 27.54	37 45.58	41.96
E.	μ Herculis	55 12.66	+ 0.03	— 0.14	+ 0.72	55 13 27	41 31.36	41.91
W.	γ Draconis	18 07 25.20	— 0.08	— 0.07	— 1.02	18 07 24.03	53 42.07	41.96
W.	μ^1 Sagittarii	19 54.79	+ 0.12	— 0.03	— 0.68	19 54.20	18 06 12.34	41.86
W.	η Serpentis	28 28.93	+ 0.09	— 0.04	— 0.64	18 28 28.34	14 46.27	— 13 42.07
	Mean at 17^h 30^m local sidereal time							— 13 41.95

NORMAL EQUATIONS.

$$0 = -\ 0.73 + 7.00\,\delta t - 0.18\,a + 2.78\,c \qquad \delta t = -0^s.15$$
$$0 = +\ 2.61 - 0.18\,\delta t + 5.28\,a - 5.19\,c \qquad a = +0^s.13$$
$$0 = -10.01 + 2.78\,\delta t - 5.19\,a + 17.33\,c \qquad c = +0^s.64$$

GEORGETOWN, COLORADO, JUNE 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	η Ursæ Majoris	13 56 15.67	+ 0.25	— 0.11	— 1.02	13 56 14.79	13 42 33.78	— 13 41.01
W.	η Bootis	14 02 21.60	— 0.33	— 0.13	— 0.70	14 02 20.44	48 39.61	40.83
W.	τ Virginis	08 54.57	— 0.54	— 0.10	— 0.66	08 53.27	55 12.34	40.93
W.	α Bootis	23 35.62	— 0.32	— 0.11	— 0.70	23 34.49	14 09 53.52	40.97
W.	θ Bootis	34 36.39	+ 0.32	— 0.14	— 1.08	34 35.49	20 54.33	41.16
E.	5 Ursæ Minoris	41 29.66	+ 2.22	— 0.50	+ 2.77	41 34.15	27 53.38	40.77
E.	ζ Bootis	48 47.55	— 0.39	— 0.14	+ 0.69	48 47.71	35 06.55	41.16
E.	ε Bootis	53 08.76	— 0.21	— 0.16	+ 0.74	53 09.13	39 28.08	41.05
E.	β Ursæ Minoris	15 04 47.24	+ 1.92	— 0.46	+ 2.49	15 04 51.19	51 09.97	41.22
E.	β Bootis	10 51.93	+ 0.03	— 0.30	+ 0.87	10 52.53	14 57 11.60	— 13 40.93
	Mean at 14^h 20^m local sidereal time							— 13 41.00

NORMAL EQUATIONS.

$$0 = -\ 6.32 + 10.00\,\delta t - 3.33\,a + 5.17\,c \qquad \delta t = 0^s.00$$
$$0 = +22.86 - 3.33\,\delta t + 12.10\,a - 18.44\,c \qquad a = -0^s.88$$
$$0 = -45.59 + 5.17\,\delta t - 18.44\,a + 44.44\,c \qquad c = +0^s.66$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JUNE 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	ω Draconis	17 51 24.25	+ 1.16	— 0.58	+ 1.89	17 51 26.72	17 37 45.56	— 13 41.16
E.	μ Herculis	55 12.24	— 0.21	— 0.29	+ 0.77	55 12.51	41 31.38	41.13
E.	ψ^1 Draconis	57 54.39	+ 1.53	— 0.64	+ 2.27	57 57.55	44 16.30	41.25
E.	γ Draconis	18 07 22.02	+ 0.50	— 0.33	+ 1.09	18 07 23.28	53 42.07	41.21
E.	o Herculis	16 18.25	— 0.19	— 0.24	+ 0.78	16 18.60	18 02 37.38	41.22
W.	b Draconis	35 48.09	+ 0.54	— 0.20	— 1.32	35 47.11	22 05.92	41.19
W.	1 Aquilæ	42 02.40	— 0.66	— 0.07	— 0.70	42 00.97	28 19.81	41.16
W.	α Lyræ	46 22.68	— 0.02	— 0.12	— 0.88	46 21.66	32 40.47	41.19
W.	δ Sagittarii	19 01 08.75	— 0.89	— 0.06	— 0.76	19 01 07.04	18 47 25.77	— 13 41.27
	Mean at 18^h 12^m local sidereal time							— 13 41.20

NORMAL EQUATIONS.

$$0 = - 3.12 + 9.00\,\delta t - 2.04\,a + 4.60\,c \qquad \delta t = - 0^s.20$$
$$0 = + 13.28 - 2.04\,\delta t + 7.35\,a - 10.68\,c \qquad a = - 0^s.87$$
$$0 = - 29.85 + 4.60\,\delta t - 10.68\,a + 31.43\,c \qquad c = + 0^s.68$$

GEORGETOWN, COLORADO, JUNE 26, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	η Ursæ Majoris	13 57 13.94	+ 0.95	+ 0.06	— 0.89	13 57 14.06	13 42 33.75	— 13 40.31
W.	η Bootis	14 02 21.45	— 1.26	+ 0.02	— 0.61	14 02 19.60	48 39.60	40.00
W.	τ Virginis	08 55.09	— 2.08	+ 0.01	— 0.57	08 52.45	55 12.33	40.12
W.	α Draconis	14 37.46	+ 3.44	+ 0.02	— 1.36	14 39.56	14 00 59.51	40.05
W.	κ Virginis	19 52.08	— 2.63	+ 0.01	— 0.59	19 48.87	06 08.73	40.14
W.	α Bootis	23 35.61	— 1.23	+ 0.01	— 0.61	23 33.78	09 53.51	40.27
E.	θ Bootis	34 32.36	+ 1.23	— 0.10	+ 0.94	34 34.43	20 54.31	40.12
E.	5 Ursæ Minoris	41 22.64	+ 8.56	— 0.24	+ 2.42	41 33.38	27 53.31	40.07
E.	ζ Bootis	48 47.58	— 1.50	— 0.04	+ 0.60	48 46.64	35 06.54	40.10
E.	ε Bootis	53 08.40	— 0.82	— 0.04	+ 0.65	53 08.19	39 28.07	40.12
E.	β Ursæ Minoris	15 04 40.74	+ 7.40	— 0.15	+ 2.17	15 04 50.16	51 09.91	40.25
E.	β Bootis	10 51.03	+ 0.10	— 0.08	+ 0.76	10 51.81	14 57 11.59	— 13 40.22
	Mean at 14^h 20^m local sidereal time							— 13 40.15

NORMAL EQUATIONS.

$$0 = - 19.30 + 12.00\,\delta t - 3.57\,a + 5.06\,c \qquad \delta t = + 0^s.35$$
$$0 = + 58.37 - 3.57\,\delta t + 13.71\,a - 18.02\,c \qquad a = - 3^s.41$$
$$0 = - 92.52 + 5.06\,\delta t - 18.02\,a + 51.10\,c \qquad c = + 0^s.57$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JUNE 27, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	η Ursæ Majoris	13 56 14.55	+ 0.32	— 0.11	— 0.92	13 56 13.84	13 42 33.73	— 13 40.11
W.	η Bootis	14 02 20.63	— 0.43	— 0.12	— 0.63	14 02 19.45	48 39.59	39.86
W.	α Draconis	14 40.15	+ 1.17	— 0.21	— 1.41	14 39.70	14 00 59.48	40.22
W.	κ Virginis	19 50.35	— 0.89	— 0.05	— 0.61	19 48.80	06 08.71	40.09
W.	α Bootis	23 34.70	— 0.42	— 0.07	— 0.63	23 33.58	09 53.50	40.08
E.	5 Ursæ Minoris	41 28.81	+ 2.90	— 0.77	+ 2.50	41 33.44	27 53.24	40.20
E.	ζ Bootis	48 46.83	— 0.51	— 0.19	+ 0.62	48 46.75	35 06.51	40.24
E.	ε Bootis	53 08.07	— 0.28	— 0.24	+ 0.67	53 08.22	39 28.06	40.16
E.	β Ursæ Minoris	15 04 45.76	+ 2.51	— 0.74	+ 2.25	15 04 49.78	51 09.85	39.93
E.	β Bootis	10 51.18	+ 0.03	— 0.31	+ 0.79	10 51.69	14 57 11.58	— 13 40.11
	Mean at $14^h\ 20^m$ local sidereal time							— 13 40.10

NORMAL EQUATIONS.

$$0 = - 8.03 + 10.00\,\delta t - 3.82\,a + 4.42\,c \qquad \delta t = +0^s.10$$
$$0 = +25.64 - 3.82\,\delta t + 13.21\,a - 16.82\,c \qquad a = -1^s.16$$
$$0 = -48.06 + 4.42\,\delta t - 16.82\,a + 47.41\,c \qquad c = +0^s.59$$

GEORGETOWN, COLORADO, JUNE 28, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	α Draconis	14 14 35.73	+ 1.96	+ 0.08	+ 1.44	14 14 39.21	14 00 59.44	— 13 39.77
E.	κ Virginis	19 49.15	— 1.50	+ 0.02	+ 0.62	19 48.29	06 08.73	39.56
E.	α Bootis	23 33.26	— 0.70	0.00	+ 0.65	23 33.21	09 53.49	39.72
E.	ε Bootis	53 07.48	— 0.47	— 0.02	+ 0.69	53 07.68	39 28.05	39.63
W.	β Ursæ Minoris	15 05 47.45	+ 4.22	+ 0.06	— 2.30	15 04 49.43	51 09.79	39.64
W.	β Bootis	11 52.02	+ 0.06	+ 0.04	— 0.80	10 51.32	57 11.57	39.75
W.	ψ Bootis	13 42.89	— 0.49	+ 0.04	— 0.68	12 41.76	59 01.87	39.89
W.	3 Serpentis	15 22 35.62	— 1.11	+ 0.03	— 0.62	15 22 33.92	15 08 54.27	— 13 39.65
	Mean at $14^h\ 35^m$ local sidereal time							— 13 39.70

NORMAL EQUATIONS.

$$0 = -3.36 + 8.00\,\delta t - 0.99\,a - 1.65\,c \qquad \delta t = +0^s.30$$
$$0 = +9.79 - 0.99\,\delta t + 6.89\,a + 6.42\,c \qquad a = -1^s.94$$
$$0 = -3.67 - 1.65\,\delta t + 6.42\,a + 27.36\,c \qquad c = +0^s.61$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JUNE 28, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	1 Aquilæ	18 41 01.94	— 1.51	0.00	— 0.58	18 40 59.85	18 28 19.84	— 13 40.01
W.	α Lyræ	45 21.15	— 0.04	0.00	— 0.73	45 20.38	32 40.49	39.89
W.	β Lyræ	59 06.56	— 0.26	— 0.01	— 0.68	59 05.61	45 25.55	40.06
W.	σ Sagittarii	19 01 08.51	— 2.03	— 0.01	— 0.63	19 01 05.84	47 25.82	40.02
W.	50 Draconis	04 10.05	+ 4.56	— 0.13	— 2.23	04 12.25	50 32.01	40.24
E.	ζ Aquilæ	13 16.84	— 0.90	+ 0.01	+ 0.58	13 16.53	59 36.30	40.23
E.	d Sagittarii	23 55.93	— 1.81	+ 0.01	+ 0.60	23 54.73	19 10 14.46	40.27
E.	τ Draconis	31 37.22	+ 3.78	+ 0.06	+ 1.95	31 43.01	18 02.86	40.15
E.	κ Aquilæ	43 46.66	— 1.47	0.00	+ 0.58	43 45.77	30 05.55	40.22
E.	γ Aquilæ	53 55.78	— 1.00	— 0.09	+ 0.58	53 55.27	40 15.25	40.02
E.	α Aquilæ	58 17.68	— 1.03	— 0.09	+ 0.57	58 17.13	44 37.14	39.99
E.	ε Draconis	20 02 14.38	+ 2.93	— 0.42	+ 1.66	20 02 18.55	19 48 38.69	— 13 39.86
	Mean at $19^h\ 10^m$ local sidereal time							— 13 40.08

NORMAL EQUATIONS.

$$0 = + \ 1.67 + 12.00\,\delta t - \ 0.61\,a + \ 2.95\,c \qquad \delta t = -0^s.38$$
$$0 = + 29.59 - \ 0.61\,\delta t + 14.75\,a - \ 0.72\,c \qquad a = -1^s.99$$
$$0 = - \ 26.89 + \ 2.95\,\delta t - \ 0.72\,a + 46.45\,c \qquad c = +0^s.57$$

GEORGETOWN, COLORADO, JUNE 29, 1873.

Clamp	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	α Draconis	14 14 34.86	+ 3.24	0.00	+ 1.47	14 14 39.57	14 00 59.40	— 13 40.17
E.	κ Virginis	19 50.53	— 2.47	— 0.03	+ 0.63	19 48.66	06 08.73	39.93
E.	α Bootis	23 34.03	— 1.25	— 0.10	+ 0.66	23 33.34	09 53.48	39.86
E.	θ Bootis	34 32.21	+ 1.25	— 0.11	+ 1.02	34 34.37	20 54.24	40.13
E.	5 Ursæ Minoris	41 22.75	+ 8.04	— 0.17	+ 2.61	41 33 23	27 53.09	40.14
W.	ζ Bootis	48 48.71	— 1.41	+ 0.03	— 0.65	48 46.68	35 06.50	40.18
W.	ε Bootis	53 09.54	— 0.77	+ 0.03	— 0.70	53 08.10	39 28.04	40.06
W.	β Ursæ Minoris	15 04 44.94	+ 6.95	+ 0.18	— 2.35	15 04 49.72	51 09.72	40.00
W.	β Bootis	10 52 32	+ 0.09	+ 0.14	— 0.82	10 51.73	57 11.55	40.18
W.	γ^2 Ursæ Minoris	34 36.85	+ 5.67	+ 0.05	— 2.04	34 40.53	15 21 00.47	40.06
W.	α Coronæ	43 02.12	— 0.77	+ 0.02	— 0.70	43 00.67	29 20.46	40.21
W.	α Serpentis	15 51 45.07	— 1.73	+ 0.01	— 0.63	15 51 42.72	38 02.51	— 13 40.21
	Mean at $14^h\ 50^m$ local sidereal time							— 13 40.09

NORMAL EQUATIONS.

$$0 = - 14.21 + 12.00\,\delta t - \ 5.26\,a - \ 2.39\,c \qquad \delta t = -0^s.09$$
$$0 = + 52.63 - \ 5.26\,\delta t + 16.61\,a - \ 0.13\,c \qquad a = -3^s.20$$
$$0 = - 36.81 - \ 2.39\,\delta t + \ 0.13\,a + 59.56\,c \qquad c = +0^s.62$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JULY 1, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	θ Bootis	14 34 36.68	− 0.69	+ 0.02	− 1.20	14 34 34.81	14 20 54.20	− 13 40.61
W.	5 Ursæ Minoris	41 41.79	− 4.82	+ 0.03	− 3.07	41 33.93	27 52.94	40.99
W.	ζ Bootis	48 47.34	+ 0.84	0.00	− 0.76	48 47.42	35 06.49	40.93
W.	ε Bootis	53 09.29	+ 0.46	− 0.01	− 0.82	53 18.92	39 28.02	40.90
E.	β Ursæ Minoris	15 04 52.19	− 4.16	− 0.22	+ 2.76	15 04 50.57	51 09.59	40.98
E.	β Bootis	10 51.50	− 0.06	− 0.09	+ 0.96	10 52.31	57 11.52	40.79
E.	β Libræ	23 50.97	+ 1.46	− 0.04	+ 0.74	23 53.13	15 10 12.09	41.04
E.	γ^2 Ursæ Minoris	34 42.23	− 3.40	− 0.10	+ 2.39	34 41.12	21 00.37	40.75
E.	α Coronæ	15 43 00.18	+ 0.46	− 0.05	+ 0.82	15 43 01.41	29 20.45	− 13 40.96
	Mean at $14^h\ 55^m$ local sidereal time							− 13 40.88

NORMAL EQUATIONS.

$$0 = +16.04 + 9.00\,\delta t - 5.16\,a + 2.49\,c \qquad dt = -0.88$$
$$0 = -31.76 - 5.16\,\delta t + 15.16\,a - 2.59\,c \qquad a = +1.92$$
$$0 = -30.68 + 2.49\,\delta t - 2.59\,a + 51.83\,c \qquad c = +0.73$$

GEORGETOWN, COLORADO, JULY 2, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	θ Bootis	14 34 37.05	− 0.88	− 0.06	− 1.15	14 34 34.96	14 20 54.17	− 13 40.79
W.	5 Ursæ Minoris	41 42.94	− 6.15	0.00	− 2.96	41 33.83	27 52.87	40.96
W.	ζ Bootis	48 47.01	+ 1.08	+ 0.03	− 0.73	48 47.39	35 06.50	40.89
W.	ε Bootis	53 09.08	+ 0.59	0.00	− 0.80	53 08.87	39 28.01	40.86
E.	β Ursæ Minoris	15 04 53.28	− 5.32	− 0.34	+ 2.66	15 04 50.28	51 09.53	40.75
E.	β Bootis	10 51.73	− 0.07	− 0.14	+ 0.93	10 52.45	57 11.51	40.94
E.	β Libræ	23 50.51	+ 1.86	− 0.05	+ 0.71	23 53.03	15 10 12.08	40.95
E.	γ^2 Ursæ Minoris	34 43.49	− 4.34	− 0.11	+ 2.31	34 41.35	21 00.32	41.03
E.	α Coronæ	15 43 00.08	+ 0.59	− 0.12	+ 0.79	15 43 01.34	43 20.44	− 13 40.90
	Mean at $14^h\ 55^m$ local sidereal time							− 13 40.90

NORMAL EQUATIONS.

$$0 = +9.95 + 9.00\,\delta t - 5.16\,a + 2.49\,c \qquad \delta t = +0^s.10$$
$$0 = -34.81 - 5.16\,\delta t + 15.16\,a - 2.59\,c \qquad a = +2^s.45$$
$$0 = -30.42 + 2.49\,\delta t - 2.59\,a + 51.83\,c \qquad c = +0^s.70$$

Observations and reductions for time taken at receiving station—Continued.

GEORGETOWN, COLORADO, JULY 3, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	η Bootis	14 02 19.79	− 0.30	− 0.05	+ 1.13	14 02 20.57	13 48 39.53	− 13 41.04
E.	τ Virginis	08 52.15	+ 0.65	− 0.02	+ 0.73	08 53.51	55 12.23	41.28
E.	α Draconis	14 40.31	− 1.07	− 0.08	+ 1.72	14 40.88	14 00 59.25	41.63
E.	α Bootis	23 33.64	+ 0.38	− 0.07	+ 0.77	23 34.72	09 53.44	41.28
W.	θ Bootis	34 37.16	− 0.38	+ 0.09	− 1.19	34 35.68	20 54.15	41.53
W.	5 Ursæ Minoris	41 39.76	− 2.67	+ 0.13	− 3.06	41 34.16	27 52.78	41.38
W.	ζ Bootis	48 48.17	+ 0.47	+ 0.04	− 0.76	48 47.92	35 06.49	41.43
W.	ε Bootis	53 09.91	+ 0.26	+ 0.03	− 0.82	53 09.38	39 28.00	41.38
W.	β Ursæ Minoris	15 04 55.86	− 2.31	0.00	− 2.75	15 04 50.80	51 09.45	41.35
W.	β Bootis	10 53.88	− 0.03	− 0.01	− 0.96	10 52.88	57 11.50	41.38
E.	β Libræ	23 52.09	+ 0.81	+ 0.01	+ 0.73	23 53.64	15 10 12.08	41.56
E.	γ² Ursæ Minoris	34 41.13	− 1.88	+ 0.01	+ 2.39	34 41.65	21 00.26	41.39
E.	α Coronæ	15 43 00.84	+ 0.26	0.00	+ 0.82	15 43 01.92	29 20.43	− 13 41.49
	Mean at 14h 30m local sidereal time							− 13 41.39

NORMAL EQUATIONS.

$$
\begin{aligned}
0 &= +12.18 + 13.00\,\delta t - 5.48\,a - 1.74\,c & \delta t &= -0^s.39 \\
0 &= -28.74 - 5.48\,\delta t + 16.76\,a + 12.07\,c & a &= +1^s.06 \\
0 &= -58.56 - 1.74\,\delta t + 12.07\,a + 61.92\,c & c &= +0^s.73
\end{aligned}
$$

GEORGETOWN, COLORADO, JULY 3, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	κ Ophiuchi	17 05 21.71	+ 0.61	− 0.01	+ 0.74	17 05 23.05	16 51 41.34	− 13 41.71
E.	ε Ursæ Minoris	12 52.84	− 4.79	− 0.06	+ 5.34	12 53.34	59 11.71	41.63
E.	α¹ Herculis	22 33.86	+ 0.41	− 0.04	+ 0.73	22 34.96	17 08 53.40	41.56
E.	44 Ophiuchi	32 19.14	+ 0.93	− 0.04	+ 0.79	32 20.82	18 39.20	41.62
E.	β Draconis	41 17.27	− 0.33	− 0.16	+ 1.18	41 17.96	27 36.27	41.69
E.	α Ophiuchi	42 44.97	+ 0.44	− 0.09	+ 0.74	42 46.06	29 04.38	41.68
W.	ω Draconis	51 30.20	− 1.28	+ 0.08	− 1.99	51 27.01	37 45.43	41.58
W.	ψ Draconis	58 01.79	− 1.68	+ 0.19	− 2.36	57 57.94	44 16.14	41.80
W.	γ Draconis	18 07 25.09	− 0.55	+ 0.10	− 1.15	18 07 23.49	53 42.06	41.43
W.	γ² Sagittarii	11 22.99	+ 1.04	+ 0.02	− 0.84	11 23.21	57 41.52	41.69
W.	μ¹ Sagittarii	19 53.92	+ 0.89	+ 0.03	− 0.77	19 54.07	18 06 12.43	− 13 41.64
	Mean at 17h 30m local sidereal time							− 13 41.64

NORMAL EQUATIONS.

$$
\begin{aligned}
0 &= +8.92 + 11.00\,\delta t - 4.52\,a + 3.36\,c & \delta t &= -0^s.64 \\
0 &= -16.16 - 4.52\,\delta t + 34.37\,a - 27.05\,c & a &= +0^s.95 \\
0 &= -33.69 + 3.36\,\delta t - 27.05\,a + 85.44\,c & c &= +0^s.72
\end{aligned}
$$

Observations and reductions for time taken at sending station.

SALT LAKE CITY, UTAH, JUNE 23, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	α Bootis	6 02 23.11	+ 2.68	+ 0.03	+ 0.17	6 02 25.99	14 09 53.51	+8 07 27.52
E.	θ Bootis	13 28.63	− 2.32	+ 0.05	+ 0.26	13 26.62	20 54.36	27.74
E.	5 Ursæ Minoris	20 42.54	−17.25	+ 0.10	+ 0.67	20 26.06	27 53.53	27.47
E.	μ Virginis	28 50.82	+ 5.07	+ 0.02	+ 0.16	28 56.07	36 23.56	27.49
E.	ε Bootis	31 58.69	+ 1.83	+ 0.08	+ 0 18	32 00.78	39 28.09	27.31
E.	α^2 Libræ	36 19.19	+ 6.05	+ 0.02	+ 0.17	36 25.43	43 52.83	27.40
W.	β Ursæ Minoris	43 57.98	−14.85	+ 0.09	− 0.61	43 42.61	51 10.10	27.49
W.	β Bootis	49 44.29	− 0.02	+ 0.04	− 0.21	49 44.10	57 11.62	27.52
W.	48 Cephei, S. P.	56 17.20	+28.16	− 0.06	+ 0.73	56 46.03	15 04 13.51	27.48
W.	β Libræ	7 02 39.48	+ 5.42	+ 0.02	− 0.16	7 02 44.76	10 12.13	+8 07 27.37
	Mean at 14h.5 local sidereal time							+8 07 27.48

NORMAL EQUATIONS.

$$
\begin{aligned}
+10.00\,\delta t - 2.10\,a + 8.51\,c &= +20.92 & \delta t &= +0^s.48\\
-2.10\,\delta t + 28.61\,a - 16.81\,c &= -205.00 & a &= -7^s.040\\
+8.51\,\delta t - 16.81\,a + 62.54\,c &= +132.68 & c &= +0^s.160
\end{aligned}
$$

SALT LAKE CITY, JUNE 23, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	η Herculis	8 31 07.58	+ 0.26	− 0.04	− 0.30	8 31 07.50	16 38 34.70	+8 07 27.20
W.	κ Ophiuchi	44 10.71	+ 3.76	− 0.02	− 0.24	44 14.21	51 41.32	27.11
W.	d Herculis	49 29.07	+ 1.05	− 0.01	− 0.28	49 29.83	56 57.00	27.17
W.	ε Ursæ Minoris	51 22.21	−35.11	− 0.05	− 1.74	50 45.31	59 12.54	27.23
W.	a_1 Herculis	9 01 23.01	+ 3.27	− 0.00	− 0.24	9 01 26.04	17 08 53.38	27.34
E.	β Draconis	20 11.16	− 2.36	+ 0.02	+ 0.39	20 09.21	27 36.31	27.10
E.	ω Draconis	30 26.97	− 9.30	+ 0.06	+ 0.65	30 18.38	37 45.57	27.19
E.	μ Herculis	34 02.03	+ 1.82	+ 0.02	+ 0.27	34 04.14	41 31.36	27.22
E.	ψ^1 Draconis	36 00.59	−12.21	+ 0.02	+ 0.77	35 49.17	44 16.31	27.14
E.	γ Draconis	9 46 16.30	− 2.14	+ 0.00	+ 0.38	9 46 14.54	17 53 42.07	+8 07 27.53
	Mean at 17h.0 local sidereal time							+8 07 27.23

NORMAL EQUATIONS.

$$
\begin{aligned}
+10.00\,\delta t + 7.12\,a^1 - 1.52\,c &= +0.81 & \delta t &= +0^s.23\\
+7.12\,\delta t + 29.49\,a^1 - 25.21\,c &= -8.74 & a^1 &= -0^s.150\\
-1.52\,\delta t - 25.21\,a^1 + 85.01\,c &= +23.37 & c &= +0^s.235
\end{aligned}
$$

Adopted azimuth: $-7^s.00$; $a = -7^s.15$.

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 27, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	θ Bootis	6 13 31.08	+ 0.67	0.00	+ 0.06	6 13 31.81	14 20 54.28	+8 07 22.47
E.	μ Virginis	29 02.35	— 1.46	0.00	+ 0.04	29 00.93	36 23.53	22.60
E.	ε Bootis	32 05.90	— 0.53	0.00	+ 0.04	32 05.41	39 28.06	22.65
E.	α^2 Libræ	36 32.02	— 1.75	+ 0.15	+ 0.04	36 30.46	43 52.81	22.35
E.	θ Ursæ Minoris	43 42.41	+ 4.29	+ 0.80	+ 0.13	43 47.63	51 09.85	22.22
E.	β Bootis	49 48.68	+ 0.00	+ 0.34	+ 0.05	49 49.07	57 11.58	22.51
W.	48 Cephei, S. P	57 00.43	— 8.12	— 0.55	— 0.16	57 51.60	15 04 13.91	22.31
W.	β Libræ	7 02 51.09	— 1.56	+ 0.17	— 0.04	7 02 49.66	10 12.11	22.45
W.	o^2 Libræ	08 37.78	— 1.73	+ 0.15	— 0.04	08 36.16	15 58.52	22.36
W.	μ^1 Bootis	12 20.98	— 0.14	+ 0.33	— 0.05	12 21.12	19 43.51	22.39
W.	ζ^3 Libræ	16 11.51	— 1.77	+ 0.15	— 0.04	16 09.85	23 32.40	22.55
	α Coronæ	7 21 58.37	— 0.54	+ 0.28	— 0.04	7 21 58.07	15 29 20.47	+8 07 22.40
	Mean at 15h.0 local sidereal time							+8 07 22.45

NORMAL EQUATIONS.

$$
\begin{aligned}
+12.00\,\delta t + 6.23\,a - 0.10\,c &= -7.28 & \delta t &= +0^s.45 \\
+6.23\,\delta t + 24.03\,a - 27.73\,c &= -46.99 & a &= -2^s.029 \\
-0.10\,\delta t - 27.73\,a + 48.71\,c &= +58.12 & c &= +0^s.035
\end{aligned}
$$

SALT LAKE CITY, UTAH, JUNE 27, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α^1 Herculis	9 01 31.94	— 0.81	+ 0.22	— 0.10	9 01 31.25	17 08 53.40	+8 07 22.15
W.	Groom. 966, S. P.	15 26.23	— 6.07	— 0.40	+ 0.38	15 20.14	5 22 42.21	22.07
W.	α Ophiuchi	21 42.94	— 0.79	+ 0.22	— 0.10	21 42.27	17 29 04.36	22.09
W.	ω Draconis	30 20.81	+ 2.28	+ 0.63	— 0.28	30 23.44	37 45.53	22.09
W.	μ Herculis	34 09.57	— 0.44	+ 0.29	— 0.11	34 09.31	41 31.38	22.07
W.	ψ Draconis	36 50.84	+ 2.99	+ 0.73	— 0.33	36 54.23	44 16.27	22.04
W.	γ Draconis	46 19.30	+ 0.59	+ 0.42	— 0.16	46 20.15	53 42.08	21.93
E	η Serpentis	10 07 25.45	— 1.21	0.00	+ 0.10	10 07 24.34	18 14 46.31	21.97
E.	1 Aquilæ	20 59.18	— 1.33	— 0.02	+ 0.10	20 57.93	28 19.83	21.90
E.	α Lyræ	10 25 18.03	— 0.08	— 0.06	+ 0.13	10 25 18.02	18 32 40.48	+8 07 22.46
	Mean at 17h.5 local sidereal time							+8 07 22.08

NORMAL EQUATIONS.

$$
\begin{aligned}
+10.00\,\delta t + 2.82\,a - 3.68\,c &= -4.47 & \delta t &= +0^s.08 \\
+2.82\,\delta t - 18.26\,a + 23.35\,c &= -29.53 & a &= -1^s.755 \\
-3.68\,\delta t + 23.35\,a + 42.83\,c &= -37.13 & c &= +0^s.097
\end{aligned}
$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JUNE 28, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	θ Bootis	6 13 32.62	+ 0.65	+ 0.08	+ 0.19	6 13 33.54	14 20 54.26	+8 07 20.72
E.	5 Ursæ Minoris	20 27.14	+ 4.80	+ 0.17	+ 0.50	20 32.61	27 53.16	20.55
E.	ε Bootis	32 07.47	— 0.51	+ 0.03	+ 0.13	32 07.12	39 28.05	20.93
E.	a^2 Libræ	36 33.71	— 1.68	+ 0.01	+ 0.12	36 32.16	43 52.81	20.65
E.	β Ursæ Minoris	43 44.39	+ 4.13	+ 0.03	+ 0.45	43 49.00	51 09.78	20.78
W.	β Bootis	49 50.86	— 0.00	+ 0.05	— 0.15	49 50.76	57 11.56	20.80
W.	48 Cephei, S. P	57 00.94	— 7.83	— 0.32	+ 0.54	57 53.33	15 04 14.00	20.67
W.	β Libræ	7 02 52.93	— 1.50	+ 0.08	— 0.12	7 02 51.39	10 12.11	20.72
W.	o^2 Libræ	08 39.68	— 1.66	+ 0.06	— 0.12	08 37.96	15 58.52	20.56
W.	μ^1 Bootis	12 22.95	— 0.13	+ 0.18	— 0.15	12 22.85	19 43.50	20.65
W.	ζ^3 Libræ	16 13.35	— 1.70	+ 0.10	— 0.12	16 11.63	15 33 32.40	+8 07 20.77
	Mean at 15h.0 local sidereal time							+8 07 20.71

NORMAL EQUATIONS.

$$+11.00\,\delta t + 2.79\,a + 10.67\,c = -7.46 \qquad \delta t = -0^s.629$$
$$+2.79\,\delta t + 29.41\,a - 2.15\,c = -58.68 \qquad a = -1^s.960$$
$$+10.67\,\delta t - 2.15\,a + 64.18\,c = +8.46 \qquad c = +0^s.117$$

SALT LAKE CITY, UTAH, JUNE 28, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	η Herculis	8 31 13.80	— 0.09	+ 0.41	— 0.11	8 31 14.01	16 38 34.70	+8 07 20.69
W.	κ Ophiuchi	44 21.47	— 1.19	+ 0.29	— 0.09	44 20.48	51 41.34	20.86
W.	d Herculis	49 36.52	— 0.34	+ 0.43	— 0.11	49 36.50	56 56.99	20.49
W.	a^1 Herculis	9 01 33.17	— 1.03	+ 0.37	— 0.09	9 01 32.42	17 08 53.40	20.98
E.	μ Herculis	34 10.39	— 0.56	+ 0.55	+ 0.10	34 10.48	41 31.39	20.91
E.	γ Draconis	46 19.80	+ 0.67	+ 0.88	+ 0.14	46 21.49	53 42.08	20.59
	Mean at 17h.0 local sidereal time							+8 07 20.75

NORMAL EQUATIONS.

$$+6.00\,\delta t + 1.13\,a - 1.79\,c = -4.20 \qquad \delta t = -0^s.25$$
$$+1.13\,\delta t + 0.66\,a - 1.44\,c = -1.88 \qquad a = -2^s.240$$
$$-1.79\,\delta t - 1.44\,a + 9.05\,c = +4.44 \qquad c = +0^s.087$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 1, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	5 Ursæ Minoris....	6 20 33.44	+ 4.67	— 0.24	— 0.42	6 20 37.45	14 27 52.94	+ 8 7 15.49
E.	5 Ursæ Minoris....	20 32.34	+ 4.67	— 0.24	+ 0.42	20 37.19	27 52.94	15.75
E.	μ Virginis	29 08.91	— 1.37	— 0.03	+ 0.10	29 07.61	36 23.46	15.85
E.	ε Bootis	32 12.52	— 0.49	— 0.05	+ 0.11	32 12.09	39 28.02	15.93
E.	a^2 Libræ	36 38.26	— 1.64	— 0.02	+ 0.10	.36 36.70	43 52.79	16.09
E.	β Ursæ Minoris....	43 49.35	+ 4.03	— 0.13	+ 0.38	43 53.63	51 09.59	15.96
W.	48 Cephei, S. P......	57 05.86	— 7.64	+ 0.14	+ 0.45	57 58.81	04 14.31	15.50
W.	β Libræ............	7 02 57.73	— 1.47	— 0.04	— 0.10	7 02 56.12	15 10 12.09	15.97
W.	o^2 Libræ............	08 44.60	— 1.62	— 0.04	— 0.10	08 42.84	15 58.53	15.69
W.	μ Bootis	12 27.98	— 0.13	— 0.10	— 0.13	12 27.62	19 43.47	15.85
W.	ζ^3 Libræ............	16 18.27	— 1.66	— 0.05	— 0.10	16 16.46	23 32.39	15.93
W.	a Coronæ	22 05.21	— 0.52	— 0.10	— 0.11	22 04.43	29 20.44	15.96
W.	τ^6 Serpentis	27 55.76	— 0.82	— 0.11	— 0.10	27 54.73	35 10.58	15.85
W.	a Serpentis	30 47.85	— 1.07	— 0.10	— 0.10	7 30 46.58	15 34 02.50	+ 8 7 15.92
	Mean at 15h.0 local sidereal time							+ 8 7 15.84

NORMAL EQUATIONS.

$$
\begin{aligned}
+14.00\,\delta t + 2.65\,a + 3.97\,c &= -6.92 & \delta t &= -0^s.16\\
+2.65\,\delta t + 36.41\,a + 8.12\,c &= -69.31 & a &= -1^s.910\\
+3.97\,\delta t + 8.12\,a + 81.82\,c &= -7.95 & c &= +0^s.101
\end{aligned}
$$

SALT LAKE CITY, UTAH, JULY 2, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	μ Virginis.........	6 29 10.12	— 1.35	— 0.07	+ 0.10	6 29 08.80	14 36 23.51	+8 07 14.71
E.	a^2 Libræ............	36 39.88	— 1.62	— 0.06	+ 0.10	36 38.30	43 52.78	14.48
E.	β Ursæ Minoris....	43 50.87	+ 3.97	— 0.31	+ 0.38	43 54.91	51 09.53	14.62
W.	β Bootis	49 57.00	— 0.00	— 0.10	— 0.13	49 56.77	57 11.51	14.74
W.	48 Cephei, L. C......	56 06.54	— 7.52	+ 0.19	+ 0.45	56 59.66	04 14.40	14.74
W.	β Libræ............	7 02 58.93	— 1.45	— 0.05	— 0.10	7 02 57.33	15 10 12.08	14.75
W.	o^2 Libræ............	08 45.68	— 1.60	— 0.03	— 0.10	08 43.95	15 58.52	14.57
W.	μ^1 Bootis	12 29.08	— 0.13	— 0.06	— 0.13	12 28.76	19 43.45	14.69
E.	ζ^3 Libræ............	16 19.17	— 1.64	— 0.03	+ 0.10	16 17.60	23 32.38	14.78
E.	a Coronæ	22 06.15	— 0.51	— 0.05	+ 0.11	22 05.70	29 20.43	14.73
E.	τ^6 Serpentis	27 56.62	— 0.81	— 0.06	+ 0.10	27 55.85	35 10.58	14.73
E.	a Serpentis	30 48.76	— 1.05	— 0.06	+ 0.10	30 47.75	38 02.49	14.74
E.	ε Serpentis	7 37 17.29	— 1.11	— 0.09	+ 0.10	7 37 16.19	15 44 30.94	+8 07 14.75
	Mean at 15h.0 local sidereal time							+8 07 14.70

NORMAL EQUATIONS.

$$
\begin{aligned}
+13.00\,\delta t + 7.88\,a + 10.94\,c &= -17.71 & \delta t &= -0^s.30\\
+7.88\,\delta t + 24.69\,a + 12.85\,c &= -47.35 & a &= -1^s.880\\
+10.94\,\delta t + 12.85\,a + 47.84\,c &= -22.78 & c &= +0^s.100
\end{aligned}
$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 2, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	μ Herculis	9 34 17.16	− 0.50	− 0.14	+ 0.27	9 34 16.79	17 41 31.39	+8 07 14.60
E.	72 Ophiuchi	54 08.04	− 1.05	− 0.10	+ 0.24	54 07.13	18 01 21.79	14.66
E.	η Herculis	10 07 33.06	− 1.37	− 0.08	+ 0.24	10 07 31.85	14 46.35	14.50
W.	α Lyræ	25 26.18	− 0.10	− 0.20	− 0.30	25 25.58	32 49.52	14.94
W.	50 Draconis	43 14.17	+ 4.42	− 0.26	− 0.93	43 17.40	50 31.99	14.59
W.	α Sagittarii	11 03 02.03	− 1.82	− 0.03	− 0.25	11 03 59.93	19 10 14.51	+8 07 14.58
	Mean at 18h.0 local sidereal time							+8 07 14.66

NORMAL EQUATIONS.

$$+6.00\,\delta t + 0.21\,a - 3.13\,c = -3.18 \qquad \delta t = -0^s.34$$
$$+0.21\,\delta t + 6.62\,a + 9.28\,c = -11.02 \qquad a = -1^s.980$$
$$-3.13\,\delta t + 9.28\,a + 21.60\,c = -12.33 \qquad c = +0^s.236$$

SALT LAKE CITY, UTAH, JULY 3, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	μ Virginis	6 29 11.50	− 1.33	− 0.07	− 0.08	6 29 10.02	14 36 23.50	+8 07 13.48
W.	o^2 Libræ	7 08 46.86	− 1.57	− 0.06	− 0.08	7 08 45.15	15 15 58.51	13.36
W.	μ^1 Bootis	12 30.25	− 1.13	− 0.11	− 0.10	12 28.91	19 43.45	13.54
W.	ζ^3 Libræ	16 20.63	− 1.61	− 0.05	− 0.08	16 18.89	23 32.38	13.49
W.	α Coronæ	22 07.44	− 0.50	− 0.09	− 0.09	22 06.76	29 20.43	13.67
E.	τ^6 Serpentis	27 57.79	− 0.80	− 0.09	+ 0.08	27 56.98	35 10.56	13.58
E.	α Serpentis	30 49.97	− 1.04	− 0.07	+ 0.08	30 48.94	38 02.49	13.55
E.	ε Serpentis	37 18.38	− 1.09	− 0.07	+ 0.08	37 17.30	44 30.93	13.63
E.	ζ Ursæ Minoris	41 24.61	+ 5.49	− 0.39	+ 0.38	41 30.09	48 43.58	13.49
E.	β^1 Scorpii	50 53.33	− 1.70	− 0.05	+ 0.08	7 50 51.66	15 58 05.15	+8 07 13.49
	Mean at 15h.5 local sidereal time							+8 07 13.53

NORMAL EQUATIONS.

$$+10.00\,\delta t + 2.31\,a + 3.54\,c = +1.27 \qquad \delta t = +0^s.53$$
$$+2.31\,\delta t + 12.57\,a - 14.82\,c = -23.22 \qquad a = -1^s.850$$
$$+3.54\,\delta t - 14.82\,a + 34.13\,c = +31.99 \qquad c = +0^s.077$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 3, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	ζ Ophiuchi	8 22 59.89	— 1.37	— 0.08	+ 0.14	8 22 58.58	16 30 11.98	+8 07 13.40
E.	κ Ophiuchi	44 28.83	— 0.92	— 0.10	+ 0.14	44 27.95	51 41.34	13.39
E.	a^1 Herculis	51 40.71	— 0.80	— 0.06	+ 0.14	51 39.99	17 08 53.40	13.41
E.	Groomb. 966, S. P.	9 15 35.58	— 6.04	+ 0.05	— 0.52	9 15 29.07	5 22 42.56	13.49
W.	Groomb. 966, S. P.	15 34.48	— 6.04	+ 0.05	+ 0.52	15 29.01	5 22 42.56	13.55
W.	ω Draconis	30 29.90	+ 2.26	— 0.00	— 0.37	30 31.79	17 37 45.42	13.63
W.	72 Ophiuchi	54 09.30	— 0.92	+ 0.04	— 0.14	54 08.28	18 01 21.80	13.52
W.	η Serpentis	10 07 34.25	— 1.20	+ 0.06	— 0.14	10 07 32.97	18 14 46.36	+8 07 13.39
	Mean at $17^h.0$ local sidereal time							+8 07 13.47

NORMAL EQUATIONS.

$$+8.00\,\delta t + 8.64\,a - 1.73\,c = -11.48 \qquad \delta t = +0^s.47$$
$$+8.64\,\delta t + 27.63\,a + 4.18\,c = -43.53 \qquad a = -1^s.744$$
$$-1.73\,\delta t + 4.18\,a + 42.47\,c = -2.73 \qquad c = +0^s.135$$

The observations for time taken at Salt Lake City June 25 and 26 are printed in the report on Green River.

From these determinations of time the following tables are derived. They contain the corrections and adopted hourly rates of the chronometers used at Georgetown and Salt Lake City. The adopted rate is the mean of the rates of the chronometer at the preceding and following dates:

CHRONOMETER AT GEORGETOWN.—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	h. m.	h. m. s.	s.
June 23	15 52	— 0 13 41.855	— 0.0155
June 25	16 16	41.100	— 0.0285
June 26	14 20	40.150	— 0.0218
June 27	14 20	40.100	— 0.0050
June 28	16 52	39.890	+ 0.0006
June 29	14 50	40.090	+ 0.0128
July 1	14 55	40.880	+ 0.0087
July 2	14 55	40.900	+ 0.0126
July 3	16 13	— 0 13 41.597*	+ 0.0244

* Mean by giving the last determination the weight 3.

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h. m.*	*h. m. s.*	*s.*
June 23	15 45	+ 8 07 27.360	— 0.0544
June 25	16 30	24.610	— 0.0568
June 26	15 30	23.350	— 0.0589
June 27	16 15	22.260	— 0.0602
June 28	16 00	20.725	— 0.0652
July 1	15 00	15.840	— 0.0572
July 2	16 30	14.680	— 0.0476
July 3	16 15	+ 8 07 13.500	— 0.0497

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*h. m. s.*
June 23, 1873:							
Salt Lake City	Georgetown ...	16 33 33.77	—0 13 41.84	16 19 51.93			
	Salt Lake City.	7 47 35.48	+8 07 27.35	15 55 02.83	0 24 49.10		
Georgetown ...	Georgetown ...	16 50 58.10	—0 13 41.84	16 37 16.26			
	Salt Lake City.	8 05 00.00	+8 07 27.33	16 12 27.33	48.93	0.17	0 24 49.015
June 25, 1873:							
Salt Lake City	Georgetown ...	17 03 39.78	—0 13 41.08	16 49 58.70			
	Salt Lake City.	8 17 45.00	+8 07 24.60	16 25 09.60	49.10		
No signals sent from Georgetown	....	....	....	....	(48.94)	(0.16)	49.020
June 27, 1873:							
Salt Lake City	Georgetown ...	17 14 15.77	—0 13 40.09	17 00 35.68			
	Salt Lake City	8 28 24.33	+8 07 22.24	16 35 46.57	49.11		
No signals sent from Georgetown; circuit open	....	....	....	....	(48.95)	(0.16)	49.030
June 28, 1873:							
Salt Lake City	Georgetown ...	16 52 57.27	—0 13 39.89	16 39 17.38			
	Salt Lake City.	8 07 07.60	+8 07 20.71	16 14 28.31	49.07		
Georgetown ...	Georgetown ...	16 58 30.00	—0 13 39.89	16 44 50.11			
	Salt Lake City.	8 12 50.46	+8 07 20.70	16 20 11.16	48.95	0.12	49.010
July 2, 1873:							
Georgetown ...	Georgetown ...	16 30 29.54	—0 13 40.92	16 16 48.62			
	Salt Lake City.	7 44 44.95	+8 07 14.71	15 51 59.66	48.96		
Salt Lake City	Georgetown ...	16 35 52.23	—0 13 40.92	16 22 11.31			
	Salt Lake City.	7 50 07.47	+8 07 14.71	15 57 22.18	49.13	0.17	49.045
July 3, 1873:							
Salt Lake City	Georgetown ...	16 43 52.20	—0 13 41.59	16 30 10.61			
	Salt Lake City.	7 58 08.00	+8 07 13.51	16 05 21.51	49.10		
Georgetown ...	Georgetown ...	16 48 29.57	—0 13 41.59	16 34 47.98			
	Salt Lake City.	8 02 45.55	+8 07 13.50	16 09 59.05	0 24 48.93	0.17	0 24 49.015

Georgetown east of Salt Lake City............$0^h\ 24^m\ 49^s.023 \pm 0^s.0036$.

Mean places of stars for 1873 *used for determination of latitude of Georgetown, Colorado.*

No. of pair.	No. in B. A. C.	Right ascension.	Declination.
		h. m. s.	° ′ ″
1	5463	16 15 55	46 37 00.2
	5484	18 04	32 37 50.8
2	5702	49 47	18 38 15.0
	5717	52 18	60 33 57.8
3	5763	58 57	35 35 41.4
	5775	17 01 13	43 59 09.5
4	5842	12 38	33 14 17.7
	5871	16 46	46 21 58.6
5	5911	23 23	48 22 02.9
	5962	31 47	30 51 54.5
6	6184	18 07 46	56 14 17.4
	6241	16 51	23 13 19.8
7	6349	31 06	38 47 32.5
	6364	35 27	40 49 11.9
8	6426	45 02	32 40 04.0
9	6480	52 16	32 44 22.4
	6520	57 51	46 45 20.6
10	6583	19 09 16	56 38 35.9
	6602	12 21	22 47 55.0
11	6629	15 38	62 58 36.6
	6642	18 40	16 41 30.8
12	6724	31 32	16 10 45.5
	6737	33 24	63 09 05.6
13	6762	38 43	26 50 58.6
	6824	47 26	52 39 58.8
14	6856	52 21	52 06 09.4
	6879	55 52	27 24 16.0
15	7037	20 19 31	68 28 24.3
	7079	25 07	10 50 03.0
16	7114	20 30 01	40 39 41.2
	7176	36 15	38 37 51.3
17	7211	41 34	66 11 43.6
	7258	49 36	13 14 17.8
18	7333	21 00 19	43 25 19.1
	7373	08 20	36 06 36.2
19	7402	13 43	43 24 44.0
	7453	20 36	36 07 10.3
20	7465	22 42	31 40 10.8
	7496	27 42	47 53 00.6
21	7545	35 02	56 54 55.2
	7496	40 13	22 21 52.7
22	7606	44 04	16 41 48.0
	7658	53 04	63 01 16.3
23	7679	57 31	42 12 07.1
24	7743	22 05 47	42 24 24.1
	7777	10 26	37 07 01.1
25	7798	15 27	27 41 29.9
	7815	18 34	51 35 35.8
26	7824	19 58	50 36 38.1
27	7888	32 10	50 53 23.5
	7914	35 46	28 38 43.4
28	7943	40 20	11 31 17.8
	7963	44 40	67 53 46.4
29	8074	23 03 52	74 42 03.5
	8127	13 52	4 41 18.4

NOTE.—The places of μ Herculis and γ Draconis are taken from the American Ephemeris.

Observations and computations for latitude.

GEORGETOWN, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1873.		*t. d.*	*d*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
June 22	5763	11 55.5	21.0	14.0						
	5775	2 45.2	9.0	25.5		39 47 23.3	− 4 42.7	− 2.6	......	39 42 38.0
	5842	14 92.7	9.0	25.6						
	5871	4 43.3	21.1	14.0		48 05.6	− 5 25.9	− 2.6	......	37.1
June 26	5702	15 45.2	12.0	18.0						
	5717	3 66.9	7.6	23.0		36 05.3	+ 6 37.0	− 5.9	......	36.4
	5763	5 29.9	15.0	15.0						
	5775	14 34.3	6.0	25.0		39 47 24.2	− 4 40.9	− 5.2	......	38.1

Observations and computations—Continued.

GEORGETOWN, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
June 26	5842	14 91.6	21.0	10.0						
	5871	4 63.5	10.0	41.0		39 48 06.6	— 5 19.3	—11.0	......	39 42 36.3
	5911	15 88.0	7.0	25.0						
	5962	4 63.3	5.0	27.0		36 56.6	+ 5 49.3	—11.0	......	34.9
	μ Herc.	12 96.2	20.0	11.0						
	γ Drac.	5 89.0	9.0	23.0		38 59.2	+ 3 39.7	— 1.4	......	37.5
	6184	10 57.8	12.0	20.0						
	6241	8 58.3	7.3	25.0		43 44.8	— 1 02.0	— 7.0	......	35.8
	6426	10 91.9	16.0	16.0		42 37.1	+ 0 04.9	— 6.4	......	35.6
	6480	6 74.0	16.0	16.0		44 46.2	— 2 04.8	— 6.4	......	35.0
	6520	10 76.0	4.7	27.8						
	6583	10 12.5	17.0	15.0						
	6602	9 32.9	0.0	32.6		43 09.8	— 0 24.7	— 8.4	......	36.7
	6629	2 86.3	18.0	14.5						
	6642	16 93.9	2.5	30.3		49 57.9	— 7 17.2	— 6.7	......	34.0
	6724	11 63.3	19.0	14.0						
	6737	6 07.0	5.0	28.0	50ˢ late.	39 49.5	+ 2 52.8	— 4.9	— 0.4	37.0
	6762	12 58.5	19.0	14.0						
	6824	8 44.7	0.0	33.0		44 52.1	— 2 08.5	— 7.7	......	35.9
	7114	6 47.7	15.0	18.0						
	7167	14 21.8	10.3	23.0		38 38.5	+ 4 00.4	— 2.7	......	36.3
	7211	10 17.5	14.0	19.3						
	7258	10 66.2	21.0	13.0		42 53.6	— 0 15.1	+ 0.7	......	39.2
	7333	13 01.5	17.0	16.0						
	7373	6 97.3	13.0	20.0		45 49.5	— 3 11.3	— 1.6	......	36.6
	7402	12 43.9	13.8	20.0						
	7453	6 33.8	13.0	21.0		45 48.8	— 3 09.5	— 3.9	......	35.4
	7465	6 17.7	15.0	19.0						
	7496	13 59.1	16.0	18.0		46 27.3	— 3 50.3	— 1.6	......	35.4
June 27	6349	4 55.3	14.0	22.0						
	6364	15 59.2	23.7	12.3		48 18.0	— 5 42.9	+ 0.9	......	36.0
	6426	11 84.2	17.0	19.0		42 37.4	+ 0 00.7	— 1.1	......	37.0
	6480	7 67.8	17.0	19.3		44 46.5	— 2 08.6	— 1.1	......	36.8
	6520	11 81.8	17.0	19.0						
	6583	9 15.0	13.0	22.0						
	6602	8 06.5	26.0	10.0		43 10.1	— 0 33.7	+ 1.9	......	38.3
	6629	2 02.3	26.0	11.0						
	6642	16 23.2	6.6	30.0		39 49 58.3	— 7 21.3	— 2.3	......	39 42 34.7

Observations and computations—Continued.

GEORGETOWN, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
June 27	6724	7 83.2	17.3	19.0						
	6737	13 28.5	17.2	19.2		39 39 49.7	+ 2 49.3	− 1.0	......	39 42 38.0
	6762	7 78.6	14.8	22.0						
	6784	12 17.0	21.0	16.0		44 52.4	− 2 16.1	− 0.6	......	35.7
	6856	11 10.8	19.6	17.0						
	6879	6 38.7	12.2	24.0		45 06.2	− 2 26.3	− 2.5	......	37.4
	7037	5 85.4	22.0	15.0						
	7079	12 73.6	8.0	28.8	Dpl. med.	39 07.5	+ 3 33.7	− 3.8	......	37.4
	7114	5 82.5	14.0	23.0						
	7167	13 64.7	18.0	19.3		38 38.8	+ 4 02.9	− 2.8	......	38.9
	7211	8 52.2	18.0	19.3						
	7258	7 96.1	22.0	16.0		42 53.9	+ 0 17.4	+ 1.3	......	37.8
	7333	12 02.0	18.2	19.3						
	7373	5 90.6	10.0	28.0		45 49.8	− 3 09.9	− 5.2	......	34.7
	7402	11 43.6	18.0	20.0						
	7453	5 33.8	16.7	21.0		45 49.1	− 3 09.4	− 1.7	......	38.0
July 1..	5842	4 52.1	27.0	15.1						
	5871	15 17.0	14.3	28.0		48 07.9	− 5 30.8	− 0.5	......	36.6
	5911	4 54.3	22.2	20.1						
	5962	15 53.0	10.0	33.0		36 57.9	+ 5 43.3	− 5.7	......	35.5
	μ Herc.	13 79.1	19.9	24.0						
	γ Drac.	6 67.2	14.5	29.0		39 00.6	+ 3 41.1	− 5.1	......	36.6
	6184	10 67.8	22.3	21.0						
	6241	8 51.5	16.3	27.3		43 46.2	− 1 07.2	− 2.7	......	36.3
	6349	3 26.9	19.0	25.5						
	6364	14 28.0	24.2	20.1		48 19.1	− 5 42.0	− 0.7	......	36.4
	6426	11 18.4	22.0	22.9		42 38.6	+ 0 02.2	− 4.9	......	35.9
	6480	6 98.0	22.0	23.0		44 47.7	− 2 08.3	− 4.9	......	34.5
	6520	11 11.2	14.0	31.0						
	6583	10 11.0	22.3	21.9						
	6602	9 13.9	14.0	30.3		43 11.3	− 0 30.2	− 4.4	......	36.7
	6629	17 52.1	25.8	18.0						
	6642	3 25.0	15.6	29.1		49 59.4	− 7 23.2	− 1.4	......	34.8
	6724	12 26.2	29.3	14.0						
	6737	6 93.6	17.1	27.9		39 50.9	+ 2 45.4	+ 0.7	......	37.0
	6762	7 41.3	19.7	25.0						
	6824	11 83.0	23.2	22.0		39 44 53.6	− 2 17.2	− 1.1	......	39 42 35.3

Observations and computations—Continued.

GEORGETOWN, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1873.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
July 1..	7037	5 65.7	23.3	21.7						
	7079	12 25.6	27.0	18.0		39 39 08.6	+ 3 25.0	+ 2.9	......	39 42 36.5
	7114	6 12.9	20.0	25.0						
	7167	13 73.5	26.0	19.0		38 40.1	+ 3 56.2	+ 0.6	......	36.9
	7211	9 09.2	23.9	21.8						
	7258	8 47.4	25.1	20.2		42 55.0	— 0 19.2	+ 1.9	......	37.7
	7333	12 70.1	23.5	21.8						
	7373	6 58.8	11.3	34.0		45 51.0	— 3 09.9	— 5.8	......	35.3
	7402	12 17.4	24.0	21.2						
	7453	6 02.1	15.0	30.3		45 50.3	— 3 11.1	— 3.4	......	35.8
	7465	5 91.7	19.2	25.8						
	7496	13 31.0	18.0	27.3		46 28.8	— 3 49.6	— 4.4	......	34.8
July 2..	5763	5 20.8	27.9	20.2						
	5775	14 58.1	22.9	25.2		47 25.9	— 4 51.1	+ 1.5	......	36.3
	5842	3 22.7	25.0	23.0						
	5871	13 92.2	22.2	26.0		48 08.2	— 5 32.2	— 0.5	......	35.5
	5911	4 11.7	27.7	20.3						
	5962	15 00.0	20.3	27.7		36 58.1	+ 5 37.8	0.0	......	35.9
	μ Herc.	13 29.6	30.5	17.5						
	γ Drac.	6 34.9	17.0	31.8		39 00.9	+ 3 35.8	— 0.5	......	36.2
	6184	10 62.7	29.0	19.5						
	6241	8 31.8	19.9	28.6		43 46.5	— 1 11.7	+ 0.2	......	35.0
	6349	3 10.7	21.5	27.0						
	6364	14 20.7	26.5	21.7		48 19.5	— 5 44.8	— 0.2	......	34.5
	6426	10 59.1	20.0	28.5		42 38.8	— 0 03.4	+ 0.3	......	35.7
	6480	6 41.9	21.0	27.7		44 47.9	— 2 13.0	+ 0.8	......	35.7
	6520	10 70.2	29.3	19.6						
	6583	10 03.1	23.0	25.3						
	6602	8 83.7	25.2	23.0		43 11.6	— 0 37.1	0.0	......	34.5
	6629	17 16.0	19.0	29.3						
	6642	2 91.2	27.8	21.0		49 59.7	— 7 22.5	— 1.0	......	36.2
	6724	12 09.4	24.0	25.0						
	6737	6 81.4	26.3	22.8		39 51.2	+ 2 44 0	+ 0.7	......	35.9
	6762	6 60.8	18.0	31.3						
	6824	11 06.9	32.0	17.0		44 53.9	— 2 18.6	+ 0.5	......	35.8
	7114	6 13.7	21.0	29.0						
	7167	13 74.0	29.0	21.0		38 40.4	+ 3 56.2	0.0	......	36.6
	7211	8 95.2	26.3	24.0						
	7258	8 32.3	26.0	24.3		39 42 55.3	— 0 19.5	+ 1.1	......	39 42 36.9

Observations and computations—Continued.

GEORGETOWN, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
July 2..	7333	12 50.0	21.0	29.0						
	7373	6 28.1	26.3	24.0		39 45 51.3	− 3 13.2	− 1.5	....	39 42 36.6
	7402	11 94.9	13.8	37.0						
	7453	5 70.2	35.0	15.0		45 50.6	− 3 14.0	− 0.9	.....	35.7
	7465	5 23.3	19.4	31.2						
	7496	12 78.9	31.0	19.7		46 29.1	− 3 54.7	− 0.2	......	34.2
	7545	4 44.9	25.0	25.3						
	7585	12 78.0	26.0	24.3		38 17.5	+ 4 18.8	+ 0.4	......	36.7
	7606	0 84.3	26.0	24.0						
	7658	17 89.2	25.0	25.6		51 25.7	− 8 49.5	+ 0.4	....	36.6
	7679	2 53.5	23.0	27.4	Very faint.	39 27.2	+ 3 10.4	− 2.2	....	35.4
	7743	14 36.0	24.3	26.0		45 35.6	− 2 56.9	− 1.4	....	37.3
	7777	8 66.5	23.5	27.0						
	7798	13 07.0	27.9	23.0						
	7815	5 05.3	23.3	27.2		38 26.8	+ 4 09.0	+ 0.3	....	36.1
	7824	0 57.1	23.0	27.3		37 34.0	+ 5 02.0	− 0.6	....	35.4
	7888	16 76.8	26.0	24.6		45 56.5	− 3 21.1	+ 0.9	....	36.3
	7914	10 29.5	26.3	24.3						
	7943	9 59.7	24.3	26.0						
	7963	9 39.2	29.0	21.4		42 26.2	+ 0 06.4	+ 1.6	....	34.2
July 4..	5463	3 85.3	14.0	37.0						
	5484	13 74.2	38.8	12.0		37 27.9	+ 5 07.2	+ 0.8	....	35.9
	5702	15 63.3	18.5	33.0						
	5717	3 15.0	34.4	17.3		36 07.1	+ 6 27.7	+ 1.0	....	35.8
	5763	5 51.6	28.8	23.0						
	5775	15 04.0	37.3	14.5		47 26.3	− 4 55.8	+ 7.8	....	38.3
	5842	3 95.8	23.9	28.2						
	5871	14 88.7	39.6	12.5		48 08.7	− 5 39.4	+ 6.2	....	35.5
	5911	3 36.5	19.0	33.3						
	5962	14 07.0	41.8	10.6		36 58.6	+ 5 32.5	+ 4.7	....	35.8
	μ Herc	13 21.6	26.0	26.5						
	γ Drac.	6 44.2	37.7	15.0		39 01.4	+ 3 30.4	+ 6.1	....	37.9
	6114	12 05.9	28.7	24.0						
	6123	6 78.8	30.5	22.2		45 15.5	− 2 43.6	+ 3.6	....	35.5
	6184	10 93.1	25.4	15.0						
	6241	8 47.2	23.8	16.7		43 47.1	− 1 16.4	+ 4.8	......	35.5
	6349	3 49.8	22.0	8.4						
	6364	14 74.2	17.2	13.2		39 48 20.1	− 5 49.2	+ 4.8	....	39 42 35.7

Observations and computations—Continued.

GEORGETOWN, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1873.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
July 4..	6426	11 46.8	19.3	29.3		39 42 39.5	— 0 07.4	+ 4.0	......	39 42 36.1
	6480	7 27.4	21.8	27.8		44 48.6	— 2 17.6	+ 5.1	......	36.1
	6520	11 70.6	37.0	12.5						
	6583	10 35.9	24.7	24.7						
	6602	9 04.8	37.7	11.7		43 12.2	— 0 40.7	+ 7.1	......	38.6
	6724	11 87.2	31.0	18.6						
	6737	6 74.1	31.0	18.6		39 51.7	+ 2 39.4	+ 6.8	......	37.9
	6762	6 78.6	18.0	31.9						
	6824	11 54.3	47.2	2.3		44 54.6	— 2 27.8	+ 8.5	......	35.3
	6856	11 94.9	33.0	17.0						
	6879	6 88.8	24.7	25.8		45 08.4	— 2 37.2	+ 4.1	......	35.3
	7037	6 17.0	25.3	25.0						
	7079	13 03.0	12.0	38.3		39 09.5	+ 3 33.1	— 7.2	......	35.4
	7114	5 46.9	25.7	24.5						
	7167	13 31.0	8.0	42.2		38 41.1	+ 4 03.5	— 9.1	......	35.5
	7211	9 00.9	24.0	26.0						
	7258	8 62.9	12.0	37.9		42 55.9	— 0 11.8	— 7.7	......	36.4
	7333	12 33.6	19.0	31.0						
	7373	6 09.4	30.0	20.0		45 51.9	— 3 13.9	— 0.6	......	37.4
	7402	11 75.2	25.8	24.0						
	7453	5 55.2	18.0	31.8		45 51.3	— 3 12.6	— 3.3	......	35.4
	7465	5 75.7	22.0	27.8						
	7496	13 21.2	24.5	25.0		46 29.7	— 3 51.6	— 1.7	......	36.4
	7545	4 38.7	26.5	23.3						
	7585	12 82.5	19.8	29.4		38 18.1	+ 4 22.1	— 1.7	......	38.5
	7606	— 0 11.8	31.0	18.5						
	7658	16 82.3	15.0	33.8		51 26.3	— 8 46.5	— 1.7	......	38.1
	7679	2 89.0	22.0	28.0		39 27.7	+ 3 06.2	+ 3.4	......	37.3
	7743	14 80.0	21.0	29.0		45 36.2	— 3 03.7	+ 2.9	......	35.4
	7777	8 88.5	33.8	15.3						
	7798	13 20.0	29.3	20.3						
	7815	5 05.5	14.0	36.0		38 27.4	+ 4 13.0	— 3.6	......	36.8
	7824	— 0 01.9	21.8	28.0		37 34.5	+ 5 03.2	— 0.9	......	36.8
	7888	16 10.5	22.0	27.5		45 57.1	— 3 17.6	— 0.7	......	38.8
	7914	9 74.2	26.0	23.0						
	7943	9 74.4	25.1	23.6						
	7963	9 46.4	22.5	26.2		42 26.7	+ 0 08.7	— 0.6	......	34.8
July 5..	7037	5 79.0	29.3	21.0						
	7079	12 24.1	35.0	15.3		39 39 09.7	+ 3 20.4	+ 7.7	......	39 42 37.8

Observations and computations—Continued.

GEORGETOWN, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
July 5..	7114	6 62.3	24.3	26.0						
	7167	14 00.2	39.0	11.6		39 38 41.4	+ 3 49.2	+ 7.1	......	39 42 37.7
	7211	9 18.6	33.6	17.1						
	7258	8 31.0	36.0	14.7		42 56.2	− 0 27.3	+10.3	......	39.2
	7333	12 53.1	25.0	26.0						
	7373	6 37.2	14.3	37.0		45 52.3	− 3 11.3	− 6.5	......	34.5
	7402	12 12.4	17.5	34.0						
	7453	5 78.9	34.0	17.7		45 51.6	− 3 16.8	0.0	......	34.8
	7465	5 19.3	25.0	26.8						
	7496	12 53.3	17.0	34.9		46 30.0	− 3 48.0	− 5.4	......	36.6
	7545	4 72.0	31.1	21.0						
	7585	13 09.7	15.0	38.0		38 18.4	+ 4 20.2	− 3.5	......	35.1
	7606	0 38.3	26.0	27.0						
	7658	17 46.5	29.7	23.8		51 26.7	− 8 50.6	+ 1.4	......	37.5
	7679	2 81.6	22.0	31.9		39 28.0	+ 3 08.4	+ 2.5	......	38.9
	7743	14 66.5	22.0	32.2		45 36.5	− 2 59.6	+ 2.4	......	39.3
	7777	8 88.3	36.0	17.0						
	7798	13 09.7	33.7	20.0						
	7815	4 97.0	14.0	39.8		38 27.7	+ 4 12.4	− 3.3	......	36.8
	7824	0 08.0	21.7	32.2		37 34.8	+ 5 03.3	− 2.2	......	35.9
	7888	16 27.0	23.9	30.0		45 57.4	− 3 19.6	− 1.0	......	36.8
	7914	9 84.5	28.3	25.7						
	7943	9 71.0	33.0	20.9						
	7963	9 35.5	18.3	35.7		42 27.0	+ 0 11.0	− 1.4	......	36.6
	8074	8 21.0	27.6	25.0						
	8127	10 25.2	15.2	37.5		39 41 36.6	+ 1 03.4	− 5.4	......	39 42 34.6

ASTRONOMICAL CO-ORDINATES OF STATION AT GEORGETOWN, COLORADO.

Adopting the longitude of Washington and Salt Lake City, as given in the report for Colorado Springs, the astronomical co-ordinates for station at Georgetown, Colorado, will be:—

Longitude..$7^h\ 02^m\ 45^s.84$ or $105°\ 41'\ 27''.60$ west from Greenwich.

" $1^h\ 54^m\ 33^s.72 \pm 0^s.0036$ or $28°\ 38'\ 25''.80 \pm 0''.0.05$ west from U. S. Naval Observatory at Washington, D. C.

Latitude ... . $39°\ 42'\ 36''.36 \pm 0''.06$ north.

The probable error of one observation is derived from all results obtained more than three times, and is found to be $\pm 0''.61$; therefore the probable error of the final result will be $\pm 0''.06$. This must be combined with the probable error of the star-places used for the determination, in order to get the probable inaccuracy of the result.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF HUGHES, COLORADO.

SEASON OF 1873.

COMPUTATIONS BY

DR. F. KAMPF AND JOHN H. CLARK.

HUGHES, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, ... $104^\circ\ 48'\ 58''.80 \pm 0''.06$ west from Greenwich.
Latitude, ... $39^\circ\ 59'\ 24''.09 \pm 0''.0.03$ north.
Barometric altitude of observatory above sea-level, 5,021.6 feet.

The astronomical station was equidistant from the Denver Pacific and Boulder Valley Railroads, about 135 feet from the track of each. South of the monument was the railway office, with which was combined the telegraph office; north of it were two frame houses; and in a north-east direction was the water-tank. These buildings constituted the station of Hughes, whose population, exclusive of the few laborers engaged upon repairs of track, numbered but seven persons.

The neighboring country for a radius of about 15 miles is a very level plain, covered but sparsely with grass, and affording little inducement to the farmer. One-half of a mile from the station the Platte River flows down the valley, but its water is impure and useful only as a means of irrigation.

METEOROLOGICAL CONDITIONS.

As a rule the weather was favorable for this work. Although it generally became cloudy at four o'clock in the afternoon, it was clear again by eight or nine o'clock. The air was as quiet as could be desired, and the process of observation was more easy and successful than at the previous station. Sometimes a heavy wind arose at night, but, the tent being closed as far as possible, it did not disturb the instrument materially.

The following table gives the direction of the wind, the aspect of the sky, and other meteorological conditions attendant upon the occupation of this station:

Date.	Direction of the wind.			Remarks.
	12 p. m. to 8 a. m.	8 a. m. to 4 p. m.	4 p. m. to 12 p. m.	
1873.				
July 12	....	S. E.	N.	From 12 m. to 3 p. m., rain, thunder, and wind.
13	S. E.	S. W.	N.	Clear.
14	N.	S. W.	S.	From 4 to 7 p. m., rain and storm.
15	S.	N.	Variable.	Lightning at 8 o'clock, in the north.
16	S. W.	S. W.	S. W.	Do.
17	S. and N. E.	S. and N. E.	E.	Lightning at 8 o'clock, in the south.
18	N. E.	N. E.	S. E.	Do.
19	N. W.	Variable.	No wind.	Clear.
20	S.	Variable.	S.	Do.
21	S.	S. E.	W.	Rain at 8 p. m.; lightning in northwest, at 11 p. m.
22	S.	S. E.	W.	Very heavy rain and lightning in the afternoon.
23	S. E.	S. E.	N. and S. E.	Do.

OBSERVATORY.—TELEGRAPHIC COMMUNICATION.

The construction and arrangement of the observatory was the same as at Colorado Springs, a description of which is given in the astronomical report of 1874. Owing to the failure of the stonemason to provide the monument at the specified time it became necessary to erect a temporary pile of bricks to answer that purpose. In the following September this was replaced by a permanent monument of the prevailing design. The northern meridian mark was fixed on a stable 280 feet from the station.

Denver and Cheyenne are connected by two wires of the Western Union Telegraph Company. The lower one of these was conducted into the tent by means of a loop. It was impossible to procure a suitable telegraph pole to lift the wire out of the way of accident, and, in spite of all precautions used, it was swept away by a passing wagon one day, much to the vexation of the astronomer and the delay of his work. In the transmission of signals able assistance was rendered by Mr. R. Bush, in charge of the Hughes telegraph office. Thanks are also due to the operators at Denver and Cheyenne for their liberality in surrendering their wires to the uses of this work as often as they could be spared.

INSTRUMENTS.—VALUES.—BATTERY.

The astronomical and meteorological instruments, with the values pertaining to them, were the same as at Colorado Springs, described in the report on that station. The length of circuit, Hughes to Salt Lake City, via Corinne, is about 650 miles. The battery employed was the private property of the astronomer. It was composed of two Grove cells, very powerful in their action, which were re-inforced by a repeater at Cheyenne and another at Corinne.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

The astronomical work at Hughes was conducted by Dr. F. Kampf. Exchanges for time were made with Mr. John H. Clark at Salt Lake City on July 12, 17, 18, and 19 Observations for latitude were made July 16, 18, 19, 20, 21, and 23. Each astronomer performed the computations to accompany his own work.

Tabulation of stars used for determination of time at Hughes, Colorado, and Salt Lake City, Utah.

Name of star.	Hughes, Colorado.									Salt Lake City, Utah.					
	July 12.	July 13.	July 15.	July 16.	July 17.	July 18.	July 19.	July 20.	July 21.	July 12.	July 14.	July 16.	July 17.	July 18.	July 19.
5 Ursæ Minoris	----	----	×	----	----	----	----	----	----	----	----	----	----	----	----
ε Bootis	----	----	×	----	----	----	----	----	----	----	----	----	----	----	----
β Ursæ Minoris	----	----	×	----	----	----	----	----	----	----	----	----	----	----	----
μ^1 Bootis	----	----	×	----	----	----	----	----	----	----	×	----	----	----	----
γ^2 Ursæ Minoris	----	----	----	----	----	----	----	----	----	----	----	×	×	×	----
ζ^3 Libræ	----	----	----	----	----	----	----	----	----	----	×	----	----	----	----
α Coronæ	----	----	----	×	×	×	×	----	----	----	×	×	×	×	----
τ^6 Serpentis	----	----	----	----	----	----	----	----	----	----	×	×	×	×	----
α Serpentis	----	----	----	×	×	×	----	×	----	----	×	----	×	×	----
ε Serpentis	----	×	×	×	×	×	×	×	----	----	----	×	×	×	----
ζ Ursæ Minoris	----	----	×	×	×	×	×	×	----	----	×	----	----	----	----
ε Coronæ	×	×	×	×	×	×	----	×	----	----	----	----	----	----	----
δ Scorpii	----	----	----	----	----	----	----	----	----	×	----	×	×	×	----
β^1 Scorpii	×	----	----	----	----	----	----	×	----	×	×	----	×	×	----
Groombr. 2320	×	×	×	×	×	----	×	×	----	×	----	×	----	----	----
δ Ophiuchi	----	×	×	----	×	×	×	×	----	----	×	×	×	×	----
τ Herculis	×	----	----	×	×	×	×	×	----	×	×	×	×	×	----
α Scorpii	×	×	----	×	×	×	×	×	----	----	----	----	----	----	----
η Draconis	----	----	----	----	----	----	----	----	----	×	×	×	×	×	----
A Draconis	----	×	----	×	----	×	×	×	----	----	----	----	----	----	----
ζ Ophiuchi	----	----	----	×	×	×	×	×	----	×	×	×	×	×	----
η Herculis	----	×	----	----	----	----	----	----	----	----	----	----	×	----	----
κ Ophiuchi	----	×	----	----	----	----	----	×	----	----	----	----	----	----	----
ε Ursæ Minoris	----	×	----	----	----	×	----	×	----	----	----	----	----	----	----
α^1 Herculis	----	----	----	----	----	----	----	×	----	----	----	----	----	----	----
44 Ophiuchi	----	----	----	----	----	----	----	×	----	----	----	----	----	----	----
β Draconis	----	----	----	----	----	----	----	×	----	----	----	----	----	----	×
α Ophiuchi	----	----	----	----	----	----	----	×	----	----	----	----	----	----	----
ω Draconis	----	----	----	----	----	----	----	×	----	----	----	----	----	----	----
μ Herculis	----	----	----	----	----	----	----	×	----	----	----	----	----	----	×
ψ^1 Draconis	----	----	----	----	----	----	----	×	----	----	×	----	----	----	----
γ Draconis	----	----	----	----	----	----	----	----	----	----	×	×	×	×	×
72 Ophiuchi	----	----	----	----	----	----	----	----	----	×	×	×	×	×	×
Bradl. 2313	----	----	----	----	----	----	----	----	----	----	----	----	----	×	×
μ^1 Sagittarii	----	----	----	----	----	----	----	----	×	×	×	×	×	×	----
δ Ursæ Minoris	----	----	----	----	----	----	----	----	×	----	----	----	----	----	----
η Serpentis	----	----	----	----	----	----	----	----	----	×	×	×	×	×	----
1 Aquilæ	----	----	----	----	----	----	----	----	×	×	×	×	×	×	×
α Lyræ	----	----	----	----	----	----	----	----	×	×	×	×	×	×	×
ζ^1 Lyræ	----	----	----	----	----	----	----	----	----	----	----	----	----	×	×
ζ^2 Lyræ	----	----	----	----	----	----	----	----	----	----	----	----	----	×	×
β Lyræ	----	----	----	----	----	----	----	----	×	×	×	×	×	×	×
50 Draconis	----	----	----	----	----	----	----	----	×	×	×	×	×	×	×
ζ Aquilæ	----	----	----	----	----	----	----	----	×	×	×	----	×	×	----
d Sagittarii	----	----	----	----	----	----	----	----	×	×	----	----	----	----	----
δ Draconis	----	----	----	----	----	----	----	----	×	×	----	----	----	----	----
τ Draconis	----	----	----	----	----	----	----	----	×	×	----	----	----	----	----
α Aquilæ	×	----	----	----	----	----	----	----	----	----	----	----	----	----	----
τ Aquilæ	×	----	----	----	----	----	----	----	----	----	----	----	----	----	----
κ Cephei	×	----	----	----	----	----	----	----	----	----	----	----	----	----	----
π Capricorni	×	----	----	----	----	----	----	----	----	----	----	----	----	----	----
ε Delphini	×	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Groombr. 3241	×	----	----	----	----	----	----	----	----	----	----	----	----	----	----
α Cygni	×	----	----	----	----	----	----	----	----	----	----	----	----	----	----
μ Aquarii	×	----	----	----	----	----	----	----	----	----	----	----	----	----	----
12 Y. C. 1879	×	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Observations and reductions for time taken at sending station.

HUGHES, COLORADO, JULY 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	ε Coronæ	16 02 37.06	— 0.61	— 0.18	— 1.80	16 02 34.47	15 52 21.66	— 10 12.81
W.	β^1 Scorpii	08 22.19	— 2.23	— 0.07	— 1.67	08 18.22	58 05.11	13.11
W.	Groombr. 2320	16 16.27	+ 3.09	— 0.26	— 4.25	16 14.85	16 06 01.75	13.10
W.	τ Herculis	26 12.72	+ 0.42	— 0.16	— 2.29	26 10.69	15 57.38	13.31
E.	α Scorpii	16 31 53.54	— 2.50	— 0.10	+ 1.75	16 31 52.69	16 21 39.47	— 10 13.22
	Mean at 16h 08m local sidereal time							— 10 13.11

NORMAL EQUATIONS.

$$0 = +5.64 + 5.00\,\delta t + 0.75\,a - 5.23\,c \qquad \delta t = +0^s.39$$
$$0 = +2.48 + 0.75\,\delta t + 3.55\,a + 3.50\,c \qquad a = -2^s.45$$
$$0 = -7.02 - 5.23\,\delta t + 3.50\,a + 12.99\,c \qquad c = +1^s 58$$

HUGHES, COLORADO, JULY 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	α Aquilæ	19 54 50.60	— 0.38	— 0.28	+ 1.85	19 54 50.79	19 44 37.35	— 10 13.44
E.	ε Draconis	58 44.58	+ 3.81	— 0.91	+ 5.30	58 52.78	48 38.85	13.93
E.	τ Aquilæ	20 08 11.80	— 1.43	— 0.30	+ 1.83	20 08 11.90	57 58.28	13.62
E.	κ Cephei	23 11.81	+ 7.17	— 1.37	+ 8.26	23 25.87	20 13 11.98	13.89
E.	π Capricorni	30 19.59	— 2.32	— 0.12	+ 1.91	30 19.06	20 05.40	13.66
W.	ε Delphini	37 27.37	— 1.28	— 0.17	— 1.85	37 24.07	27 10.77	13.30
W.	Groombr. 3241	40 51.09	+ 4.51	— 0.52	— 5.92	40 49.16	30 35.73	13.43
W.	α Cygni	47 24.07	+ 0.31	— 0.23	— 2.56	47 21.54	37 08.29	13.25
W.	μ Aquarii	56 07.73	— 2.01	— 0.15	— 1.85	56 03.72	45 50.33	13.39
W.	12 Y. C. 1879	21 03 36.51	+ 9.72	— 1.01	—10.55	21 03 34.67	20 53 21.58	— 10 13.09
	Mean at 20h 20m local sidereal time							— 10 13.50

NORMAL EQUATIONS.

$$0 = -28.52 + 10.00\,\delta t - 6.56\,a - 1.97\,c \qquad \delta t = +1^s.50$$
$$0 = +64.13 - 6.56\,\delta t + 28.80\,a + 11.45\,c \qquad a = -2^s.61$$
$$0 = -111.03 - 1.97\,\delta t + 11.45\,a + 80.85\,c \qquad c = +1^s.82$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 13, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	ε Serpentis	15 54 45.54	− 0.32	− 0.03	− 1.64	15 54 43.55	15 44 30.88	− 10 12.67
W.	ε Coronæ	16 02 36.20	− 0.14	− 0.02	− 1.85	16 02 34.19	52 21.64	12.55
W.	Groombr. 2320	16 18.28	+ 0.70	− 0.05	− 4.36	16 14.57	16 06 01.73	12.84
W.	δ Ophiuchi	17 58.14	− 0.38	− 0.01	− 1.64	17 56.11	07 43.27	12.84
E.	α Scorpii	31 51.17	− 0.57	− 0.15	+ 1.80	31 52.25	21 39.47	12.78
E.	A Draconis	38 25.21	+ 0.75	− 0.34	+ 4.53	38 30.15	28 17.60	12.55
E.	η Herculis	48 45.48	− 0.02	− 0.18	+ 2.09	48 47.37	38 34.57	12.80
E.	κ Ophiuchi	17 01 53.01	− 0.28	− 0.15	+ 1.65	17 01 54.23	51 41.33	12.90
E.	ε Ursæ Minoris	17 09 09.70	+ 2.77	− 1.04	+12.02	17 09 23.45	16 59 10.65	− 10 12.80
	Mean at $16^h 22^m$ local sidereal time							− 10 12.75

NORMAL EQUATIONS.

$$0 = -\ 26.38 + 9.00\,\delta t - 4.51\,a + 7.77\,c \qquad \delta t = +\,1^s.25$$
$$0 = +\ 82.76 - 4.51\,\delta t + 30.37\,a - 37.14\,c \qquad a = -\,0^s.56$$
$$0 = -\,155.57 + 7.77\,\delta t - 37.14\,a + 77.20\,c \qquad c = +\,1^s.62$$

HUGHES, COLORADO, JULY 15, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	5 Ursæ Minoris	14 38 13.53	− 3.02	+ 0.13	− 6.97	14 38 03.67	14 27 51.81	− 10 11.86
W.	ε Bootis	49 40.80	+ 0.30	+ 0.03	− 1.88	49 39.25	39 27.86	11.39
W.	β Ursæ Minoris	15 01 28.64	− 2.62	+ 0.06	− 6.28	15 01 19.80	51 08.62	11.18
W.	μ^1 Bootis	29 56.51	+ 0.05	+ 0.08	− 2.10	29 54.54	15 19 43.28	11.26
E.	ε Serpentis	54 39.98	+ 0.70	− 0.06	+ 1.67	54 42.29	44 30.87	11.42
E.	ζ Ursæ Minoris	58 49.73	− 3.75	− 0.23	+ 8.09	58 53.84	48 42.57	11.27
E.	ε Coronæ	16 02 31.03	+ 0.30	− 0.06	+ 1.89	16 02 33.16	52 21.63	11.53
E.	Groombr. 2320	16 10.68	− 1.53	− 0.12	+ 4.45	16 13.48	16 06 01.64	11.84
E.	δ Ophiuchi	16 17 52.46	+ 0.83	− 0.04	+ 1.66	16 17 54.91	16 07 43.26	− 10 11.65
	Mean at $15^h 18^m$ local sidereal time							− 10 11.49

NORMAL EQUATIONS.

$$0 = -\ 2.23 + 9.00\,\delta t - 7.20\,a^1 + 0.33\,c^1 \qquad \delta t = +\,0^s.01$$
$$0 = +\ 6.52 - 7.20\,\delta t + 23.00\,a^1 + 1.35\,c^1 \qquad a^1 = -\,0^s.29$$
$$0 = -\,10.44 + 0.33\,\delta t + 1.35\,a^1 + 69.44\,c^1 \qquad c^1 = +\,0^s.16$$

To avoid large numbers an azimuth of $+\,1^s.50$ and an error of collimation of $+\,1^s.50$ were adopted; therefore

$$a = +\,1^s.21$$
$$c = +\,1^s.66$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α Coronæ	15 39 32.10	— 0.11	+ 0.07	+ 0.08	15 39 32.14	15 29 20.30	— 10 11.84
W.	α Serpentis	48 14.36	— 0.26	+ 0.05	+ 0.08	48 14.23	38 02.41	11.82
W.	ε Serpentis	54 42.67	— 0.27	+ 0.06	+ 0.07	54 42.53	44 30.86	11.67
W.	ζ Ursæ Minoris	58 51.95	+ 1.41	+ 0.35	+ 0.37	58 54.08	48 42.46	11.62
W.	ε Coronæ	16 02 33.13	— 0.12	+ 0.15	+ 0.08	16 02 33.24	52 21.61	11.63
E.	Groombr. 2320	16 13.48	+ 0.58	— 0.14	— 0.20	16 13.72	16 06 01.59	12.13
E.	τ Herculis	26 09.10	— 0.08	— 0.07	— 0.11	26 08.84	15 57.32	11.52
E.	α Scorpii	31 51.74	— 0.47	— 0.02	— 0.08	31 51.17	21 39.45	11.72
E.	A Draconis	38 28.44	+ 0.63	— 0.02	— 0.21	38 28.84	28 17.48	11.36
E.	ζ Ophiuchi	16 40 23.87	— 0.36	0.00	— 0.07	16 40 23.44	16 30 11.95	— 10 11.49
	Mean at 16h 00m local sidereal time							— 10 11.68

NORMAL EQUATIONS.

$$0 = +0.04 + 10.00\,\delta t - 2.06\,a - 0.21\,c \qquad \delta t = -0^s.10$$
$$0 = +7.39 - 2.06\,\delta t + 15.01\,a + 8.42\,c \qquad a = -0^s.46$$
$$0 = +7.53 - 0.21\,\delta t + 8.42\,a + 48.88\,c \qquad c = -0^s.07$$

HUGHES, COLORADO, JULY 17, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α Coronæ	15 39 31.69	— 0.20	— 0.03	+ 0.22	15 39 31.68	15 29 20.29	— 10 11.39
W.	α Serpentis	48 14.16	— 0.45	— 0.02	+ 0.20	48 13.89	38 02.40	11.49
W.	ε Serpentis	54 42.54	— 0.47	— 0.02	+ 0.20	54 42.25	44 30.85	11.40
W.	ζ Ursæ Minoris	58 50.39	+ 2.48	— 0.16	+ 0.97	58 53.68	48 42.38	11.30
W.	ε Coronæ	16 02 32.91	— 0.20	— 0.04	+ 0.22	16 02 32.89	52 21.60	11.29
E.	Groombr. 2320	16 12.76	+ 1.02	— 0.23	— 0.52	16 13.03	16 06 01.55	11.48
E.	δ Ophiuchi	17 55.52	— 0.55	— 0.07	— 0.19	17 54.71	07 43.24	11.47
E.	τ Herculis	26 08.98	— 0.14	— 0.14	— 0.28	26 08.42	15 57.30	11.12
E.	α Scorpii	31 51.76	— 0.83	— 0.05	— 0.22	31 50.66	21 39.44	11.22
E.	ζ Ophiuchi	16 40 24.16	— 0.63	— 0.04	— 0.20	16 40 23.29	16 30 11.94	— 10 11.35
	Mean at 16h 00m local sidereal time							— 10 11.34

NORMAL EQUATIONS.

$$0 = -0.02 + 10.00\,\delta t - 0.03\,a - 2.00\,c \qquad \delta t = -0^s.04$$
$$0 = +13.61 - 0.03\,\delta t + 13.65\,a + 12.87\,c \qquad a = -0^s.81$$
$$0 = +18.59 - 2.00\,\delta t + 12.87\,a + 42.10\,c \qquad c = -0^s.20$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 18, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α Coronæ	15 39 31.29	+ 0.09	+ 0.03	+ 0.11	15 39 31.52	15 29 20.27	— 10 11.25
W.	α Serpentis	48 13.39	+ 0.20	+ 0.02	+ 0.10	48 13.71	38 02.39	11.32
W.	ε Serpentis	54 41.77	+ 0.21	+ 0.02	+ 0.10	54 42.10	44 30.84	11.26
W.	ζ Ursæ Minoris	58 54.27	— 1.10	+ 0.04	+ 0.50	58 53.71	48 42.29	11.42
W.	ε Coronæ	16 02 32.52	+ 0.09	0.00	+ 0.11	16 02 32.72	52 21.59	11.13
E.	δ Ophiuchi	17 54.58	+ 0.25	— 0.05	— 0.10	17 54.68	16 07 43.24	11.44
E.	τ Herculis	26 09.15	+ 0.06	— 0.13	— 0.15	26 08.93	15 57.28	11.65
E.	α Scorpii	31 50.50	+ 0.37	— 0.04	— 0.11	31 50.72	21 39.44	11.28
E.	A Draconis	38 29.75	— 0.49	— 0.29	— 0.28	38 28.69	28 17.40	11.29
E.	ζ Ophiuchi	40 23.16	+ 0.28	— 0.08	— 0.10	40 23.26	30 11.94	11.32
E.	ε Ursæ Minoris	17 09 24.94	— 1.81	— 1.04	— 0.74	17 09 21.35	16 59 10.06	— 10 11.29
	Mean at 16ʰ 00ᵐ local sidereal time							— 10 11.33

NORMAL EQUATIONS.

$$0 = -\ 0.98 + 11.00\,\delta t - \ 5.10\,a + \ 5.51\,c \qquad \delta t = +0^s.31$$
$$0 = -14.97 - \ 5.10\,\delta t + 38.68\,a - 24.41\,c \qquad a = +0^s.36$$
$$0 = +16.97 + \ 5.51\,\delta t - 24.41\,a + 97.55\,c \qquad c = -0^s.10$$

HUGHES, COLORADO, JULY 19, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	α Coronæ	15 39 31.86	— 0.23	— 0.07	— 0.16	15 39 31.40	15 29 20.26	— 10 11.14
E.	ε Serpentis	54 42.70	— 0.55	— 0.06	— 0.15	54 41.94	44 30.83	11.11
E.	ζ Ursæ Minoris	58 51.79	+ 2.85	— 0.39	— 0.72	58 53.53	48 42.20	11.33
W.	Groombr. 2320	16 16 11.44	+ 1.18	— 0.16	+ 0.39	16 16 12.85	16 06 01.47	11.38
W.	δ Ophiuchi	17 55.26	— 0.64	— 0.05	+ 0.15	17 54.72	07 43.23	11.49
W.	τ Herculis	26 08.49	— 0.16	— 0.17	+ 0.21	26 08.37	15 57.26	11.11
W.	α Scorpii	31 51.35	— 0.96	— 0.07	+ 0.16	31 50.48	21 39.43	11.05
W.	A Draconis	38 27.33	+ 1.27	— 0.50	+ 0.40	38 28.50	28 17.36	11.14
W.	ζ Ophiuchi	16 40 24.00	— 0.72	— 0.14	+ 0.15	16 40 23.29	16 30 11.93	— 10 11.36
	Mean at 17ʰ 00ᵐ local sidereal time							— 10 11.23

NORMAL EQUATIONS.

$$0 = +\ 0.10 + 9.00\,\delta t - \ 2.18\,a - \ 2.94\,c \qquad \delta t = -0^s.28$$
$$0 = +11.89 - 2.18\,\delta t + 15.11\,a - \ 9.94\,c \qquad a = -0^s.94$$
$$0 = -\ 3.28 - 2.94\,\delta t - \ 9.94\,a + 47.56\,c \qquad c = -0^s.15$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 20, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	α Serpentis........	15 47 13.14	— 0.15	— 0.06	— 0.20	15 47 12.73	15 37 02.37	— 10 10.36
E.	ε Serpentis........	54 41.93	— 0.16	— 0.06	— 0.20	54 41.51	44 30.82	10.69
E.	ζ Ursæ Minoris	58 53.17	+ 0.82	— 0.31	— 0.98	58 52.70	48 42.09	10.61
E.	ε Coronæ	16 02 32.57	— 0.07	— 0.09	— 0.22	16 02 32.19	52 21.57	10.62
E.	β^1 Scorpii..........	08 16.40	— 0.25	— 0.04	— 0.21	08 15.90	58 05.05	10.85
W.	Groombr. 2320 ...	16 11.58	+ 0.34	— 0.21	+ 0.53	16 12.24	16 06 01.41	10.83
W.	δ Ophiuchi........	17 54.11	— 0.18	— 0.06	+ 0.20	17 54.07	07 43.23	10.84
W.	τ Herculis	26 07.63	— 0.05	0.00	+ 0.29	26 07.87	15 57.24	10.63
W.	α Scorpii..........	31 50.30	— 0.28	— 0.01	+ 0.22	31 50.23	21 39.42	10.81
W.	A Draconis	38 26.76	+ 0.38	— 0.07	+ 0.56	38 27.63	28 17.30	10.33
W.	ζ Ophiuchi........	16 40 22.76	— 0.21	— 0.02	+ 0.20	16 40 22.73	16 30 11.92	— 10 10.81
	Mean at 16^h 00^m local sidereal time........							— 10 10.67

NORMAL EQUATIONS.

$$0 = -0.77 + 11.00\,\delta t - 0.71\,a - 0.85\,c \qquad \delta t = +0^s.04$$
$$0 = +2.72 - 0.71\,\delta t + 16.24\,a - 8.41\,c \qquad a = -0^s.27$$
$$0 = +7.47 - 0.85\,\delta t - 8.41\,a + 49.75\,c \qquad c = -0^s.20$$

HUGHES, COLORADO, JULY 20, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	κ Ophiuchi........	17 01 52.09	— 0.22	— 0.04	+ 0.26	17 01 52.09	16 51 41.28	— 10 10.81
W.	ε Ursæ Minoris	09 16.87	+ 2.11	— 0.27	+ 1.90	09 20.61	59 09.80	10.81
W.	α^1 Herculis	19 04.18	— 0.19	— 0.05	+ 0.27	19 04.21	17 28 53.36	10.85
W.	44 Ophiuchi.........	28 50.28	— 0.41	— 0.04	+ 0.28	28 50.11	18 39.21	10.90
E.	β Draconis	37 47.58	+ 0.15	— 0.13	— 0.42	37 47.18	27 36.07	11.11
E.	α Ophiuchi..........	39 15.76	— 0.20	— 0.22	— 0.26	39 15.08	29 04.37	10.71
E.	ω Draconis	47 56.38	+ 0.57	— 0.46	— 0.71	47 55.78	37 44.96	10.82
E.	μ Herculis	51 42.61	— 0.10	— 0.19	— 0.29	51 42.03	41 31.35	10.68
E.	ψ^1 Draconis	17 54 26.95	+ 0.74	— 0.48	— 0.84	17 54 26.37	17 44 15.57	— 10 10.80
	Mean at 17^h 18^m local sidereal time........							+ 10 10.83

NORMAL EQUATIONS.

$$0 = -\ 2.33 + 9.00\,\delta t - 5.78\,a - 0.72\,c \qquad \delta t = -0^s.03$$
$$0 = +19.66 - 5.78\,\delta t - 31.45\,a + 25.59\,c \qquad a = -0^s.42$$
$$0 = +31.70 - 0.72\,\delta t + 25.59\,a + 81.63\,c \qquad c = -0^s.26$$

Observations and reductions for time taken at sending station—Continued.

HUGHES, COLORADO, JULY 21, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	μ^1 Sagittarii	18 16 23.42	— 0.68	— 0.07	— 0.24	18 16 22.43	18 06 12.52	— 10 09.91
E.	δ Ursæ Minoris	23 38.89	+ 8.83	— 1.62	— 3.87	23 42.23	13 32.30	09.93
E.	1 Aquilæ	38 30.77	— 0.54	— 0.05	— 0.23	38 29.95	28 19.99	09.96
E.	α Lyræ	42 50.80	— 0.01	— 0.06	— 0.29	42 50.44	42 40.52	09.92
W.	β Lyræ	55 35.28	— 0.10	+ 0.04	+ 0.27	55 35.49	45 25.63	09.86
W.	50 Draconis	19 00 38.79	+ 1.63	+ 0.13	+ 0.87	19 00 41.42	50 31.58	09.84
W.	ζ Aquilæ	09 46.39	— 0.32	+ 0.05	+ 0.23	09 46.35	59 36.47	09.88
W.	d Sagittarii	20 25.16	— 0.69	+ 0.03	+ 0.24	20 24.74	10 14.71	10.03
W.	δ Draconis	22 42.63	+ 0.90	+ 0.14	+ 0.61	22 44.28	12 34.39	09.89
W.	τ Draconis	19 28 10.49	+ 1.35	+ 0.17	+ 0.79	19 28 12.80	19 18 02.71	— 10 10.09
	Mean at 18^h 42^m local sidereal time							— 10 09.93

NORMAL EQUATIONS.

$$0 = -14.44 + 10.00\,\delta t - 14.40\,a + 7.00\,c \qquad \delta t = +0^s.57$$
$$0 = +82.44 - 14.40\,\delta t + 163.16\,a - 188.59\,c \qquad a = -0^s.72$$
$$0 = -64.91 + 7.00\,\delta t - 188.59\,a + 326.81\,c \qquad c = -0^s.23$$

Observations and reductions for time taken at sending station.

SALT LAKE CITY, UTAH, JULY 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	δ Scorpii	7 45 44.41	— 1.63	+ 0.02	+ 0.16	7 45 42.96	15 52 51.44	+8 07 08.48
E.	β^1 Scorpii	50 58.06	— 1.56	+ 0.05	+ 0.16	50 56.71	57 05.11	08.40
E.	Groombr. 2320	58 50.57	+ 2.11	+ 0.28	+ 0.40	58 53.36	16 05 01.76	08.40
E.	τ Herculis	8 08 48.26	+ 0.26	+ 0.30	+ 0.22	8 08 49.04	15 57.37	68.33
E.	η Draconis	15 08.64	+ 1.29	+ 0.45	+ 0.32	15 10.70	22 19.15	08.45
E.	ζ Ophiuchi	8 23 04.61	— 1.34	+ 0.17	+ 0.15	8 23 04.59	16 30 11.96	+8 07 08.37
	Mean at $16^h.0$ local sidereal time							+8 07 08.41

NORMAL EQUATIONS.

$$+6.00\,\delta t + 0.52\,a = +1.56 \qquad \delta t = +0^s.41$$
$$+0.52\,\delta t + 4.52\,a = -7.46 \qquad a = -1^s.697$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	72 Ophiuchi	9 54 14.08	— 1.00	+ 0.14	+ 0.11	9 54 13.33	18 01 21.80	+8 07 08.47
E.	μ Sagittarii	59 05.55	— 1.79	+ 0.06	+ 0.12	59 03.94	06 12.49	08.55
E.	η¹ Serpentis	10 07 39.01	— 1.30	+ 0.07	+ 0.11	07 37.89	14 46.41	08.52
W.	1 Aquilæ	21 13.08	— 1.43	+ 0.05	— 0.11	21 11.59	28 19.96	08.37
W.	α Lyræ	25 31.82	— 0.09	+ 0.06	— 0.14	25 31.65	32 40.54	08.89
W.	β Lyræ	38 17.23	— 0.30	+ 0.09	— 0.13	38 16.89	45 25.63	08.74
W.	50 Draconis	43 19.39	+ 4.19	+ 0.26	— 0.43	43 23.41	50 31.85	08.44
W.	ζ Aquilæ	52 28.82	— 0.88	+ 0.07	— 0.11	52 27.90	59 36.43	08.53
W.	d Sagittarii	11 03 08.01	— 1.73	+ 0.04	— 0.12	11 03 06.20	19 10 14.64	08.44
W.	δ Draconis	05 24.06	+ 2.20	+ 0.14	— 0.29	05 26.11	17 34.47	08.36
W.	τ Draconis	11 10 50.92	+ 3.46	+ 0.15	— 0.37	11 10 54.16	19 18 02.86	+8 07 08.70
	Mean at 19h.0 local sidereal time							+8 07 08.55

NORMAL EQUATIONS.

$$+11.00\,\delta t - 0.71\,a - 12.48\,c = +5.98 \qquad \delta t = +0^s.54$$
$$-0.71\,\delta t + 13.07\,a + 17.95\,c = -23.07 \qquad a = -1^s.880$$
$$-12.48\,\delta t + 17.95\,a + 43.02\,c = -35.87 \qquad c = +0^s.108$$

SALT LAKE CITY, UTAH, JULY 14, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	μ¹ Bootis	7 12 35.66	— 0.13	+ 0.15	— 0.21	7 12 35.47	15 19 43.29	+8 07 07.82
W.	ζ³ Libræ	21 26.41	— 1.63	+ 0.07	— 0.17	21 24.68	28 32.31	07.63
W.	α Coronæ	22 13.13	— 0.50	+ 0.15	— 0.18	22 12.60	29 20.31	07.71
W.	τ⁶ Serpentis	28 03.74	— 0.80	+ 0.16	— 0.17	28 02.93	35 10.50	07.57
W.	α Serpentis	30 55.88	— 1.05	+ 0.16	— 0.17	30 54.82	38 02.42	07.60
W.	ζ Ursæ Minoris	41 29.67	+ 5.55	+ 0.70	— 0.80	41 35.12	48 42.65	07.53
E.	β¹ Scorpii	51 59.02	— 1.72	+ 0.08	+ 1.17	51 58.55	58 05.10	07.55
E.	δ Ophiuchi	8 00 36.73	— 1.31	+ 0.12	+ 0.16	8 00 35.70	07 43.26	07.56
E.	τ Herculis	08 49.04	+ 0.28	+ 0.22	+ 0.24	08 49.78	15 57.33	07.55
E.	η Draconis	15 09.30	+ 1.42	+ 0.30	+ 0.35	15 11.37	22 19.08	07.71
E.	ζ Ophiuchi	8 23 03.61	— 1.48	+ 0.12	+ 0.17	8 23 02.42	15 30 11.95	+8 07 07.53
	Mean at 16h.0 local sidereal time							+8 07 07.61

NORMAL EQUATIONS.

$$+11.00\,\delta t + 0.73\,a - 3.71\,c = +4.78 \qquad \delta t = +0^s.61$$
$$+0.73\,\delta t + 12.69\,a + 12.87\,c = -21.17 \qquad a = -1^s.870$$
$$-3.71\,\delta t + 12.87\,a + 39.73\,c = -19.82 \qquad c = +0^s.164$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 17, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	γ^2 Ursæ Minoris....	7 13 50.25	+ 3.11	— 0.14	+ 0.36	7 13 53.58	15 20 59.45	+8 67 05.87
E.	α Coronæ	22 14.80	— 0.49	— 0.05	+ 0.12	22 14.38	29 20.29	05.91
E.	τ^6 Serpentis........	28 05.24	— 0.78	— 0.05	+ 0.11	28 04.52	35 10.44	05.92
E.	α Serpentis........	30 57.46	— 1.01	— 0.05	+ 0.11	30 56.51	38 02.40	05.89
E.	ε Serpentis........	37 25.89	— 1.07	— 0.07	+ 0.11	37 24.86	44 30.85	05.99
W.	δ Scorpii..........	45 47.39	— 1.74	— 0.02	— 0.12	45 45.51	52 51.41	05.90
W.	β^1 Scorpii..........	52 01.02	— 1.67	— 0.01	— 0.12	52 59.22	58 05.08	05.86
W.	δ Ophiuchi........	8 00 38.72	— 1.27	— 0.01	— 0.11	8 00 37.33	16 07 43.24	05.91
W.	τ Herculis	08 51.47	+ 0.27	— 0.00	— 0.16	08 51.58	15 57.30	05.72
W.	η Draconis........	15 11.81	+ 1.38	— 0.00	— 0.23	15 12.96	22 19.00	06.04
W.	ζ Ophiuchi........	23 07.54	— 1.43	+ 0.01	— 0.11	23 06.01	30 11.94	05.93
W.	η Herculis	8 31 28.75	— 0.07	+ 0.01	— 0.14	8 31 28.55	16 38 34.53	+8 07 05.98
	Mean at 16h.0 local sidereal time							+8 07 05.90

NORMAL EQUATIONS.

$$+12.00\,\delta t + 2.63\,a - 1.56\,c = -6.07 \qquad \delta t = +0^s.10$$
$$+2.63\,\delta t + 7.34\,a - 5.49\,c = -14.19 \qquad a = -1^s.810$$
$$-1.56\,\delta t - 5.49\,a + 27.75\,c = +13.04 \qquad c = +0^s.113$$

SALT LAKE CITY, UTAH, JULY 17, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	γ Draconis	9 46 35.73	+ 0.58	+ 0.05	— 0.18	9 46 36.18	17 53 41.97	+8 07 05.79
W.	72 Ophiuchi........	54 17.08	— 1.02	+ 0.03	— 0.11	54 15.98	18 01 21.80	05.82
W.	μ^1 Sagittarii	59 08.54	— 1.82	— 0.01	— 0.12	59 06.59	06 12.52	05.93
W.	η Serpentis........	10 07 42.10	— 1.32	— 0.01	— 0.11	10 07 40.66	14 46.44	05.78
E.	1 Aquilæ..........	21 15.48	— 1.46	— 0.03	+ 0.11	21 14.10	28 19.98	05.88
E.	α Lyræ	25 34.52	— 0.10	— 0.06	+ 0.14	25 34.50	32 40.53	06.03
E.	β Lyræ	38 19.92	— 0.31	— 0.06	+ 0.13	38 19.68	45 25.64	05.96
E.	50 Draconis........	43 21.46	+ 4.28	— 0.16	+ 0.44	43 26.02	50 31.72	05.70
E.	ζ Aquilæ..........	10 52 31.52	— 0.90	— 0.06	+ 0.11	10 52 30.67	18 59 36.46	+8 07 05.79
	Mean at 18h.5 local sidereal time							+8 07 05.85

NORMAL EQUATIONS.

$$+9.00\,\delta t + 1.08\,a + 3.76\,c = -2.98 \qquad \delta t = +0^s.15$$
$$+1.08\,\delta t + 7.55\,a - 9.06\,c = -15.60 \qquad a = -1^s.920$$
$$+3.76\,\delta t - 9.06\,a + 26.15\,c = +19.56 \qquad c = +0^s.105$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, JULY 19, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	β Draconis	9 20 29.66	+ 0.52	— 0.08	+ 0.19	9 20 30.29	17 27 36.09	+8 07 05.80
E.	μ Herculis	34 25.78	— 0.39	— 0.06	+ 0.12	34 29.45	41 31.36	05.91
E.	γ Draconis	46 35.22	+ 0.47	— 0.08	+ 0.19	46 35.80	53 41.94	06.14
E.	72 Ophiuchi	54 16.86	— 0.83	— 0.04	+ 0.12	54 16.11	18 01 21.82	05.71
E.	Bradl. 2313	10 14 55.42	— 1.33	— 0.03	+ 0.12	10 14 54.18	21 59.88	05.70
E.	1 Aquilæ	21 15.50	— 1.19	— 0.03	+ 0.12	21 14.40	28 19.99	05.59
E.	α Lyræ	25 34.58	— 0.07	— 0.05	+ 0.15	25 34.61	32 40.53	05.92
W.	ζ¹ Lyræ	33 20.72	— 0.11	— 0.02	— 0.14	33 20.45	40 26.12	05.67
W.	ζ² Lyræ	33 22.56	— 0.11	— 0.02	— 0.14	33 22.29	40 27.97	05.68
W.	β Lyræ	38 20.18	— 0.25	+ 0.01	— 0.14	38 19.80	45 25.64	05.84
W.	50 Draconis	10 43 22.88	+ 3.50	+ 0.05	— 0.48	10 43 25.95	18 50 31.66	+8 07 05.71
	Mean at $18^h.0$ local sidereal time							+ 8 07 05.80

NORMAL EQUATIONS.

$$11.00\,\delta t - 0.12\,a + 1.05\,c = -1.99 \qquad \delta t = -0^s.20$$
$$-0.12\,\delta t + 6.85\,a + 9.93\,c = -9.61 \qquad a = -1^s.570$$
$$+1.05\,\delta t + 9.93\,a + 31.42\,c = -12.12 \qquad c = +0^s.116$$

The observations for time at Salt Lake City for July 16 and July 19 are printed in the report on Winnemucca.

The following tables show the corrections and rates of the chronometers used at Hughes and Salt Lake City:

CHRONOMETER AT HUGHES.—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	h.	h. m. s.	s.
July 12	18.2	— 0 10 13.31	— 0.0265
July 13	16.4	12.75	— 0.0245
July 15	15.3	11.49	— 0.0102
July 16	16.0	11.68	— 0.0065
July 17	16.0	11.34	— 0.0070
July 18	16.0	11.33	— 0.0020
July 19	17.0	11.23	— 0.0120
July 20	16.6	10.75	— 0.0270
July 21	18.7	— 0 10 09.93	— 0.0340

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*h. m. s.*	*s.*
July 12	17.5	+ 8 07 08.48	— 0.018
July 14	16.0	07.61	— 0.020
July 16	17.0	06.60	— 0.026
July 17	17.3	05.85	— 0.018
July 18	17.3	05.72	— 0.001
July 19	18.0	+ 8 07 05.80	+ 0.003

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
July 12, 1873:		*h. m. s.*	*h. m. s.*	*h. m. s.*	*m. s.*	*s.*	*s.*
Salt Lake City.	Hughes	17 57 26.57	— 0 10 13.32	17 47 13.25			
	Salt Lake City.	9 11 45.75	+ 8 07 08.48	17 18 54.23	28 19.02		
Hughes	Hughes	18 19 49.82	— 0 10 13.31	18 09 36.51			
	Salt Lake City.	9 34 09.18	+ 8 07 08.48	17 41 17.66	18.85	0.17	18.935
July 17, 1873:							
Salt Lake City.	Hughes	17 34 03.43	— 0 10 11.33	17 23 52.10			
	Salt Lake City.	8 48 27.25	+ 8 07 05.85	16 55 33.10	19.00		
Hughes	Hughes	17 48 15.36	— 0 10 11.33	17 38 04.03			
	Salt Lake City.	9 02 39.31	+ 8 07 05.85	17 09 45.16	18.87	0.13	18.935
July 18, 1873:							
Salt Lake City.	Hughes	17 52 51.34	— 0 10 11.32	17 42 40.02			
	Salt Lake City.	9 07 15.28	+ 8 07 05.72	17 14 21.00	19.02		
Hughes	Hughes	17 59 25.40	— 0 10 11.32	17 49 14.08			
	Salt Lake City.	9 13 49.53	+ 8 07 05.72	17 20 55.25	18.83	0.19	18.925
July 19, 1873:							
Salt Lake City.	Hughes	17 43 25.77	— 0 10 11.22	17 33 14.55			
	Salt Lake City	8 57 49.70	+ 8 07 05.80	17 04 55.50	19.05		
Hughes	Hughes	17 56 05.38	— 0 10 11.22	17 45 54.16			
	Salt Lake City.	9 10 29.50	+ 8 07 05.80	17 18 35.30	28 18.86	0.19	18.955

Hughes east of Salt Lake City .... $0^h\ 28^m\ 18^s.938 \pm 0^s.004$

Mean places of stars for 1873.0 *used for determination of latitude of Hughes, Colorado.*

No. of pair.	No. in B. A. C.	Approximate right ascension.	Declination.	No. of pair.	No. in B. A. C.	Approximate right ascension.	Declination.
		h. m. s.	° ′ ″			h. m. s.	° ′ ″
1	5775	17 01 13	43 59 09.5	22	7041	20 21 00	42 11 24.5
	5788	03 32	36 06 05.7		7061	22 54	38 01 27.5
2	5883	18 48	23 04 50.2	23	7091	27 24	48 47 32.6
	5902	21 13	57 07 37.4		7131	32 22	31 07 47.8
3	5927	26 07	31 15 15.1	24	7182	38 18	49 53 04.8
	5975	33 18	48 39 36.5		7194	40 25	30 15 26.1
4	5986	35 10	31 16 15.7	25	7213	42 28	36 01 29.7
5	6052	46 02	50 48 42.9		7253	48 45	43 54 26.2
	6024	52 49	29 15 45.2	26	7313	57 29	39 00 32.8
6	6129	59 50	48 27 33.0		7326	59 07	41 07 38.4
	6178	18 07 07	31 22 28.9	27	Lal.*	21 10 35	36 43 28.4
	6234	15 29	28 55 42.5		7402	13 43	43 24 44.0
7	6246	16 58	51 17 34.9	28	7462	22 11	36 33 56.1
8	6258	18 30	51 14 25.2	29	Arg.†	32 50	50 29 37.5
9	6349	31 06	38 47 32.5	30	7560	37 35	50 36 38.5
10	6355	32 38	38 40 00.4		7607	44 13	29 35 02.2
	6404	42 09	41 18 23.2	31	7631	47 43	55 12 00.9
11	6453	49 23	22 29 07.9		7706	22 01 06	24 43 32.1
	6496	54 36	57 38 48.7	32	7753	07 11	33 58 46.5
12	6516	57 38	47 51 19.2		7800	15 47	45 53 51.4
	6553	19 02 37	32 18 11.1	33	7858	26 50	39 07 37.8
13	6602	12 20	22 47 54.6		7917	35 56	40 53 00.5
	6640	17 56	57 24 19.7	34	7931	38 22	38 48 01.9
14	6673	23 12	29 11 33.8		7962	44 38	41 16 53.0
	6723	31 02	50 57 54.0	35	7997	51 13	20 05 17.1
15	6740	34 24	29 51 42.0		8033	58 09	59 45 42.9
	6763	38 26	50 13 52.4	36	8091	23 08 45	27 22 47.4
16	6805	44 55	10 05 58.3	37	8097	09 33	27 33 20.8
	6836	48 35	69 56 39.2		8107	10 54	52 31 43.0
17	6851	51 32	34 44 49.8	38	8131	14 21	23 02 43.2
	6876	55 31	45 25 36.2		8158	18 22	56 50 19.1
	6890	57 41	15 40 34.0		8203	27 06	21 47 53.2
18	6905	20 00 07	64 27 56.5	39	Gr.4110	32 21	57 57 05.6
19	6913	00 54	64 16 33.6	40	8268	40 51	57 56 41.0
20	6928	02 53	52 47 27.4	41	8280	42 41	59 16 21.1
	6973	10 30	27 25 32.7		8296	45 57	20 57 53.1
21	6996	13 37	40 20 13.8	42	8344	55 08	60 30 56.2
	7022	17 40	39 51 04.6		32	0 08 00	19 30 00.9

* Lalande, No. 41341.

† Argelander's Durchmusterung, 50°, No. 3382.

Observations and computations for latitude.

HUGHES, COLORADO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 16.....	6602	3 85.2	15.9	20.0					
	6640	16 71.5	14.3	20.3		40 06 07.2	− 6 39.5	−2.8	39 59 24.9
	6673	5 67.1	14.0	20.0					
	6723	15 85.8	15.0	19.1		04 43.7	− 5 16.4	−2.8	24.5
	6740	7 11.4	14.3	21.3					
	6763	13 54.6	15.7	20.7		02 46.9	− 3 19.8	−3.3	23.8
	6805	9 19.2	16.0	20.0					
	6836	12 74.9	14.0	22.0		01 17.9	− 1 50.5	−3.3	24.1
	6996	15 91.5	17.0	19.0					
	7002	3 98.8	10.0	26.0		05 38.1	− 6 10.4	−4.9	22.8
	7041	16 88.0	19.0	17.0					
	7061	3 49.9	5.0	31.0		40 06 24.8	− 6 55.6	−6.6	22.6
	7091	3 85.4	17.5	18.5					
	7131	7 36.1	12.0	24.2		39 57 38.9	+ 1 48.9	−3.6	24.2
	7182	13 94.0	12.0	24.0					
	7194	4 75.7	17.2	18.3		40 04 13.9	− 4 45.2	−3.6	25.1
	7402	13 61.7	3.0	33.7					
	7462	13 93.1	27.0	10.0		39 59 17.9	+ 0 00.7	−3.8	23.8
	Arg.	10 00.6	12.0	23.0		40 02 17.5	− 2 51.9	−0.8	24.8
	7560	16 77.7	12.0	23.0		05 47.9	− 6 22.1	−0.9	24.9
	7607	4 47.3	21.8	13.9					
	7631	9 02.3	21.8	13.9					
	7706	12 33.7	7.3	28.7		39 57 44.1	+ 1 42.9	−3.7	23.3
	7997	13 56.7	16.8	18.0					
	8033	5 93.0	16.0	19.0		39 55 27.3	+ 3 57.2	−1.2	23.3
July 18.....	6453	6 40.2	15.2	22.6	Heavy wind;				
	6496	15 39.2	30.2	8.0	dusty.	40 03 59.4	− 4 39.2	+4.1	24.3
	6516	14 07.1	17.3	21.0					
	6553	3 65.0	25.0	13.7		04 47.1	− 5 23.7	+2.1	25.5
	6602	3 19.6	18.9	20.2					
	6640	16 30.4	24.8	14.3		06 07.5	− 6 47.1	+2.5	22.9
	6740	7 49.4	17.0	22.0					
	6763	14 14.1	27.0	12.6		02 47.5	− 3 26.5	+2.6	23.6
	6805	7 25.5	16.3	23.0					
	6836	10 97.7	23.8	15.4		01 18.4	− 1 55.6	+0.5	23.3
	6851	3 08.6	19.0	20.2					
	6876	14 41.0	23.0	16.3		40 05 13.0	− 5 51.7	+1.5	22.8
	6890	7 88.2	24.7	15.0					
	6905	17 24.7	15.0	24.4		04 15.0	− 4 50.9	+0.1	24.2
	6913	6 27.4	15.0	24.4		39 58 33.6	+ 0 49.9	+0.1	23.6

Observations and computations—Continued.

HUGHES, COLORADO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 18.....	6928	16 43.0	14.7	24.8					
	6973	2 06.5	26.3	12.7		40 06 29.9	− 7 07.5	+1.0	39 59 23.4
	6996	15 58.3	22.6	16.7					
	7022	3 50.3	16.9	22.4		05 38.7	− 6 15.2	+0.1	23.6
	7041	15 95.2	15.2	24.0					
	7061	2 29.0	29.0	10.0		40 06 25.4	− 7 04.3	+2.8	23.9
	7091	3 73.7	22.9	16.3					
	7131	7 02.3	19.0	20.3		39 57 39.5	+ 1 42.1	+1.5	23.1
	7182	14 04.2	24.3	14.9					
	7194	4 63.2	17.8	21.6		40 04 14.6	− 4 52.3	+1.4	23.7
	7213	11 74.6	16.6	22.8					
	7253	9 00.3	26.3	13.0		39 57 56.9	+ 1 25.2	+2.0	24.1
	7313	5 23.0	21.5	17.8					
	7326	14 22.0	17.3	22.0		40 04 04.4	− 4 39.2	−0.3	24.9
	Lal.	3 71.5	22.5	16.9		40 04 04.7	− 4 41.9	+0.2	23.0
	7402	12 79.2	17.3	22.2					
	7462	12 90.7	25.0	14.4		39 59 18.5	+ 0 03.6	+1.6	23.7
	Arg.	9 51.3	16.4	24.0		40 02 18.1	− 2 57.1	+2.7	23.7
	7560	16 25.9	15.5	25.0		40 05 48.6	− 6 26.7	+2.2	24.1
	7607	3 81.0	29.0	11.6					
	7631	8 00.0	24.0	16.7					
	7706	11 07.6	22.8	18.3		39 57 44.9	+ 1 35.5	+3.3	23.7
	7753	13 38.5	22.2	19.0					
	7800	7 32.5	19.9	23.0		39 56 16.7	+ 3 08.2	0.0	24.9
	7858	8 52.3	21.0	22.0					
	7917	10 30.5	25.0	19.0		40 00 16.7	− 0 55.3	+1.4	22.8
	7931	7 46.3	21.0	22.8					
	7962	13 35.9	26.3	18.2		40 02 25.0	− 3 03.1	+1.9	23.8
	7997	13 37.8	21.2	23.0					
	8033	5 84.4	27.7	17.4		39 55 27.8	+ 3 54.0	+2.3	24.1
	8091	14 43.0	21.3	24.0		39 57 12.7	+ 2 07.8	+2.7	23.2
	8097	4 23.8	20.0	25.3		40 02 29.4	− 3 08.7	+2.0	22.7
	8107	10 31.4	29.2	16.8					
	8131	13 06.4	22.0	24.0					
	8158	7 50.1	28.3	18.0		39 56 28.7	+ 2 52.8	+2.3	23.8
	8203	18 79.0	19.0	27.7					
	Gr. 4110	5 39.6	28.5	18.9		52 27.0	+ 6 56.0	+0.3	23.3
	8268	4 99.7	29.0	18.4		39 52 14.7	+ 7 08.4	+0.5	39 59 23.6

Observations and computations—Continued.

HUGHES, COLORADO.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 18.....	8344	10 88.5	29.2	18.7					
	32	8 85.2	20.3	28.0		40 00 26.4	— 1 03.1	+0.8	39 59 24.1
July 19.....	6129	10 57.8	20.0	17.1					
	6178	18 83.2	12.3	25.1		39 55 03.7	+ 4 16.4	+2.7	22.8
	6355	12 91.9	20.2	18.5					
	6404	12 57.0	18.0	21.0		39 59 13.9	+ 0 10.8	—0.4	24.3
	6453	6 81.8	17.3	21.8					
	6496	15 81.0	28.0	11.3		40 03 59.7	— 4 39.3	+3.4	23.8
	6516	14 21.1	20.0	18.9					
	6553	3 67.3	30.0	9.0		04 46.6	— 5 27.3	+6.1	25.4
	6602	3 36.9	20.0	19.0					
	6640	16 42.4	22.2	16.8		06 08.0	— 6 45.5	+1.8	24.3
	6673	5 37.2	17.6	21.0					
	6723	15 81.0	29.0	10.4		04 44.6	— 5 24.2	+4.2	24.6
	6740	6 65.6	18.3	21.0					
	6763	13 33.6	29.8	9.8		02 47.8	— 3 27.5	+4.7	25.0
	6805	7 29.5	17.0	22.3					
	6836	11 06.2	25.0	14.0		01 18.7	— 1 57.0	+1.6	23.3
	6851	4 14.5	24.0	15.0					
	6876	15 44.2	18.0	21.0		05 13.3	— 5 50.9	+1.6	24.0
	6890	7 25.9	26.0	13.5					
	6905	16 66.4	13.0	26.8		40 04 15.3	— 4 52.1	—0.4	22.8
	6913	5 66.0	13.0	26.8		39 58 33.8	+ 0 49.7	—0.4	23.1
	6928	16 64.7	24.6	15.0					
	6973	2 91.8	14.8	25.5		40 06 30.1	— 7 06.4	—0.3	23.4
	6996	16 27.0	23.3	16.8					
	7022	4 21.2	16.8	23.5		05 39.1	— 6 14.5	—0.1	24.5
	7041	16 51.9	19.5	21.0					
	7061	2 92.5	21.3	19.0		40 03 25.7	— 7 02.2	+0.2	23.7
	7091	3 63.6	23.2	17.0					
	7131	7 02.3	14.7	25.8		39 57 39.8	+ 1 45.2	—1.4	23.6
	7182	14 05.0	17.6	23.0					
	7194	4 63.2	26.5	14.0		40 04 14.9	— 4 52.8	+2.0	24.1
	7313	5 52.5	16.7	24.4					
	7326	14 55.0	27.0	14.3		04 04.71	— 4 40.3	+1.4	25.8
	Lal.	4 08.8	—1.5	42.7		40 04 05.0	— 4 40.6	—0.6	23.8
	7402	13 12.2	41.5	0.2					
	7462	13 31.0	—1.2	42.5		39 59 18.8	+ 0 05.8	—0.7	39 59 23.9

Observations and computations—Continued.

HUGHES, COLORADO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 19.....	Arg.	10 34.0	23.0	19.0		40 02 18.4	− 2 52.4	−2.6	39 59 23.4
	7560	17 10.1	23.6	19.0		40 05 48.9	− 6 22.4	−2.4	24.1
	7607	4 78.9	14.7	28.0					
	7631	8 82.4	21.9	21.0					
	7706	12 00.7	19.3	24.0		39 57 45.0	+ 1 38.9	−1.0	22.9
	7753	14 13.2	19.3	24.6					
	7800	8 14.4	27.8	16.9		39 56 17.0	+ 3 06.0	+1.5	24.5
	7858	3 65.1	27.8	17.0					
	7917	5 32.7	14.0	31.0		40 00 17.0	− 0 52.1	−1.7	23.2
	7931	7 48.2	19.5	25.4					
	7962	13 36.5	27.9	17.4		40 02 25.3	− 3 02.7	+1.3	23.9
	7997	13 78.7	25.0	19.8					
	8033	6 12.1	15.0	30.0		39 55 28.1	+ 3 58.1	−2.7	23.5
	8091	14 28.2	30.0	14.8					
	8107	9 98.0	9.3	35.3		57 13.0	+ 2 13.6	−3.0	23.6
	8131	13 32.4	19.3	25.0					
	8158	7 75.0	28.3	16.2		56 29.0	+ 2 53.1	+1.8	23.9
	8203	18 77.7	23.0	21.4					
	Gr. 4110	5 45.7	27.7	17.6		52 27.3	+ 6 53.7	+3.2	24.2
	8268	5 04.1	28.6	18.0		39 52 14.9	+ 7 06.6	+3.4	24.9
	8280	17 41.8	25.0	20.3					
	8296	2 54.3	20.3	25.0		40 07 04.5	− 7 42.0	+2.6	25.1
	8344	10 86.3	24.0	21.7					
	32	8 86.4	21.0	24.9		00 26.7	− 1 02.1	−0.4	21.2
July 20.....	6234	1 50.2	16.4	22.1					
	6246	15 60.6	21.0	18.0		06 41.4	− 7 18.0	−0.7	22.7
	6453	6 56.7	23.0	16.0					
	6496	15 44.1	14.0	25.3		03 59.9	− 4 35.6	−1.2	23.1
	6602	3 45.4	17.0	23.3					
	6640	16 52.3	27.7	13.0		06 08.3	− 6 45.9	+2.3	24.7
	6805	8 60.5	23.0	17.3					
	6836	12 29.6	20.3	21.1		01 19.0	− 1 54.6	+1.3	25.7
	6851	3 61.4	20.3	21.0					
	6876	14 84.5	19.0	22.8		05 13.6	− 5 48.8	−1.2	23.6
	6890	7 44.8	20.3	21.0					
	6905	16 79.0	18.0	23.8		40 04 15.5	− 4 50.2	−1.8	23.5
	6913	5 80.0	17.4	24.0		39 58 34.1	+ 0 51.2	−2.0	23.3
	6928	16 28.0	20.2	21.0					
	6973	2 56.7	23.3	17.4		40 06 30.4	− 7 05.9	+1.4	39 59 25.9

Observations and computations—Continued.

HUGHES, COLORADO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 20.....	6996	15 61.8	23.2	17.3					
	7022	3 59.4	14.6	25.6		40 05 39.4	− 6 13.5	−1.4	39 59 24.5
	7041	16 47.2	22.1	18.2					
	7061	2 92.6	15.3	24.4		40 06 26.1	− 7 00.7	−1.4	24.0
	7091	2 81.0	18.3	22.0					
	7131	6 15.0	23.0	16.7		39 57 40.1	+ 1 43.7	+0.7	24.5
	7182	13 45.3	24.0	15.9					
	7194	4 15.2	12.0	27.6		40 04 15.2	− 4 48.9	−2.1	24.2
	7313	5 11.4	21.8	18.4					
	7326	14 06.0	13.4	27.0		40 04 05.0	− 4 37.9	−2.8	24.3
	7402	12 48.0	24.4	16.0					
	7462	12 65.3	15.0	25.8		39 59 19.2	+ 0 05.4	−0.7	23.9
	Arg.	9 66.4	24.3	17.0		40 02 18.7	− 2 52.5	−1.5	24.7
	7560	16 42.4	23.9	17.4		40 05 49.2	− 6 22.4	−1.7	25.1
	7607	4 11.1	14.3	27.0					
	7631	8 79.8	23.5	18.3					
	7706	12 02.7	15.7	27.0		39 57 45.3	+ 1 40.3	−1.7	23.9
	7753	13 27.2	25.7	17.0					
	7800	7 27.6	19.0	24.0		39 56 17.3	+ 3 06.2	+1.0	24.5
	7858	9 09.5	26.3	17.0					
	7917	10 80.0	17.0	26.8		40 00 17.3	− 0 53.0	−0.1	24.2
	7931	7 41.5	18.3	25.0					
	7962	13 26.9	27.5	16.4		40 02 25.6	− 3 01.8	+1.2	25.0
	7997	13 37.9	22.0	22.0					
	8033	5 83.0	25.2	19.0		39 55 28.4	+ 3 54.5	+1.7	24.6
	8091	15 10.0	28.0	16.3		39 57 13.3	+ 2 10.8	+0.6	24.7
	8097	4 90.4	27.3	17.0		40 02 30.0	− 3 05.9	+0.2	24.3
	8107	10 88.8	17.4	27.0					
	8131	12 86.6	21.2	22.9					
	8158	7 21.9	23.0	21.2		39 56 29.3	+ 2 55.4	0.0	24.7
	8203	18 37.8	19.0	25.1					
	Gr. 4110	4 97.5	26.0	18.5		52 27.6	+ 6 56.3	+0.4	24.3
	8268	4 57.4	27.0	17.4		39 52 15.2	+ 7 08.8	+1.0	25.0
	8280	16 52.5	23.0	21.7					
	8296	1 70.0	19.9	24.8		40 07 05.3	− 7 40.5	−1.0	23.8
	8344	11 11.0	23.0	22.0					
	32	9 06.3	24.0	21.7		00 26.9	− 1 03.6	+0.9	24.2
July 21.....	6805	8 63.5	16.6	27.8					
	6836	12 47.1	36.5	9.3		40 01 19.3	− 1 59.2	+4.4	39 59 24.5

Observations and computations—Continued.

HUGHES, COLORADO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 21	6890	7 04.5	28.2	18.3					
	6905	16 47.0	19.5	26.0		40 04 15.8	− 4 52.7	+0.9	39 59 24.0
	6913	5 48.0	19.0	27.0		39 58 34.4	+ 0 48.6	+0.5	23.5
	6928	16 09.8	24.8	21.0					
	6973	2 20.4	31.0	15.0		40 06 30.7	− 7 11.5	+5.4	24.6
	6996	15 65.9	26.5	19.5					
	7022	3 52.4	22.0	24.0		40 05 39.7	− 6 16.9	+1.4	24.2
	7091	3 54.4	19.0	27.8					
	7131	6 81.3	32.3	14.7		39 57 40.4	+ 1 41.5	+2.4	24.3
	7182	13 66.8	29.0	18.0					
	7194	4 24.6	19.3	27.6		40 04 15.5	− 4 52.6	+0.7	23.6
	7213	11 48.0	22.0	24.7					
	7253	8 77.8	31.3	15.8		39 57 57.8	+ 1 23.9	+3.5	25.2
	Lal.	3 76.0	7.3	40.4		40 04 05.7	− 4 42.3	+1.3	24.7
	7402	12 84.8	42.7	5.0					
	7462	12 96.4	7.3	40.4		39 59 19.5	+ 0 03.6	+1.3	24.4
	Arg.	9 28.2	24.0	22.2		40 02 19.0	− 2 54.3	−0.9	23.8
	7560	16 09.9	28.8	19.5		40 05 49.5	− 6 26.1	+1.2	24.6
	7607	3 66.9	21.9	26.9					
	7631	8 18.0	25.0	23.3					
	7706	11 33.8	23.3	25.2		39 57 45.6	+ 1 38.1	0.0	23.7
	7753	12 48.3	21.7	26.8					
	7800	6 59.7	35.4	13.9		39 56 17.6	+ 3 02.8	+4.5	24.9
	7858	8 97.2	35.4	13.9					
	7917	10 80.4	21.7	26.8	Cloudy.	40 10 17.6	− 0 56.9	+4.5	25.2
July 23	5775	13 16.8	29.0	16.0					
	5788	6 73.5	20.0	25.0		02 41.6	− 3 19.8	+2.2	24.0
	5883	2 87.2	26.0	20.3					
	5902	16 13.0	28.8	18.4		40 06 18.0	− 6 51.8	−1.3	24.9
	5975	7 71.8	12.3	35.0					
	5986	10 34.7	37.0	10.2		39 58 00.4	+ 1 21.7	+1.1	23.2
	6052	12 84.2	37.0	10.2					
	6084	7 23.2	12.3	35.0		40 02 17.5	− 2 54.3	+1.1	24.3
	6129	5 83.4	26.6	21.8					
	6178	14 15.0	23.0	26.0		39 55 04.7	+ 4 18.3	+0.5	23.5
	6234	1 66.6	30.3	18.9					
	6246	15 73.9	18.4	31.0		40 06 42.1	− 7 17.1	−0.3	24.7
	6258	12 68.9	17.9	31.6		05 07.2	− 5 42.4	−0.6	24.2
	6349	5 72.6	23.0	27.0		40 03 01.2	− 3 41.4	+4.0	23.8
	6355	13 02.3	22.8	27.0		39 59 15.1	+ 0 05.3	+4.0	39 59 24.4
	6404	12 85.3	34.6	16.0					

Observations and computations—Continued.

HUGHES, COLORADO.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		*t.* *d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
July 23....	6453	6 49.4	24.5	25.6					
	6496	15 56.4	33.8	16.8		40 04 00.7	− 4 41.7	+4.4	39 59 23.4
	6516	14 10.4	26.3	24.2					
	6553	3 56.6	33.0	17.7		04 47.7	− 5 27.3	+4.8	25.2
	6602	2 69.3	32.4	18.7					
	6640	15 68.0	13.8	38.0		06 09.1	− 6 43.4	−2.9	22.8
	6673	5 10.9	29.2	22.0					
	6723	15 44.3	22.2	29.8		04 45.8	− 5 21.0	−0.1	24.7
	6740	6 65.3	26.5	25.0					
	6763	13 26.5	28.2	23.9		02 49.0	− 3 25.4	+1.6	25.2
	6805	7 08.3	23.8	28.0					
	6836	10 94.2	34.2	18.0		01 19.7	− 1 59.9	+3.3	23.1
	6851	2 95.9	25.0	26.7					
	6876	14 22.2	27.5	24.0		05 14.5	− 5 49.8	+0.5	25.2
	6890	6 68.0	25.2	26.5					
	6905	16 12.2	27.3	24.3		40 04 16.3	− 4 53.3	+0.5	23.5
	6913	5 12.5	28.2	24.0		39 58 34.9	+ 0 48.3	+0.8	24.0
	6928	16 57.6	29.7	22.3					
	6973	2 80.0	23.0	29.4		40 06 31.3	− 7 07.9	+0.3	23.7
	6996	15 42.3	29.5	22.8					
	7022	3 40.8	24.3	28.4		05 40.3	− 6 16.3	+0.7	24.7
	7041	16 41.4	29.0	23.5					
	7061	2 75.3	25.9	27.0		40 06 27.0	− 7 04.3	+1.2	23.9
	7091	3 26.7	24.6	28.0					
	7131	6 52.1	31.0	21.9		39 57 41.0	+ 1 41.1	+1.6	23.7
	7182	13 50.2	24.0	28.8					
	7194	4 01.2	35.0	18.0		40 04 16.1	− 4 54.8	+3.4	24.7
	7213	11 40.6	29.9	23.2					
	7253	8 73.2	28.8	24.6		39 57 58.4	+ 1 23.1	+3.0	24.5
	7313	5 70.0	26.8	26.6					
	7326	14 83.6	31.4	22.2		40 04 06.0	− 4 43.8	+2.6	24.8
	Lal.	3 52.2	23.7	30.0		40 04 06.3	− 4 44.8	+2.2	23.7
	7402	12 69.1	34.0	19.8					
	7462	12 79.0	20.0	34.0		39 59 20.1	+ 0 03.1	+0.0	23.2
	Arg.	8 68.1	23.4	31.0		40 02 19.7	− 2 58.6	+4.5	25.6
	7560	15 44.5	23.3	31.0		40 05 50.1	− 6 28.7	+4.5	39 59 25.9
	7607	2 93.0	38.9	15.0					

Observations and computations—Continued.

HUGHES, COLORADO.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		*t.* *d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
July 23.....	7631	8 43.0	31.5	22.8					
	7706	11 56.2	23.9	31.0		39 57 46.2	+ 1 37.3	+0.4	39 59 23.9
	7753	12 78.0	24.8	29.9					
	7800	6 86.8	36.0	19.0	Cloudy	39 56 18.2	+ 3 03.6	+3.3	39 59 25.1

ASTRONOMICAL CO-ORDINATES OF HUGHES, COLORADO.

Longitude.. $6^h\ 59^m\ 15^s.92$ or $104^\circ\ 48'\ 58''.80 \pm 0''.06$ west from Greenwich.
Longitude.. $1^h\ 51^m\ 03^s.80$ or $27^\circ\ 45'\ 57''.00$ west from U. S. Naval Observatory, Washington, D. C.
Latitude ... $39^\circ\ 59'\ 24''.09 \pm 0''.03$ north.

From all pairs observed more than twice the probable error of one observation for latitude is found to be $\pm$ 0.″40, and, therefore, that of the final result is $\pm$ 0.″033.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF LABRAN, COLORADO.

SEASON OF 1873.

COMPUTATIONS BY

Dr. F. KAMPF and JOHN H. CLARK.

LABRAN, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . $105^\circ\ 06'\ 17''.78 \pm 0''.44$ west from Greenwich.
Latitude, . . . $38^\circ\ 23'\ 08''.97 \pm 0''.03$ north.
Barometric altitude of observatory above sea-level, 5217.8 feet.

The astronomical monument is 157 feet from the southwest corner of the depot at Labran. At the date of its occupation this station was the regular terminus of the railroad from Pueblo, but from here a branch diverged to some neighboring coal-mines, for the convenience of the Colorado Central Improvement Company. Since that time the track has been continued to Cañon City.

Streets were laid out through this settlement; but only four houses, besides the railway depot, had been erected. The office of the improvement company was in charge of Mr. Neilson R. Clark, civil engineer, to whom thanks are due for his assistance in making the various arrangements at this place.

In the east and southeast the country is level to the horizon. In the south, southwest, and northwest the foot-hills of the Rocky Mountains rise abruptly to an eminent height. But little farming, and that by irrigation, is done in this part of Colorado. Three inches below the surface the ground is too hard to be permeated by the water of the rains, and it escapes to the Arkansas River, which flows by in an easterly direction, at a distance of one and a half miles.

METEOROLOGICAL CONDITIONS.

The atmosphere at this station was free from undulation. At first it was constantly stormy, and neither stars nor sun were visible, but after three days of rain it cleared away and became tolerably fair. The wind was always very strong, and the observing-tent was often in danger of being blown away.

The following table gives the general direction of the wind and the appearance of the sky during the observations at this station:

Date.	General direction of wind.			General appearance of the sky.
	0^h to 8 a. m.	8 a. m. to 4 p. m.	4 p. m. to 0^h.	
1873. August 12	....	N. W. and N. E.	E. and N. W.	Thunder and rain at 4.50 p. m.; clear at night.
13	N. W.	N. E.	S. E. and N. W.	Lightning at 8 p. m.
14	N. W.	N. E.	N. W.	Cloudy and rainy winds at 2.35 p. m.; heavy rain and storm at 4.30 p. m.
15	S. W.	S. E.	E. and N. E.	Rainy the whole day.
16	N. W.	E.	N. E. and N. W.	Heavy rain and lightning; clearing off a little at night.
17	(No.)	N. E.	N. W.	Rain-storm at 1.30 p. m. and 2.30 p. m.
18	N. W.	N. W.	S. E. and N. W.	Rain from 2.15 to 5 p. m.; then clearing off.
19	N. W.	N. W.	N. W.	Rain at 4 p. m.; clearing off at night.
20	N. W.	N. W. and N. E.	N. W.	Partly cloudy; lightning in south at 11 p. m.
21	S. W. and N. W.	N. E.	E.	Rain at 3 p. m.; clear at night.
22	(No.)	N. E.	N. W.	Rain-storm from 2.05 p. m. to 3.45 p. m.; rain at 6 and 11 p. m.
23	N. W.	N. W. and N. E.	S. E.	Rain-storm from 2.20 p. m. to 3.50 p. m.; hail-storm at 3.30 p. m.; lightning in northeast.
24	N. W.	N. W. and N. E.	S. E.	Rainy.
25	Changeable.	N. E.	E. and S.	Clear.
26	S. W.	N. W.	N. E.	Clear.
27	Changeable.	N. W. and N. E.	N. E.	Partly cloudy.
28	N. W.	....	....	

OBSERVATORY—INSTRUMENTS—INSTRUMENTAL VALUES.

The observatory and instruments were the same here as at Colorado Springs, and are described in the report upon the latter station, date of 1874. The telegraph-line was a loop from the office at Pueblo, used for railroad business alone. This loop was continued from the local office into the astronomical tent. Mr. D. Siemsen, in charge of the railway and telegraph office at this point, kindly assisted in the exchange of signals. The line was always in very bad condition, and exchanges had to be made by sound, except on the 25th, when the signals were recorded by the chronograph. The length of circuit from Labran to Salt Lake City is about 800 miles. The signals were transferred at Denver, Cheyenne, and Corinne by automatic repeaters.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

Salt Lake City was the connected station, at which point Mr. John H. Clark was observer. Observations at Labran were made by Dr. F. Kampf. Each observer made the computations to accompany his own work.

Tabulation of stars used for determination of time at Labran, Colorado, and Salt Lake City, Utah, 1873.

Name of star.	Labran, Colorado.									Salt Lake City, Utah.			
	August 12.	August 16.	August 17.	August 18.	August 19.	August 20.	August 21.	August 25.	August 26.	August 16.	August 19.	August 25.	August 26.
ζ Ophiuchi	....	....	×	×	....	....	....	....	....	....	....	....	....
η Herculis	....	....	×	×	....	....	....	....	....	....	....	....	....
κ Ophiuchi	....	....	×	×	....	....	....	....	....	....	....	....	....
ε Ursæ Minoris	....	....	×	×	....	....	....	....	....	....	....	....	....
α^1 Herculis	....	....	×	×	....	....	....	....	....	×	....	....	....
44 Ophiuchi	....	....	×	×	....	....	×	....	×	....	....	....	....
β Draconis	....	....	×	×	....	×	×	×	×	....	....	....	....
α Ophiuchi	....	....	×	×	....	×	....	×	×	....	....	....	....
ω Draconis	....	....	×	×	....	×	×	....	×	×	....	×	....
μ Herculis	....	....	×	×	....	×	×	....	×	×	....	×	×
88 Herculis	....	....	....	....	....	....	....	....	....	....	....	×	×
89 Herculis	....	....	....	....	....	....	....	....	....	....	....	×	×
ψ^1 Draconis	....	....	....	....	....	×	×	....	×	....	....	....	....
γ Draconis	....	....	....	....	....	×	×	....	×	×	....	×	×
γ^2 Sagittarii	....	....	....	....	....	....	×	....	×	....	....	....	....
72 Ophiuchi	....	....	....	....	....	....	....	....	....	×	×	×	×
μ^1 Sagittarii	....	....	....	....	....	....	×	....	×	×	×	×	×
δ Ursæ Minoris	....	....	....	....	....	....	×	....	×	....	....	....	....
η Serpentis	....	....	....	....	....	....	....	×	....	×	×	×	×
Brad. 2313	....	....	....	....	....	....	....	....	....	×	×	×	×
1 Aquilæ	....	....	....	....	....	×	×	×	×	×	×	×	×
α Lyræ	....	....	....	....	....	....	....	×	×	....	×	×	×
ζ^1 Lyræ	....	....	....	....	....	....	....	....	....	....	....	×	×
ζ^2 Lyræ	....	....	....	....	....	....	....	....	....	....	....	×	×
β Lyræ	....	....	....	....	....	×	....	×	....	....	....	×	×
50 Draconis	....	....	....	....	....	×	....	×	....	....	....	×	×
ζ Aquilæ	....	....	....	....	....	×	....	×	....	....	....	×	×
d Sagittarii	....	....	....	....	....	×	....	×	....	....	....	....	....
δ Draconis	....	....	....	....	....	×	....	×	....	....	....	....	....
τ Draconis	....	....	....	....	....	....	....	×	....	....	....	....	....
κ Aquilæ	....	....	....	....	×	....	....	....	....	....	....	....	....
θ Cygni	....	....	....	....	....	....	....	....	....	....	×	....	....
γ Aquilæ	....	....	....	....	....	....	....	....	....	×	×	....	....
α Aquilæ	....	....	....	....	....	....	....	....	....	×	....	....	....
ε Draconis	....	....	....	....	....	....	....	....	....	×	×	....	....
τ Aquilæ	×	....	....	....	×	....	....	....	....	×	×	....	....
θ Aquilæ	....	....	....	....	....	....	....	....	....	×	×	....	....
c^2 Capricorni	....	....	....	....	....	....	....	....	....	×	×	....	....
κ Cephei	×	....	....	....	×	....	....	....	....	....	....	....	....
ω^1 Cygni	....	....	....	....	....	....	....	....	....	....	×	....	....
π Capricorni	×	....	....	....	×	....	....	×	....	....	....	....	....
ε Delphini	×	....	....	....	×	....	....	×	....	....	×	....	×
α Delphini	....	....	....	....	....	....	....	....	....	....	×	....	....
Groombr. 3241	×	....	....	....	×	....	....	×	....	....	....	×	×
α Cygni	×	×	....	....	×	....	....	×	....	....	....	×	×
ε Aquarii	....	....	....	....	....	....	....	....	....	....	....	×	×
μ Aquarii	×	×	....	....	×	....	....	....	....	....	....	×	×
ν Cygni	....	....	....	....	....	....	....	....	....	....	....	×	×
12-Year Catalogue, 1879	×	×	....	....	×	....	....	×	....	....	....	....	....
61 Cygni	×	×	....	....	×	....	....	×	....	....	....	×	×
ζ Cygni	×	×	....	....	×	....	....	×	....	....	....	×	×
α Cephei	....	×	....	....	×	....	....	×	....	....	....	×	×
β Aquarii	....	×	....	....	....	....	....	×	....	....	....	×	×
β Cephei	....	×	....	....	....	....	....	....	....	....	....	....	....
ξ Aquarii	....	×	....	....	....	....	....	....	....	....	....	....	....
μ Capricorni	....	×	....	....	....	....	....	....	....	....	....	....	....
79 Draconis	....	×	....	....	....	....	....	....	....	....	....	....	....
α Aquarii	....	×	....	....	....	....	....	....	....	....	....	....	....

Observations and reductions for time taken at sending station.

LABRAN, COLORADO, AUGUST 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	τ Aquilæ	20 09 31.33	+ 0.25	— 0.22	— 0.03	20 09 31.28	19 57 58.47	— 11 32.81
E.	κ Cephei	24 46.14	— 1.35	— 0.21	— 0.37	24 44.21	20 12 11.44	32.77
E.	π Capricorni	31 38.06	+ 0.42	— 0.02	— 0.09	31 38.37	20 05.70	32.67
E.	ε Delphini	38 43.48	+ 0.22	— 0.03	— 0.08	38 43.59	27 11.02	32.57
E.	Groombr. 3241	42 09.57	— 0.85	— 0.05	— 0.26	42 08.41	30 35.61	32.80
W.	α Cygni	48 41.40	— 0.08	+ 0.06	+ 0.11	48 41.49	37 08.47	33.02
W.	μ Aquarii	57 23.11	+ 0.36	+ 0.03	+ 0.08	57 23.58	45 50.68	32.90
W.	12 Y. C. 1879	21 04 55.40	— 1 82	+ 0.17	+ 0.47	21 04 54.22	53 21.52	32.70
W.	61 Cygni	12 47.48	0.00	+ 0.03	+ 0.10	12 47.61	21 01 14.88	32.73
W.	ζ Cygni	21 19 06.57	+ 0.08	— 0.01	+ 0.09	21 19 06.73	21 07 34.17	— 11 32.56
	Mean at $20^h\ 33^m$ local sidereal time							— 11 32.75

NORMAL EQUATIONS.

$$0 = + 5.33 + 10.00\,\delta t - 5.88\,a + 0.25\,c \qquad \delta t = -0^s.25$$
$$0 = - 14.47 - 5.88\,\delta t + 28.34\,a + 4.64\,c \qquad a = + 0^s.47$$
$$0 = + 3.86 + 0.25\,\delta t + 4.64\,a + 74.13\,c \qquad c = - 0^s.08$$

NOTE.—These observations were taken by eye and ear.

LABRAN, COLORADO, AUGUST 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Cygni	20 48 44.42	+ 0.37	+ 0.17	— 1.07	20 48 43.89	20 37 08.46	— 11 35.43
W.	μ Aquarii	57 28.79	— 1.78	+ 0.10	— 0.78	57 26.33	45 50.70	35.63
W.	12 Y. C. 1879	21 04 51.63	+ 9.03	+ 0.65	— 4.42	21 04 56.89	53 21.35	35.54
W.	61 Cygni	12 51.25	0.00	+ 0.18	— 0.97	12 50.46	21 01 14.89	35.57
W.	ζ Cygni	19 10.87	— 0.40	+ 0.17	— 0.88	19 09.76	07 34.18	35.58
W.	α Cephei	27 10.37	+ 2.01	+ 0.30	— 1.62	27 11.06	15 35.55	35.51
E.	β Aquarii	36 31.04	— 1.66	0.00	+ 0.77	36 30.15	24 54.90	35.25
E.	β Cephei	38 34.04	+ 3.60	0.00	+ 2.23	38 39.87	27 03.94	35.91
E.	ξ Aquarii	42 38.25	— 1.71	0.00	+ 0.78	42 37.32	31 01.96	35.36
E.	μ Capricorni	58 01.50	— 1.94	— 0.07	+ 0.79	58 00.28	46 24.92	35.36
E.	79 Draconis	22 02 49.05	+ 4.56	— 0.28	+ 2.62	22 02 55.95	51 20.72	35.23
E.	α Aquarii	22 10 54.27	— 1.47	— 0.08	+ 0.76	22 10 53.48	21 59 18.10	— 11 35.38
	Mean at $21^h\ 18^m$ local sidereal time							— 11 35.48

NORMAL EQUATIONS.

$$0 = - 0.92 + 12.00\,\delta t - 4.88\,a^1 - 2.37\,c^1 \qquad \delta t = - 0^s.05$$
$$0 = + 7.05 - 4.88\,\delta t + 24.11\,a^1 + 14.94\,c^1 \qquad a^1 = - 0^s.34$$
$$0 = + 0.72 - 2.37\,\delta t + 14.94\,a^1 + 68.00\,c^1 \qquad c^1 = + 0^s.06$$

Adopted azimuth $= - 2^s.00$
collimation $= + 0^s.70$
therefore $a = - 2^s.34$
and $c = + 0^s.76$

Observations and reductions for time taken at sending station—Continued.

LABRAN, COLORADO, AUGUST 17, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	ζ Ophiuchi	16 41 51.33	− 2.57	− 0.04	− 0.95	16 41 47.77	16 30 11.64	− 11 36.13
W.	η Herculis	50 11.41	+ 0.07	− 0.10	− 1.20	50 10.18	38 33.96	36.22
W.	κ Ophiuchi	17 03 19.86	− 1.63	− 0.09	− 0.95	17 03 17.19	51 40.99	36.20
W.	ε Ursæ Minoris	10 32.19	+17.13	− 0.64	− 6.88	10 41.80	59 05.52	36.28
W.	α^1 Herculis	20 31.76	− 1.40	− 0.13	− 0.97	20 29.26	17 08 53.07	36.19
E.	44 Ophiuchi	30 17.70	− 3.23	− 0.12	+ 1.01	30 15.36	18 38.97	36.39
E.	β Draconis	39 09.34	+ 1.33	− 0.40	+ 1.52	39 11.79	27 35.41	36.38
E.	α Ophiuchi	40 41.24	− 1.50	− 0.24	+ 0.96	40 40.46	29 04.12	36.34
E.	ω Draconis	49 13.34	+ 4.67	− 0.79	+ 2.56	49 19.78	37 43.67	36.11
E.	μ Herculis	17 53 07.23	− 0.70	− 0.33	+ 1.05	17 53 07.25	17 41 31.05	− 11 36.20
	Mean at $17^h\ 06^m$ local sidereal time							− 11 36.25

NORMAL EQUATIONS.

$$0 = -15.27 + 10.00\,\delta t - 3.65\,a - 4.13\,c \qquad \delta t = +0^s.75$$
$$0 = +73.98 - 3.65\,\delta t + 30.74\,a + 33.63\,c \qquad a = -3^s.33$$
$$0 = +46.92 - 4.13\,\delta t + 33.63\,a + 73.57\,c \qquad c = +0^s.93$$

LABRAN, COLORADO, AUGUST 18, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	ζ Ophiuchi	16 41 48.37	− 0.26	0.00	+ 0.80	16 41 48.91	16 30 11.62	− 11 37.29
E.	η Herculis	50 10.16	+ 0.01	− 0.04	+ 1.01	50 11.14	38 33.94	37.20
E.	κ Ophiuchi	17 03 17.68	− 0.17	− 0.05	+ 0.80	17 03 18.26	51 40.98	37.28
E.	ε Ursæ Minoris	10 35.55	+ 1.76	− 0.43	+ 5.79	10 42.67	59 05.33	37.34
E.	α^1 Herculis	20 29.76	− 0.14	− 0.07	+ 0.81	20 30.36	17 08 53.05	37.31
W.	44 Ophiuchi	30 17.59	− 0.33	0.00	− 0.85	30 16.41	18 38.96	37.45
W.	β Draconis	39 13.92	+ 0.14	0.00	− 1.28	39 12.78	27 35.38	37.40
W.	α Ophiuchi	40 42.37	− 0.15	0.00	− 0.81	40 41.41	29 04.10	37.31
W.	ω Draconis	49 22.52	+ 0.48	0.00	− 2.16	49 20.84	37 43.61	37.23
W.	μ Herculis	17 53 09.30	− 0.07	0.00	− 0.88	17 53 08.35	17 41 31.03	− 11 37.32
	Mean at $17^h\ 06^m$ local sidereal time							− 11 37.31

NORMAL EQUATIONS.

$$0 = -6.37 + 10.00\,\delta t - 3.65\,a + 4.13\,c \qquad \delta t = +0^s.19$$
$$0 = +37.52 - 3.65\,\delta t + 30.74\,a - 33.63\,c \qquad a = -0^s.34$$
$$0 = -69.84 + 4.13\,\delta t - 33.63\,a + 73.57\,c \qquad c = +0^s.78$$

Observations and reductions for time taken at sending station—Continued.

LABRAN, COLORADO, AUGUST 19, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	κ Aquilæ	19 41 44.99	+ 0.13	— 0.08	— 0.34	19 41 44.70	19 30 05.86	— 11 38.84
W.	τ Aquilæ	20 09 37.42	+ 0.09	— 0.05	— 0.33	20 09 37.13	57 58.45	38.68
W.	κ Cephei	24 52.01	— 0.51	— 0.18	— 1.52	24 49.80	20 13 11.08	38.72
W.	π Capricorni	32 44.84	+ 0.16	— 0.02	— 0.35	32 44.63	20 05.71	38.92
W.	ε Delphini	38 50.12	+ 0.08	— 0.03	— 0.34	38 49.83	27 11.03	38.80
W.	Groombr. 3241	42 15.70	— 0.32	— 0.08	— 1.08	42 14.22	30 35.42	38.80
E.	α Cygni	48 46.77	— 0.03	— 0.20	+ 0.47	48 47.01	37 08.44	38.57
E.	μ Aquarii	57 29.14	+ 0.14	— 0.09	+ 0.34	57 29.53	45 50.70	38.83
E.	12 Y. C. 1879	21 04 59.43	— 0.69	— 0.61	+ 1.92	21 05 00.05	53 21.21	38.84
E.	61 Cygni	12 53.37	0.00	— 0.20	+ 0.42	12 53.59	21 01 14.89	38.70
E.	ζ Cygni	19 12.75	+ 0.03	— 0.20	+ 0.38	19 12.96	07 34.19	38.77
E.	α Cephei	21 27 14.10	— 0.15	— 0.36	+ 0.71	21 27 14.30	21 15 35.54	— 11 38.76
	Mean at 20^h 30^m local sidereal time							— 11 38.77

NORMAL EQUATIONS.

$$0 = + 6.42 + 12.00\,\delta t - 6.02\,a + 0.86\,c \qquad \delta t = -0^s.47$$
$$0 = - 5.70 - 6.02\,\delta t + 29.60\,a - 7.20\,c \qquad a = +0^s.18$$
$$0 = -24.73 + 0.86\,\delta t - 7.20\,a + 79.71\,c \qquad c = +0^s.33$$

LABRAN, COLORADO, AUGUST 20, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	β Draconis	17 39 14.52	— 0.09	+ 0.09	+ 0.48	17 39 15.00	17 27 35.32	— 11 39.68
E.	α Ophiuchi	40 42.98	+ 0.10	+ 0.07	+ 0.30	40 43.45	29 04.07	39.38
E.	ω Draconis	49 22.20	— 0.31	+ 0.19	+ 0.80	49 22.88	37 43.50	39.38
E.	μ Herculis	53 09.95	+ 0.05	+ 0.08	+ 0.33	53 10.41	41 31.00	39.41
E.	ψ^1 Draconis	55 52.96	— 0.41	+ 0.16	+ 0.95	55 53.66	44 13.82	39.84
W.	γ Draconis	18 05 21.00	— 0.08	+ 0.19	— 0.46	18 05 20.65	53 41.27	39.38
W.	1 Aquilæ	39 59.88	+ 0.16	— 0.07	— 0.30	39 59.67	18 28 19.87	39.80
W.	β Lyræ	57 05.18	+ 0.02	— 0.11	— 0.32	57 04.77	45 25.39	39.38
W.	50 Draconis	19 02 11.55	— 0.53	— 0.31	— 1.14	19 02 09.57	50 29.98	39.59
W.	ζ Aquilæ	11 16.40	+ 0.10	— 0.09	— 0.30	11 16.11	59 36.37	39.74
W.	d Sagittarii	21 54.56	+ 0.20	— 0.06	— 0.31	21 54.39	19 10 14.70	39.69
W.	δ Draconis	19 24 14.32	— 0.28	— 0.23	— 0.76	19 24 13.05	19 12 33.55	— 11 39.50
	Mean at 18^h 30^m local sidereal time							— 11 39.56

NORMAL EQUATIONS.

$$0 = + 2.57 + 12.00\,\delta t - 4.79\,a - 2.54\,c \qquad \delta t = -0^s.06$$
$$0 = - 3.86 - 4.79\,\delta t + 14.50\,a + 1.16\,c \qquad a = +0^s.22$$
$$0 = -15.46 - 2.54\,\delta t + 1.16\,a + 52.62\,c \qquad c = +0^s.29$$

Observations and reductions for time taken at sending station—Continued.

LABRAN, COLORADO, AUGUST 21, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	44 Ophiuchi	17 20 19.27	+ 0.55	— 0.04	— 0.37	17 30 19.41	17 18 38.92	— 11 40.49
W.	β Draconis	29 16.03	— 0.23	— 0.14	— 0.56	39 16.00	27 35.29	40.71
W.	ω Draconis	39 25.88	— 0.79	— 0.21	— 0.95	49 23.93	37 43.44	40.49
W.	μ Herculis	43 11.87	+ 0.12	— 0.11	— 0.39	53 11.49	41 30.98	40.51
W.	ψ^1 Draconis	45 56.77	— 1.03	— 0.30	— 1.12	55 54.32	44 13.76	40.56
E.	γ Draconis	18 05 21.66	— 0.20	— 0.31	+ 0.55	18 05 21.70	53 41.25	40.45
E.	γ^2 Sagittarii	09 21.02	+ 0.61	— 0.08	+ 0.40	09 21.95	57 41.38	40.57
E.	μ Sagittarii	17 52.17	+ 0.52	— 0.11	+ 0.37	17 52.95	18 06 12.34	40.61
E.	δ Ursæ Minoris	25 07.18	— 7.12	— 2.67	+ 5.82	25 03.21	13 22.66	40.55
E.	1 Aquilæ	18 39 59.93	+ 0.41	— 0.16	+ 0.35	18 40 00.53	18 28 19.86	— 11 40.67
	Mean at 18h 00m local sidereal time							— 11 40.56

NORMAL EQUATIONS.

$$0 = + \ 3.67 + 10.00\,\delta t - \ 12.67\,a + \ 11.85\,c \qquad \delta t = -0^s.06$$
$$0 = -26.20 - 12.67\,\delta t + 167.86\,a - 201.39\,c \qquad a = +0^s.56$$
$$0 = + \ 5.92 + 11.85\,\delta t - 201.39\,a + 315.14\,c \qquad c = +0^s.34$$

LABRAN, COLORADO, AUGUST 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	β Draconis	17 39 20.07	— 0.31	— 0.06	+ 0.35	17 39 20.05	17 27 35.16	— 11 44.89
E.	α Ophiuchi	40 48.30	+ 0.35	— 0.08	+ 0.22	40 48.79	29 04.00	44.79
E.	η Serpentis	18 26 30.35	+ 0.51	— 0.13	+ 0.22	18 26 30.95	18 14 46.22	44.73
E.	1 Aquilæ	40 03.92	+ 0.57	— 0.08	+ 0.22	14 04.63	28 19.82	44.81
E.	α Lyræ	44 24.52	— 0.01	— 0.12	+ 0.28	44 24.67	32 40.10	44.57
W.	β Lyræ	57 10.15	+ 0.08	+ 0.20	— 0.24	57 10.19	45 25.31	44.88
W.	50 Draconis	19 02 17.07	— 1.83	+ 0.25	— 0.84	19 02 14.65	50 29.62	45.03
W.	ζ Aquilæ	11 21.00	+ 0.34	— 0.03	— 0.22	11 21.09	59 36.32	44.77
W.	d Sagittarii	21 59.03	+ 0.69	0.00	— 0.23	21 59.49	19 10 14.67	44.82
W.	δ Draconis	24 19.47	— 0.99	+ 0.05	— 0.56	24 17.97	12 33.35	44.62
W.	τ Draconis	19 29 48.03	— 1.53	+ 0.11	— 0.74	19 29 45.87	19 18 01.30	— 11 44.57
	Mean at 18h 46m local sidereal time							— 11 44.78

NORMAL EQUATIONS.

$$0 = + \ 6.74 + 11.00\,\delta t - \ 2.74\,a - \ 7.21\,c \qquad \delta t = -0^s.28$$
$$0 = -15.24 - \ 2.74\,\delta t + 13.38\,a + 19.05\,c \qquad a = +0^s.78$$
$$0 = -26.44 - \ 7.21\,\delta t + 19.05\,a + 44.96\,c \qquad c = +0^s.21$$

Observations and reductions for time taken at sending station—Continued.

LABRAN, COLORADO, AUGUST 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	π Capricorni	20 31 50.02	+ 0.72	+ 0.05	— 0.17	20 31 50.62	20 20 05.69	— 11 44.93
W.	ε Delphini	38 55.62	+ 0.38	+ 0.07	— 0.16	38 55.91	37 11.01	44.90
W.	Groombr. 3241	42 21.92	— 1.47	+ 0.17	— 0.52	42 20.10	30 35.32	44.78
W.	α Cygni	48 53.54	— 0.13	+ 0.07	— 0.23	48 53.25	37 08.40	44.85
E.	12-Y. C., 1879	21 05 08.39	— 3.13	— 0.39	+ 0.93	21 05 05.80	53 20.91	44.89
E.	61 Cygni	12 59.55	0.00	— 0.12	+ 0.20	12 59.63	21 01 14.88	44.75
E.	ζ Cygni	19 18.73	+ 0.14	— 0.09	+ 0.18	19 18.96	07 34.17	44.79
E.	α Cephei	27 20.78	— 0.70	— 0.17	+ 0.34	27 20.25	15 35.48	44.77
E.	β Aquarii	21 36 39.05	+ 0.57	— 0.06	+ 0.16	21 36 39.72	21 24 54.93	— 11 44.79
	Mean at 21ʰ 00ᵐ local sidereal time							— 11 44.83

NORMAL EQUATIONS.

$$0 = +\ 1.34 + 9.00\,\delta t - 4.45\,a + 4.62\,c \qquad \delta t = +\,0^s.17$$
$$0 = -\,12.87 - 4.45\,\delta t + 20.49\,a - 18.62\,c \qquad a = +\,0^s.81$$
$$0 = +\ 5.21 + 4.62\,\delta t - 18.62\,a + 56.84\,c \qquad c = +\,0^s.16$$

LABRAN, COLORADO, AUGUST 26, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	44 Ophiuchi	17 30 25.95	— 1.84	— 0.05	+ 0.21	17 30 24.27	17 18 38.84	— 11 45.43
E.	β Draconis	39 19.79	+ 0.76	— 0.12	+ 0.31	39 20.74	27 35.13	45.61
E.	α Ophiuchi	40 50.14	— 0.85	— 0.06	+ 0.19	40 49.42	29 03.98	45.44
E.	ω Draconis	49 25.82	+ 2.65	— 0.17	+ 0.52	49 28.82	34 43.15	45.67
E.	μ Herculis	53 16.53	— 0.40	— 0.09	+ 0.21	53 16.25	41 30.89	45.36
E.	ψ¹ Draconis	55 55.26	+ 3.45	— 0.27	+ 0.62	55 59.06	44 13.40	45.66
W.	γ Draconis	18 05 26.27	+ 0.68	— 0.04	— 0.30	18 05 26.61	53 41.09	45.52
W.	γ² Sagittarii	09 29.30	— 2.05	— 0.01	— 0.22	09 27.02	54 41.31	45.71
W.	μ¹ Sagittarii	17 59.90	— 1.74	— 0.02	— 0.20	17 57.94	18 06 12.28	45.66
W.	δ Ursæ Minoris	24 45.76	+23.88	6.00	— 3.19	25 06.45	13 20.88	45.57
W.	1 Aquilæ	40 07.12	— 1.38	— 0.01	— 0.19	40 05.54	23 19.81	45.73
W.	α Lyræ	18 44 25.86	+ 0.02	— 0.01	— 0.24	18 44 25.63	18 32 40.08	— 11 45.55
	Mean at 18ʰ 00ᵐ local sidereal time							— 11 45.58

NORMAL EQUATIONS.

$$0 = +\ 0.86 + 12.00\,\delta t - 12.23\,a^1 - 12.11\,c^1 \qquad \delta t = +\,0^s.02$$
$$0 = -\,15.15 - 12.23\,\delta t + 168.06\,a^1 + 201.86\,c^1 \qquad a^1 = +\,0^s.11$$
$$0 = -\,17.41 - 12.11\,\delta t + 201.86\,a^1 + 317.86\,c^1 \qquad c^1 = -\,0^s.01$$

Adopted azimuth $-\,2^s.00$
error of collimation $+\,0^s.20$
therefore $a = -\,1^s.89$
$c = +\,0^s.19$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, AUGUST 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	α^1 Herculis	9 01 47.50	− 0.84	+ 0.03	+ 0.22	9 01 46.91	17 08 53.08	+8 07 06.17
E.	ω Draconis	30 34.58	+ 2.37	+ 0.10	+ 0.58	30 37.63	37 43.72	06.09
E.	μ Herculis	34 25.04	− 0.46	+ 0.06	+ 0.24	34 24.88	41 31.06	06.18
W.	γ Draconis	46 34.86	+ 0.55	+ 0.17	− 0.34	46 35.24	53 41.38	06.14
W.	72 Ophiuchi	54 16.59	− 0.96	+ 0.09	− 0.21	54 15.51	18 01 21.63	06.12
W.	μ^1 Sagittarii	59 08.14	− 1.73	+ 0.05	− 0.22	59 06.24	06 12.39	06.15
W.	η Serpentis	10 07 41.62	− 1.26	+ 0.08	− 0.21	10 07 40.23	14 46.32	06.09
W.	Bradl. 2313	14 55.30	− 1.55	+ 0.07	− 0.22	14 53.60	21 50.78	06.18
W.	1 Aquilæ	10 21 15.34	− 1.38	+ 0.09	− 0.21	10 21 13.84	18 28 19.91	+8 07 06.07
	Mean at $18^h.0$ local sidereal time							+8 07 06.13

NORMAL EQUATIONS.

$$+9.00\,\delta t + 2.89\,a - 1.81\,c = -4.44 \qquad \delta t = +0^s.13$$
$$+2.89\,\delta t + 5.01\,a - 6.28\,c = -10.01 \qquad a = -1^s.820$$
$$-1.81\,\delta t - 6.28\,a + 17.86\,c = +14.91 \qquad c = +0^s.209$$

SALT LAKE CITY, UTAH, AUGUST 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	γ Aquilæ	11 33 10.39	− 0.79	+ 0.09	− 0.17	11 33 09.52	19 40 15.55	+8 07 06.03
W.	α Aquilæ	37 32.42	− 0.82	+ 0.08	− 0.16	37 31.52	44 37.47	05.95
W.	ϵ Draconis	41 30.44	+ 2.14	+ 0.20	− 0.47	41 32.31	48 38.27	05.96
E.	τ Aquilæ	50 52.97	− 0.85	+ 0.07	+ 0.16	50 52.35	57 58.45	06.10
E.	θ Aquilæ	57 42.26	− 1.01	+ 0.07	+ 0.16	57 41.48	20 04 47.45	05.97
E.	α^2 Capricorni	12 03 58.15	− 1.25	+ 0.07	+ 0.17	12 03 57.14	20 11 02.98	+8 07 05.84
	Mean at $20^h.0$ local sidereal time							+8 07 05.97

NORMAL EQUATIONS.

$$+6.00\,\delta t + 1.70\,a - 1.91\,c = -3.04 \qquad \delta t = -0^s.03$$
$$+1.70\,\delta t + 4.03\,a + 5.17\,c = -5.30 \qquad a = -1^s.510$$
$$-1.91\,\delta t + 5.17\,a + 13.67\,c = -5.53 \qquad c = +0^s.162$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 19, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	72 Ophiuchi	9 54 16.20	— 0.83	+ 0.05	+ 0.18	9 54 15.60	18 01 21.00	+8 07 06.00
E.	μ^1 Sagittarii	59 07.70	— 1.49	+ 0.02	+ 0.19	59 06.42	06 12.36	05.94
E.	η Serpentis	10 07 41.29	— 1.08	+ 0.01	+ 0.18	10 07 40.40	14 46.29	05.89
E.	Bradl. 2313	14 55.01	— 1.33	0.00	+ 0.19	14 53.87	21 59.76	05.89
E.	ι Aquilæ	21 14.93	— 1.19	0.00	+ 0.18	21 13.92	28 19.88	05.96
E.	α Lyræ	10 25 33.91	— 0.08	0.00	+ 0.23	10 25 34.06	18 32 40.20	+8 07 06.14
	Mean at 18h.0 local sidereal time							+8 07 05.97

NORMAL EQUATIONS.

$$+6.00\,\delta t + 3.83\,a = -5.78 \qquad \delta t = -0^s.03$$
$$+3.83\,\delta t + 2.96\,a = -4.50 \qquad a = -1^s.570$$
$$c \text{ adopted} = +0^s.180.$$

SALT LAKE CITY, UTAH, AUGUST 19, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	θ Cygni	11 25 57.43	+ 0.43	— 0.12	+ 0.32	11 25 58.06	19 33 04.27	+8 07 06.21
E.	γ Aquilæ	33 10.12	— 0.89	— 0.05	+ 0.21	33 09.39	40 15.53	06.14
E.	ϵ Draconis	41 29.10	+ 2.43	— 0.05	+ 0.61	41 26.09	48 38.16	06.07
E.	τ Aquilæ	50 53.16	— 0.96	— 0.00	+ 0.21	50 52.41	57 58.45	06.04
W.	θ Aquilæ	57 42.64	— 1.15	+ 0.09	— 0.21	57 41.37	20 04 47.47	06.10
W.	α^2 Capricorni	12 03 58.50	— 1.42	+ 0.05	— 0.21	12 03 56.92	11 02.98	06.06
W.	ω^1 Cygni	16 05.51	+ 0.38	+ 0.09	— 0.32	16 05.66	23 11.72	06.06
W.	ϵ Delphini	20 06.01	— 0.87	+ 0.03	— 0.21	20 04.96	27 11.03	06.07
W.	α Delphini	12 26 41.36	— 0.75	0.00	— 0.22	12 26 40.39	20 33 46.66	+8 07 06.27
	Mean at 20h.0 local sidereal time							+8 07 06.11

NORMAL EQUATIONS.

$$+9.00\,\delta t + 1.64\,a + 0.89\,c = -1.60 \qquad \delta t = +0^s.11$$
$$+1.64\,\delta t + 4.30\,a - 5.61\,c = -8.33 \qquad a = -1^s.710$$
$$+0.89\,\delta t - 5.61\,a + 19.48\,c = +13.76 \qquad c = +0^s.208$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	ω Draconis	9 30 37.29	+ 2.30	− 0.07	− 0.52	9 30 39.00	17 37 43.21	+8 07 04.21
W.	μ Herculis	34 37.24	− 0.44	− 0.03	− 0.21	34 36.56	41 30.90	04.34
W.	88 Herculis	39 41.04	+ 0.36	− 0.04	− 0.28	39 41.08	46 45.59	04.51
W.	89 Herculis	43 15.90	− 0.50	− 0.03	− 0.21	43 15.16	50 19.45	04.29
W.	γ Draconis	46 36.58	+ 0.53	− 0.03	− 0.30	46 36.78	53 41.12	04.34
W.	72 Ophiuchi	54 18.38	− 0.94	− 0.01	− 0.19	54 17.24	18 01 25.55	04.31
E.	μ Sagittarii	59 09.38	− 1.68	0.00	+ 0.20	59 07.90	06 12.29	04.39
E.	η Serpentis	10 07 42.98	− 1.22	0.00	+ 0.19	10 07 41.95	14 46.22	04.27
E.	Bradl. 2313	14 56.69	− 1.51	+ 0.01	+ 0.19	14 55.38	21 59.70	04.32
E.	1 Aquilæ	21 16.70	− 1.35	+ 0.01	+ 0.19	21 15.55	28 19.82	04.27
E.	α Lyræ	25 35.63	− 0.09	+ 0.03	+ 0.24	25 35.81	32 40.10	04.29
E.	ζ¹ Lyræ	33 21.30	− 0.12	+ 0.05	+ 0.24	33 21.47	40 25.74	04.27
E.	ζ² Lyræ	33 23.14	− 0.12	+ 0.07	+ 0.24	33 23.33	40 27.58	04.25
E.	β Lyræ	38 20.99	− 0.28	+ 0.08	+ 0.22	38 21.01	45 25.31	04.30
E.	50 Draconis	10 43 20.34	+ 3.95	+ 0.22	+ 0.74	10 43 25.25	18 50 29.61	+8 07 04.36
	Mean at $18^h.0$ local sidereal time							+8 07 04.31

NORMAL EQUATIONS.

$$
\begin{aligned}
+15.00\,\delta t + 0.63\,a + 3.92\,c &= +4\ 35 & \delta t &= +0^s.31\\
+0.63\,\delta t + 9.93\,a - 1.74\,c &= -17.74 & a &= -1^s.774\\
+3.92\,\delta t - 1.74\,a + 42.08\,c &= +12.17 & c &= +0^s.187
\end{aligned}
$$

SALT LAKE CITY, UTAH, AUGUST 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	Groombr. 3241	12 23 27.08	+ 3.40	− 0.08	+ 0.38	12 23 30.78	20 30 35.22	+8 07 04.44
E.	α Cygni	30 03.70	+ 0.18	− 0.04	+ 0.17	30 04.01	37 08.40	04.39
E.	ε Aquarii	33 47.45	− 1.59	− 0.03	+ 0.12	33 45.95	40 50.55	04.60
E.	μ Aquarii	38 47.65	− 1.57	− 0.03	+ 0.12	38 46.17	45 50.75	04.58
E.	ν Cygni	45 24.20	0.00	− 0.05	+ 0.16	45 24.31	52 28.59	04.28
W.	61¹ Cygni	54 10.73	− 0.12	0.00	− 0.15	54 10.46	21 01 14.87	04.41
W.	61² Cygni	54 12.29	− 0.12	+ 0.01	− 0.15	54 12.03	01 16.39	04.36
W.	ζ Cygni	13 00 30.47	− 0.44	+ 0.03	− 0.14	13 00 29.92	07 34.18	04.26
W.	α Cephei	08 29.49	+ 1.55	+ 0.09	− 0.25	08 30.88	15 35.48	04.60
W.	β Aquarii	13 17 52.05	− 1.47	+ 0.05	− 0.12	13 17 50 51	21 24 54.93	+8 07 04.42
	Mean at $21^h.0$ local sidereal time							+8 07 04.43

NORMAL EQUATIONS.

$$
\begin{aligned}
+10.00\,\delta t + 0.09\,a + 1.19\,c &= +4.25 & \delta t &= +0^s.43\\
+0.09\,\delta t + 5.27\,a - 3.54\,c &= -10.98 & a &= -2^s.010\\
+1.19\,\delta t - 3.54\,a + 26.52\,c &= +10.77 & c &= +0^s.118
\end{aligned}
$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 26, 1873.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	μ Herculis	9 34 27.25	− 0.41	+ 0.05	− 0.18	9 34 26.71	17 41 30.89	+8 07 04.18
W.	88 Herculis	39 41.42	+ 0.33	+ 0.04	− 0.24	39 41.55	46 45.56	04.01
W.	89 Herculis	43 15.98	− 0.46	+ 0.02	− 0.18	43 15.36	50 19.43	04.07
W.	γ Draconis	46 3[illegible].61	+ 0.49	+ 0.00	− 0.26	46 36.84	53 41.09	04.25
W.	72 Ophiuchi	54 18.40	− 0.87	+ 0.02	− 0.16	54 17.39	18 01 21.54	04.15
W.	μ^1 Sagittarii	59 09.82	− 1.56	+ 0.02	− 0.17	59 08.11	06 12.28	04.17
E.	η Serpentis	10 07 43.03	− 1.13	+ 0.04	+ 0.16	10 07 42.10	14 46.20	04.10
E.	Bradl. 2313	14 56.83	− 1.39	+ 0.03	+ 0.16	14 55.63	21 59.68	04.05
E.	1 Aquilæ	21 16.73	− 1.25	+ 0.04	+ 0.16	21 15.68	28 19.81	04.13
E.	α Lyræ	25 35.69	− 0.08	+ 0.08	+ 0.20	25 35.89	32 40.08	04.19
E.	ζ^1 Lyræ	33 21.37	− 0.11	+ 0.09	+ 0.20	33 21.55	40 25.72	04.17
E.	ζ^2 Lyræ	33 23.16	− 0.11	+ 0.09	+ 0.20	33 23.34	40 27.57	04.23
E.	β Lyræ	38 21.08	− 0.26	+ 0.12	+ 0.19	38 21.13	45 25.29	04.16
E.	50 Draconis	10 43 20.67	+ 3.66	+ 0.48	+ 0.63	10 43 25.44	18 50 29.53	+8 07 04.09
	Mean at 18h.0 local sidereal time							+8 07 04.14

NORMAL EQUATIONS.

$$+14.00\,\delta t + 1.93\,a + 4.55\,c = -0.49 \qquad \delta t = +0^s.14$$
$$+1.93\,\delta t + 8.24\,a - 7.38\,c = -14.41 \qquad a = -1^s.640$$
$$+4.55\,\delta t - 7.38\,a + 34.43\,c = +18.15 \qquad c = +0^s.159$$

SALT LAKE CITY, UTAH, AUGUST 26, 1873.

Clamp	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	ε Delphini	12 20 07.51	− 0.88	+ 0.07	+ 0.16	12 20 06.86	20 27 11.01	+8 07 04.15
E.	Groombr. 3241	23 27.39	+ 2.92	+ 0.23	+ 0.51	23 31.05	30 35.19	04.14
E.	α Cygni	30 03.66	+ 0.15	+ 0.11	+ 0.22	30 04.14	37 08.39	04.25
E.	ε Aquarii	33 47.54	− 1.37	+ 0.05	+ 0.16	33 46.38	40 50.55	04.17
E.	μ Aquarii	38 47.67	− 1.35	+ 0.05	+ 0.16	38 46.53	45 50.70	04.17
W.	ν Cygni	45 24.61	− 0.00	+ 0.13	− 0.21	45 24.53	52 28.58	04.05
W.	61[1] Cygni	54 10.94	− 0.10	+ 0.10	− 0.20	54 10.74	21 01 14.87	04.13
W.	61[2] Cygni	54 12.38	− 0.10	+ 0.10	− 0.20	54 12.18	01 16.39	04.21
W.	ζ Cygni	13 00 30.55	− 0.38	+ 0.07	− 0.18	13 00 30.06	07 34.17	04.11
W.	α Cephei	08 30.13	+ 1.33	+ 0.10	− 0.33	08 31.23	15 35.46	04.23
W.	β Aquarii	13 17 52.07	− 1.26	+ 0.02	− 0.16	13 17 50.67	21 24 54.94	+8 07 04.27
	Mean at 21h.0 local sidereal time							+8 07 04.17

NORMAL EQUATIONS.

$$+11.00\,\delta t + 0.60\,a - 0.43\,c = +0.77 \qquad \delta t = +0^s.17$$
$$+0.60\,\delta t + 5.54\,a - 3.02\,c = -9.91 \qquad a = -1^s.725$$
$$-0.43\,\delta t - 3.02\,a + 27.56\,c = +9.44 \qquad c = +0^s.156$$

From the preceding time-observations the following corrections and rates are derived:

CHRONOMETER AT LABRAN.—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*h. m. s.*	*s.*
Aug. 12	20.55	— 0 11 32.75	— 0.025
Aug. 16	21.30	35.48	— 0.032
Aug. 17	17.10	36.25	— 0.043
Aug. 18	17.10	37.31	— 0.049
Aug. 19	20.50	38.77	— 0.044
Aug. 20	18.50	39.56	— 0.039
Aug. 21	18.00	40.56	— 0.043
Aug. 25	19.90	44.81	— 0.040
Aug. 26	18.00	— 0 11 45.58	— 0.035

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*h. m. s.*	*s.*
Aug. 16	19.0	+ 8 07 06.05	0.000
Aug. 19	19.0	06.04	+ 0.006
Aug. 25	19.5	04.37	+ 0.010
Aug. 26	19.5	+ 8 07 04.16	+ 0.009

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*s.*
August 16, 1873:							
Salt Lake City	Labran.......	20 01 36.36	—0 11 35.43	19 50 00.93	....	.....	....
	Salt Lake City	11 15 45.09	+8 07 06.05	19 22 51.14	0 27 09.79	.....	....
Labran.......	Labran.......	20 06 45.05	—0 11 35.44	19 55 19.61	....	.....	....
	Salt Lake City	11 20 53.97	+8 07 06.05	19 28 00.02	09.59	... .	9.69
August 19, 1873:							
Salt Lake City	Labran.......	19 24 07.50	—0 11 38.71	19 12 28.79	....	.....	....
	Salt Lake City	10 38 13.11	+8 07 06.04	18 45 19.15	09.64	.....	....
Labran.......	Labran.......	19 28 30.05	—0 11 38.72	19 15 51.33	....	.....	....
	Salt Lake City	10 42 35.68	+8 07 06.04	18 49 41.72	09.61	.....	9.62
August 25, 1873:							
Salt Lake City	Labran.......	20 09 44.11	—0 11 44.81	19 57 59.30	....	.....	....
	Salt Lake City	11 23 45.25	+8 07 04.37	19 30 49.62	09.68	.....	....
Labran.......	Labran.......	20 16 45.57	—0 11 44.82	20 05 00.75	....	.....	....
	Salt Lake City	11 30 46.87	—8 07 04.37	19 37 51.24	09.51	.....	9.60
August 26, 1873:							
Salt Lake City	Labran......	20 51 41.21	—0 11 45.67	20 39 55.54	....	.....	....
	Salt Lake City	12 05 41.52	+8 07 04.16	20 12 45.68	09.86	.....	....
Labran.......	Labran.......	20 47 45.11	—0 11 45.67	20 35 59.44	....	.....	....
	Salt Lake City	12 01 45.56	+8 07 04.16	20 08 49.72	0 27 09.72	.....	9.79

Labran east of Salt Lake City.................. $0^h\ 27^m\ 09^s.675 \pm 0^s.029$.

Mean places of stars for 1873.0 *used for determination of latitude of Labran, Colorado.*

No. of pair.	No. in B. A. C.	Approximate right ascension.	Declination.	No. of pair.	No. in B. A. C.	Approximate right ascension.	Declination.
		h. m. s.	° ′ ″			h. m. s.	° ′ ″
1........	6157	18 03 19	20 47 46.2	25........	6528	21 33 05	19 41 35.0
	6184	07 46	56 14 17.4		7545	35 01	56 54 55.2
2........	6245	17 11	17 45 50.0	26........	7567	38 30	16 46 08.3
	6289	22 03	58 43 39.6	27........	7590	41 02	16 36 28.8
3........	6349	31 06	38 47 32.5		7605	43 41	60 03 13.0
4........	6355	32 38	38 40 00.1	28........	7676	57 11	52 16 13.6
	6365	35 54	38 15 01.5		7706	22 01 24	24 43 32.1
5........	6395	40 10	55 24 40.1		7733	04 30	20 21 16.4
	6438	46 51	21 16 26.2	29........	7754	07 14	56 12 30.7
6........	6496	54 36	57 38 48.7	30........	7778	10 22	56 24 38.8
	6527	59 18	18 57 13.2	31........	7798	15 27	27 41 29.8
7........	6581	19 09 26	38 55 43.7		7820	19 22	48 49 58.2
	6599	11 58	37 54 50.1	32........	7848	24 27	57 45 55.6
8........	6640	17 56	57 24 19.7		7893	32 44	18 51 56.5
	6654	19 54	19 33 04.9	33........	7937	39 17	18 41 50.2
9........	6690	25 36	27 41 39.8		7953	42 21	57 48 47.6
	6717	30 12	48 59 11.9	34........	7967	45 10	65 31 57.0
10........	6734	32 32	49 55 40.0		8003	52 50	11 03 03.3
	6762	38 43	26 49 58.6	35........	8036	58 29	49 21 43.4
11........	6780	40 46	57 42 52.3		8091	23 08 45	27 22 47.7
	6794	43 20	18 49 29.8		8115	12 00	44 47 45.4
12........	6824	47 26	52 39 56.8	36........	8156	17 33	31 49 58.6
	6835	49 07	23 59 18.8	37........	8159	18 38	31 41 15.2
13........	6856	52 21	52 06 09.4	38........	8177	21 31	5 40 54.0
	6883	56 38	24 35 01.0		8204	27 06	71 18 02.6
14........	6924	20 02 28	55 58 25.5	39........	8250	36 54	9 37 35.7
	6941	05 27	20 45 31.3		8273	41 51	67 06 04.5
15........	6967	09 47	36 25 07.1	40........	8316	49 08	52 01 39.6
16........	6969	09 55	36 21 59.7		8324	51 17	24 26 07.9
	6996	13 37	40 20 13.8		55	0 11 14	15 37 34.3
17........	7008	15 39	39 00 13.6	41........	65	13 49	61 10 27.0
	7061	22 52	38 01 27.5	42........	80	17 48	61 07 37.6
18........	7098	27 27	62 34 03.6	43........	100	21 24	43 41 30.1
	7107	29 22	14 14 14.4		120	24 41	32 52 49.3
19........	7152	33 46	29 53 28.5	44........	152	29 53	43 57 15.2
	7198	40 25	46 50 12.6	45........	166	32 33	30 09 55.6
20........	7268	51 32	46 55 54.0		189	36 27	46 19 46.3
21........	7301	55 30	47 01 33.4	46........	223	42 18	16 15 16.3
	7368	21 07 32	29 42 25.7		239	45 29	60 25 34.5
22........	7385	09 43	37 30 14.8	47........	250	48 16	22 56 24.0
	7398	12 26	38 51 48.6		290	56 47	53 31 25.5
23........	7417	15 45	58 05 12.5	48........	316	59 53	12 16 28.5
	7450	20 32	18 49 35.2		338	1 03 21	64 20 34.0
24........	7465	22 42	31 40 10.8	49........	391	12 07	57 33 46.3
	7501	21 28 32	45 17 28.5		430	1 19 31	19 24 39.9

Observations and computations for latitude.

LABRAN, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 13 ...	6295	7 66.4	21.1	22.0					
	6438	12 46.2	21.2	22.3		38 20 40.5	+ 2 29.0	—0.6	38 23 08.9
	6496	4 31.0	14.7	29.0					
	6527	13 95.7	29.0	14.9		18 08.1	+ 4 59.6	0.0	07.7
	6581	11 61.6	31.0	13.0					
	6599	7 55.4	14.0	30.0		25 14.6	— 2 06.2	+0.6	09.0
	6640	15 23.0	26.5	17.5					
	6654	4 29.8	22.0	22.0		28 49.4	— 5 39.6	+0.2	10.0
	6690	11 70.8	23.6	18.0					
	6717	6 67.2	17.5	22.5		20 33.3	+ 2 34.4	+0.2	07.9
	6734	8 49.0	20.3	19.7					
	6762	9 04.5	11.5	28.0	Cloudy.	22 56.7	+ 0 17.2	—4.4	09.5
August 16 ...	8036	10 03.0	22.0	18.5					
	8091	11 51.3	21.7	19.6		22 22.0	+ 0 46.1	+1.5	0[illegible].6
	8115	2 20.2	15.8	26.0					
	8156	10 19.3	31.0	10.9		18 58.3	+ 4 08.2	+2.7	09.2
	8159	18 62.6	32.0	9.8		14 36.6	+ 8 30.1	+3.3	10.0
	8177	3 85.4	26.0	15.8					
	8204	16 21.6	11.0	30.8		29 34.5	— 6 23.9	—2.6	08.0
	8250	10 92.9	26.8	15.2					
	8273	8 49.1	5.0	37.0		21 56.2	+ 1 18.8	—5.6	09.4
	8316	0 74.0	16.0	26.0					
	8324	18 32.6	30.8	11.4		13 59.7	+ 9 06.3	+2.6	08.6
	55	9 36 4	22.3	21.0					
	65	11 20.9	19.1	23.3		24 06.3	— 0 57.3	—0.8	08.2
	80	8 45.5	19.0	23.4		22 42.4	+ 0 28.2	—0.9	09.7
	100	5 03.6	20.8	21.7					
	120	16 54.2	13.7	28.9		17 15.1	+ 5 57.4	—4.4	08.1
	152	10 69.7	27.6	15.0		20 07.6	+ 3 01.6	—0.7	08.5
	166	17 69.3	20.4	22.0					
	189	1 82.7	23.0	19.3		14 56.2	+ 8 12.8	+0.6	09.6
	223	12 33.4	23.3	19.0					
	239	7 19.6	16.8	25.6		20 30.8	+ 2 39.6	—1.3	09.1
	250	19 53.4	29.0	13.2					
	290	1 86.7	13.0	29.3		13 59.9	+ 9 08.7	—0.1	08.5
	316	13 79.8	26.7	15.8					
	338	4 98.6	12.0	30.3		18 36.5	+ 4 33.7	—2.0	08.2
	391	16 05.0	16.0	27.0					
	430	4 09.6	31.0	12.0		38 29 18.0	— 5 11.3	+2.2	38 23 08.9

Observations and computations—Continued.

LABRAN, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
August 17 ...	6157	2 56.5	22.6	19.1					
	6184	18 03.6	16.0	26.2		38 31 09.7	— 8 00.5	—1.8	38 23 07.4
	6218	14 02.6	19.3	23.0					
	6235	6 53.2	23.3	19.2		27 01.2	— 3 52.8	+0.1	08.5
	6245	17 62.7	25.0	17.5					
	6289	1 65.4	17.8	26.0		14 52.6	+ 8 16.1	—0.2	08.5
	6349	17 25.1	20.4	23.8		31 25.7	— 8 16.6	—0.3	08.8
	6355	9 96.0	20.9	23.7		27 39.5	— 4 30.0	— 0.2	09.3
	6365	1 26.4	23.3	21.1					
	6395	8 07.2	23.0	21.9					
	6438	12 86.8	20.4	24.9		20 41.2	+ 2 29.0	—0.9	09.3
	6496	5 02.9	12.6	32.9					
	6527	14 65.2	33.2	12.0		18 08.9	+ 4 58.9	+0.3	08.1
	6581	11 44.4	14.4	31.2					
	6599	7 34.4	32.2	13.2		25 15.5	— 2 07.4	+0.6	08.7
	6640	14 81.2	21.3	24.3					
	6654	3 85.2	21.6	24.0		28 50.3	— 5 40.4	—1.5	08.4
	6690	11 83.7	21.5	24.0					
	6717	6 79.2	21.4	24.3		20 34.2	+ 2 36.7	—1.5	09.4
	6730	8 65.7	18.5	27.7					
	6762	9 01.6	27.9	18.4		22 57.7	+ 0 11.1	+0.1	08.9
	6780	2 79.7	20.0	26.4					
	6794	16 08.7	23.0	23.5		16 19.0	+ 6 52.8	—1.9	09.9
	6824	6 96.0	19.3	27.0					
	6835	13 52.1	25.8	20.6		19 46.0	+ 3 23.8	—0.7	09.1
	6856	7 35.6	16.3	30.0					
	6883	12 06.0	29.2	17.2		20 44.1	+ 2 26.1	—0.5	09.7
	6924	9 67.3	22.7	24.2					
	6941	11 68.6	23.2	23.7		22 06.4	+ 1 02.5	—0.6	08.3
	6967	9 58.9	22.4	24.3		22 48.8	+ 0 19.8	+1.5	10.1
	6969	12 60.8	22.4	24.3		21 15.1	+ 1 53.5	+1.5	10.1
	6996	8 95.2	27.0	19.7					
	7008	17 35.0	16.9	30.2					
	7061	2 28.9	27.0	19.7		30 59.0	— 7 47.8	—1.7	09.5
	7098	10 36.0	15.5	31.6					
	7107	8 21.3	29.5	17.4		24 16.6	— 1 06.7	—1.1	08.8
	7152	11 12.8	21.5	25.7					
	7198	8 80.7	20.1	26.9		21 58.7	+ 2 12.1	—3.0	07.8
	7268	6 00.9	21.8	26.3		19 17.9	+ 3 54.8	—4.4	08.3
	7301	11 49.2	23.5	24.6		38 22 07.6	+ 1 04.5	—3.5	38 23 08.6
	7368	13 57.0	18.3	29.8					

Observations and computations—Continued.

LABRAN, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 17 ...	7385	20 76.4	26.0	22.0					
	7398	— 2 51.4	13.2	34.7		38 11 09.7	+12 03.3	—4.8	38 23 08.2
	7417	13 57.4	6.6	41.4					
	7450	5 25.2	33.6	14.0		27 31.5	— 4 18.5	—4.2	08.8
	7465	3 59.8	21.6	26.0					
	7501	14 67.5	18.0	29.7		28 57.5	— 5 44.1	—4.4	19.0
	7528	14 12.0	26.0	22.0					
	7545	4 73.5	11.6	36.3		18 22.6	+ 4 51.5	—5.7	08.4
	7567	4 90.1	18.9	29.0		26 18.0	— 3 05.5	—2.8	09.7
	7590	14 19.3	18.9	29.0		21 28.3	+ 1 43.1	—2.8	08.6
	7605	10 87.4	24.0	24.0					
	7676	16 31.7	13.8	34.3					
	7706	3 19.9	26.9	21.0		30 00.3	— 6 47.5	—4.0	08.8
	7733	13 14.2	27.0	20.9					
	7754	1 13.9	17.0	31.0		17 00.8	+ 6 12.8	—4.3	09.3
	7778	12 88.1	17.0	31.0		23 04.8	+ 0 08.1	—4.3	08.6
	7798	16 83.6	23.0	25.2					
	7820	2 62.1	16.9	31.5		15 51.3	+ 7 21.5	—4.6	08.2
	7848	5 27.1	16.7	31.8					
	7893	13 38.3	21.0	27.7		19 03.2	+ 4 12.0	—6.0	09.2
	7937	17 48.0	26.6	22.0					
	7953	2 45.6	15.8	33.0		15 25.8	+ 7 46.6	—3.5	08.9
	7967	5 03.7	19.0	29.8					
	8003	15 75.1	31.0	18.0		17 37.0	+ 5 32.8	+0.6	10.4
	8036	8 95.0	16.0	33.0					
	8091	10 45.0	34.3	15.1		22 22.3	+ 0 46.6	+0.6	09.5
	8115	1 68.1	20.4	29.6					
	8156	9 73.9	29.0	21.0		18 58.6	+ 4 10.3	—0.3	08.6
	8159	18 17.8	29.3	20.7		14 36.9	+ 8 32.4	—0.2	09.1
	8177	3 05.9	25.3	24.7					
	8204	15 42.5	18.7	30.8		29 34.7	— 6 24.1	—3.2	07.4
	8250	10 25.9	28.8	20.3					
	8273	7 81.6	13.0	36.0		21 56.5	+ 1 15.9	—4.0	08.4
	8316	— 0 01.7	13.0	36.0					
	8324	17 75.9	28.7	20.2		14 00.0	+ 9 12.1	—4.0	08.1
August 18 ...	6245	18 21.6	17.4	27.4					
	6289	2 09.6	19.0	26.2		14 52.6	+ 8 20.7	—4.7	08.6
	6349	17 52.8	20.0	25.6		31 25.9	— 8 13.8	—4.1	08.0
	6355	10 24.9	19.8	26.0		38 27 39.7	— 4 27.7	—4.2	38 23 07.8
	6365	1 63.0	18.3	27.5					

Observations and computations—Continued.

LABRAN, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 18 ...	6395	8 53.4	21.0	24.8					
	6438	13 14.6	33.2	12.3		38 20 41.5	+ 2 23.2	+4.7	38 23 09.4
	6496	5 05.0	22.9	23.0					
	6527	14 56.7	29.4	16.0		18 09.1	+ 4 55.6	+3.7	08.4
	6581	11 60.0	17.0	27.8					
	6599	7 45.2	32.0	12.3		25 15.7	− 2 08.8	+2.5	09.4
	6640	15 92.2	25.6	18.9					
	6654	4 94.0	19.0	25.2		28 50.5	− 5 41.1	+0.1	09.5
	6690	12 38.9	29.8	14.7					
	6717	7 37.9	13.7	30.8		20 34.5	+ 2 35.6	−0.6	09.5
	6734	8 74.1	19.0	25.5					
	6762	9 09.7	26.0	18.0		22 57.9	+ 0 11.1	+0.4	09.4
	6780	3 00.0	23.0	21.2					
	6794	16 21.2	21.0	23.2		16 19.1	+ 6 50.4	−0.1	09.4
	6824	7 67.1	26.7	17.9					
	6835	14 25.8	14.8	29.8		19 46.3	+ 3 24.6	−1.7	09.2
	6856	7 70.4	21.5	23.2					
	6883	12 42.8	20.4	24.6		20 43.7	+ 2 26.7	−1.6	08.8
	6924	8 41.0	19.0	25.9					
	6941	10 36.0	28.5	16.4		22 06.6	+ 1 00.6	+1.4	08.6
	6967	9 88.4	28.7	16.3		22 49.1	+ 0 21.3	−3.0	07.4
	6969	12 92.8	28.7	16.3		21 15.4	+ 1 55.8	−3.0	08.2
	6996	9 20.0	11.0	34.4					
	7008	18 38.8	19.5	26.0					
	7061	3 23.0	32.0	11.4		30 59.2	− 7 50.7	−0.4	08.1
	7098	10 29.7	16.2	27.0					
	7107	8 10.7	26.4	17.0		24 16.9	− 1 08.0	−0.4	08.5
	7152	11 34.7	21.0	22.0					
	7198	9 03.0	20.3	23.0		21 58.9	+ 1 12.0	−1.0	09.9
	7268	6 00.5	16.4	27.9		19 18.2	+ 3 51.6	−0.4	09.4
	7301	11 47.0	16.1	28.3		22 07.9	+ 1 01.8	−0.6	09.1
	7368	13 46.1	26.9	17.0					
	7385	21 34.1	29.0	15.3					
	7398	− 1 83.5	16.0	28.4		11 10.0	+11 59.8	+0.4	10.2
	7417	14 60.7	15.5	29.0					
	7450	6 19.1	25.0	19.0		27 31.8	− 4 21.4	−2.1	08.3
	7465	3 97.0	18.9	25.3					
	7501	15 22.9	26.5	17.8		38 28 57.7	− 5 49.7	+0.6	38 23 08.6

Observations and computations—Continued.

LABRAN, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 18 ...	7528	14 61.3	20.8	23.8					
	7545	5 37.2	21.0	23.4		38 18 22.9	+ 4 47.0	—1.5	38 23 08.4
	7567	5 45.4	18.8	26.0		26 18.3	— 3 03.8	—0.9	08.6
	7590	14 75.7	19.0	26.0		21 28.6	+ 1 40.2	—0.9	07.9
	7605	11 53.1	24.7	21.0					
	7676	17 08.8	15.3	30.9					
	7706	3 88.8	27.0	19.0		30 00.6	— 6 50.0	—2.1	08.5
	7733	14 16.4	25.8	20.0					
	7754	2 29.7	18.2	27.8		17 01.1	+ 6 08.6	—1.1	08.6
	7778	14 02.4	17.9	28.2		23 05.2	+ 0 04.3	—1.2	08.3
	7798	17 44.1	28.6	17.8					
	7820	3 31.2	15.4	31.0		15 51.6	+ 7 18.8	—1.3	09.1
	7848	6 18.2	19.0	27.9					
	7893	14 16.5	23.8	22.9		19 03.5	+ 4 08.0	—2.2	09.3
	7937	18 06.7	31.4	14.0					
	7953	3 15.0	15.3	30.9		15 26.1	+ 7 43.3	+0.3	09.7
	7967	5 37.1	25.4	20.8					
	8003	16 23.5	11.0	35.0		17 37.4	+ 5 37.4	—5.3	09.5
	8036	9 87.5	12.8	33.7					
	8091	11 44.2	31.0	15.6		22 22.6	+ 0 48.7	—1.5	09.8
	8115	2 23.7	13.0	33.6					
	8156	10 37.0	29.0	18.0		18 58.9	+ 4 12.6	—2.6	08.9
	8159	18 79.0	29.0	18.0		14 37.3	+ 8 34.1	—2.6	08.8
	8177	4 16.4	26.0	21.6					
	8204	16 40.8	14.3	32.3		29 33.0	— 6 20.3	—3.9	08.8
	8250	11 20.1	22.9	25.2					
	8273	8 69.4	15.7	32.0		21 56.7	+ 1 17.9	—5.1	09.5
	55	9 61.3	18.2	30.0					
	65	11 47.0	29.2	19.0		24 06.9	— 0 57.7	—0.4	08.8
	80	8 71.2	29.9	18.9		22 42.1	+ 0 28.0	—0.2	09.9
	100	4 90.7	24.9	24.0		17 15.7	+ 5 55.8	—2.6	08.9
	120	16 36.1	19.3	29.8					
	152	10 48.3	24.8	24.0		20 08.2	+ 3 02.6	—2.6	08.2
	223	12 66.5	29.8	18.3					
	239	7 56.6	13.8	34.3		20 32.3	+ 2 38.4	—2.6	08.1
	250	19 75.6	21.7	26.3					
	290	2 06.0	21.9	26.0		19 00.4	+ 9 09.7	—2.4	07.7
	316	14 61.2	25.8	23.2					
	338	5 79.6	27.9	21.8		38 18 37.0	+ 4 33.8	—1.0	38 23 09.8

Observations and computations—Continued.

LABRAN, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 18 ...	391	16 41.0	23.4	26.4					
	430	4 59.3	22.2	27.9		38 29 18.5	− 6 07.0	−2.4	38 23 09.1
August 20 ...	7268	6 02.9	23.0	21.6		19 18.8	+ 3 51.7	−1.6	08.9
	7301	11 49.2	23.0	21.6		22 08.5	+ 1 02.0	−1.6	08.9
	7368	13 49.0	18.9	26.0					
	7385	21 33.6	23.3	21.8					
	7398	− 1 81.0	21.3	24.0		11 10.6	+11 58.9	−0.3	09.2
	7417	13 60.0	14.0	31.2					
	7450	5 13.5	29.0	16.7		27 32.3	− 4 22.9	−1.3	08.1
	7465	3 86.3	23.9	21.9					
	7501	15 07.4	18.0	27.9		28 58.3	− 5 48.2	−2.2	07.9
	7528	13 57.5	23.3	22.7					
	7545	4 37.9	23.5	22.6		16 23.4	+ 4 45.6	+0.4	09.4
	7567	4 74.1	23.3	22.9		26 18.8	− 3 10.5	+1.3	09.6
	7590	14 03.9	22.8	23.2		21 29.1	+ 1 38.3	+1.1	08.5
	7605	10 87.3	25.2	21.0					
	7676	16 68.2	26.7	20.2					
	7706	3 41.2	18.4	28.0		30 01.2	− 6 52.1	−0.9	08.2
	7733	13 41.2	26.2	20.3					
	7754	1 49.6	15.6	31.1		17 01.7	+ 6 10.1	−2.6	09.2
	7778	13 22.6	15.8	31.2		23 05.7	+ 0 05.8	−2.6	08.9
	7848	5 52.0	19.0	24.4					
	7893	13 43.0	22.0	21.9		19 04.1	+ 4 05.7	−1.5	08.3
	8115	2 12.0	16.0	27.9					
	8156	10 12.1	29.6	14.3		18 59.5	+ 4 08.5	+0.9	08.9
	8159	18 57.5	29.8	14.0		14 37.8	+ 8 31.1	+1.1	10.0
	8250	10 92.0	25.0	20.0					
	8273	8 67.0	24.0	21.0		21 57.2	+ 1 09.9	+2.2	09.3
	8316	0 19.0	15.0	29.8					
	8324	17 80.2	29.8	15.0		14 00.8	+ 9 07.0	0.0	07.8
August 26 ...	6496	4 58.5	26.0	22.0					
	6527	14 11.4	23.8	23.9		18 10.5	+ 4 56.0	+1.1	07.6
	7301	11 90.8	15.4	18.0					
	7368	13 71.0	26.0	7.2		22 09.8	+ 0 56.0	+4.4	10.2
	7385	21 50.5	21.0	12.0					
	7398	− 1 37.6	23.7	9.5		11 12.2	+11 50.7	+6.4	09.3
	7465	3 55.1	21.8	12.0					
	7501	15 11.7	25.2	9.6		38 29 00.0	− 5 59.2	+7.0	38 23 07.8

Observations and computations—Continued.

LABRAN, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 26 ...	7528	14 05.2	23.3	11.5					
	7545	4 89.0	10.0	24.6		38 18 25.1	+ 4 41.6	—0.8	38 23 08.9
	7567	4 61.9	20.0	14.7					
	7590	13 89.8	20.0	14.7		26 20.5	— 3 10.1	—1.0	09.4
	7605	10 74.0	13.0	21.8		21 30.7	+ 1 38.1	—1.0	07.8
	7676	16 68.2	26.7	20.2					
	7706	3 41.2	18.4	28.0		30 02.9	— 6 52.2	—0.9	09.8
	7733	13 79.8	22.9	11.9					
	7754	1 98.0	11.2	23.5		17 03.4	+ 6 07.1	—0.4	10.1
	7778	13 71.2	11.4	23.3		23 07.4	+ 0 02.7	—0.3	09.8
	7798	17 47.4	17.9	17.0					
	7820	3 54.9	21.8	13.0		15 53.9	+ 7 12.5	+2.7	09.1
	7848	5 76.7	16.8	18.0					
	7893	13 65.5	15.9	19.0		19 05.8	+ 4 05.0	—1.2	09.6
	7937	17 89.2	16.4	18.9					
	7953	3 12.0	21.2	13.9		15 28.9	+ 7 38.8	+1.3	09.0
	7967	5 52.3	17.3	17.9					
	8003	16 19.0	15.0	20.3		17 39.5	+ 5 31.3	—1.6	09.2
	8036	9 69.6	10.5	25.0					
	8091	11 05.6	29.7	6.0		22 24.9	+ 0 42.2	+2.5	09.6
	8115	2 44.1	16.5	19.0					
	8156	10 43.7	18.3	17.5		19 01.3	+ 4 08.4	—0.5	09.2
	8159	18 88.9	18.0	18.0		14 39.6	+ 8 30.9	—0.7	09.8
	8177	3 88.6	18.7	17.4					
	8204	16 31.4	15.0	21.5		29 37.0	— 6 26.0	—1.4	09.6
	8250	10 99.2	21.0	16.3					
	8273	8 69.4	15.0	23.0		21 58.8	+ 1 11.8	—0.9	09.7
	55	9 05.9	21.9	15.8					
	65	10 93.9	11.0	26.4		24 09.0	— 0 58.4	—2.5	08.1
	80	8 19.3	12.0	25.4		22 44.2	+ 0 26.9	—2.0	09.1
	100	4 86.8	13.9	23.3					
	120	16 14.8	25.8	11.6		17 17.9	+ 5 50.4	+1.3	09.6
	166	17 73.5	21.4	16.1					
	189	1 90.2	13.0	24.6		14 58.9	+ 8 11.8	—1.7	09.0
	223	12 54.3	13.0	24.6					
	239	7 49.9	21.3	16.0		20 33.3	+ 2 36.7	—1.7	08.3
	250	19 45.7	18.0	20.3					
	290	1 88.0	22.0	16.6		14 02.4	+ 9 05.9	+0.9	09.2
	316	14 22.5	22.3	16.0					
	338	5 44.0	10.8	27.8		38 18 38.9	+ 4 32.9	—2.9	38 23 08.9

Observations and computations—Continued.

LABRAN, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
		t. d.	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
1873. August 26 ...	391	16 46.6	14.6	24.4					
	430	4 55.6	21.9	17.0		38 29 20.4	— 6 09.9	—1.4	38 23 09.1

The mean of all results is: 38° 23′ 08″.97 ± 0″.03.

The probable error of one observation is derived from all observations taken two or more times on one pair, and is found to be ± 0″.35; therefore the probable error of the mean result will be ± 0″.03.

ASTRONOMICAL CO-ORDINATES OF LABRAN, COLORADO.

The astronomical co-ordinates resulting from these observations are:—

Longitude.. $7^h\ 00^m\ 25^s.185$ or 105° 06′ 17″ 78 ± 0″.44 west from Greenwich.
Longitude.. $1^h\ 52^m\ 13^s.065$ or 28° 03′ 15″.98 ± 0″.43 west from U. S. Naval Observatory, Washington, D. C.
Latitude ... 38° 23′ 08″.97 ± 0″.03 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF TRINIDAD, COLORADO.

SEASON OF 1873.

COMPUTATIONS BY

Dr. F. KAMPF and JOHN H. CLARK.

TRINIDAD, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . 104° 30′ 01″.42 ± 0″.30 west from Greenwich.
Latitude, . . . 37° 10′ 46″.53 ± 0″.02 north.
Barometric altitude of observatory above sea-level, 5989.9 feet.

Trinidad is in a large valley which is drained by Purgatory Creek, a small stream flowing to the east, in which direction the valley is open. On the north and south are high mountains, the most prominent of which is Fisher's Peak, the west corner of whose summit is 201° 24′ from the true north, determined at the astronomical station. The town has its greatest extension from east to west. It is a settlement of about 1,200 inhabitants, the majority of whom are Mexicans.

The astronomical station is situated on a hill near the surveyed line of the railroad, at the northeast corner of the township in which Trinidad lies, and about two-thirds of a mile distant from the village.

METEOROLOGICAL CONDITIONS.

The following is a tabulated display of the meteorological circumstances that affected the occupation of this station:

Date.	General direction of wind.			General condition of atmosphere.
	12 p. m. to 8 a. m.	8 a. m. to 4 p. m.	4 p. m. to 12 p. m.	
1873.				
Sept. 3	....	N. W.	N. W.	Clear; heavy wind.
4	N. W.	N. E. and S. W.	S. W.	Exceedingly warm.
5	W.	N. E.	N. E. and S. E.	Rain in the afternoon and at 11 p. m.
6	N. E.	N. E.	Changeable.	Rainy the whole day.
7	S. E.	S. W.	S. W.	Rainy at night.
8	S. W.	S. W.	N. W.	Rain at 6.35 p. m.
9	S. W.	S. E.	N. W.	Clear; heavy wind.
10	S. W.	S. W.	S. W. and W.	5.40 p. m. rain and lightning; violent wind.
11	S. W.	N. W. and N.	N. E. and N. W.	Rain at 4 p. m.
12	S. W.	N.	W.	Rain at 5 p. m.
13	S. W.	S. W.	S. W.	Rain at 1.50 p. m. and 5.30 p. m
14	S. W.	S. W.	S. W.	Clear; heavy wind
15	S. W.	N. E.	N.	Cloudy at night.
16	S. W.	S. W.	S. W.	Clear.
17	S. W.	Changeable.	S. W.	Clear; heavy wind.
18	N. E.	N. E.	W. and S. W.	Partly cloudy.
19	S. W.	S. W.	S. W.	Partly cloudy.
20	S. W.	....	....	Clear.

OBSERVATORY.—INSTRUMENTS.—INSTRUMENTAL VALUES.

These are sufficiently described in the report on Colorado Springs, date of 1874, at which station they were similar.

The wire of the Western Union Telegraph Company passes directly over the monument, and was conducted into the tent by means of a loop. When this station was first occupied there was no operator at the office in Trinidad. Letters were at once dispatched to Denver and Pueblo, asking that this vacancy might be filled, but without success, as there were no men to spare. Finally an operator was obtained from Las Animas. He arrived on the 10th of September, but finding the line out of order, he had to go to repair it. This is the reason why earlier exchange was not made with Salt Lake City. Even during the time of exchanges the line was in very bad condition and would not transmit signals when the weather was rainy.

Five exchanges were made: on the 13th, 15th, 16th, 17th and 18th of September. The signals sent and received on the first two of these dates were repeated at Cheyenne and Denver; on the last three days only at Cheyenne. The length of circuit by way of Ogden, at which point there was no repeater, was 875 miles.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

John H. Clark was observer at the connected station, Salt Lake City, and Dr. F. Kampf at Trinidad. Each astronomer reduced his own notes. At Salt Lake City the weather was favorable, being cloudy but one night out of the five which were devoted to exchanges. Observations for latitude were made September 4, 5, 9, 10, 11 and 12.

Tabulation of stars used for determination of time at Trinidad, Colorado, and Salt Lake City, Utah, 1873.

Name of star.	TRINIDAD, COLORADO.						SALT LAKE CITY, UTAH				
	September 13.	September 14.	September 15.	September 16.	September 17.	September 18.	September 13.	September 15.	September 16.	September 17.	September 19.
β Lyræ	......	......	......	......	......	......	......	......	......	×	......
50 Draconis	......	......	......	......	......	......	......	......	......	×	×
ε Aquilæ	......	......	......	......	......	......	......	......	×	......	......
ζ Aquilæ	......	......	......	......	......	......	......	......	×	×	×
π Sagittarii	......	......	......	......	......	......	......	......	......	×	×
δ Draconis	......	......	......	......	......	......	......	×	×	×	×
δ Aquilæ	......	......	......	......	......	......	......	×	×	×	×
α Vulpeculæ	......	......	......	......	......	......	......	×	×	×	×
μ Aquilæ	......	......	......	......	......	......	......	......	×	×	×
κ Aquilæ	......	......	×	......	×	......	......	......	......	×	......
θ Cygni	......	......	×	......	×	×	......	......	×	×	×
γ Aquilæ	......	......	×	......	×	×	......	......	×	......	×
α Aquilæ	......	......	×	......	×	×	......	......	×	......	×
ε Draconis	......	......	×	......	......	×	......	......	......	......	......
β Aquilæ	......	......	......	......	......	......	......	......	......	......	×
τ Aquilæ	......	......	×	......	×	×	......	......	......	......	......
θ Aquilæ	......	×	×	......	×	×	......	......	×	......	......
31 o^1 Cygni	......	×	×	......	......	×	......	......	......	......	......
α^2 Capricorni	......	......	......	......	......	......	×	......	×	......	......
κ Cephei	......	×	......	......	×	......	......	......	......	......	......
β Capricorni	......	......	......	......	......	......	×	......	×	×	......
γ Cygni	......	×	......	......	......	......	......	......	......	......	......
π Capricorni	......	......	......	......	......	......	×	......	×	×	......
ω^1 Cygni	......	......	......	......	......	......	×	......	......	×	......
ε Delphini	......	×	......	......	......	......	×	......	×	×	......
Groombr. 3241	......	×	......	......	......	......	......	......	......	......	......
α Cygni	......	......	......	......	......	......	×	×	×	×	......
γ Delphini	......	......	......	×	×	......	......	......	......	......	......
ε Aquarii	......	......	......	......	......	......	×	......	×	×	......
ε Cygni	......	×	......	......	......	......	......	......	......	......	......
η Cephei	......	×	......	......	......	......	......	......	......	......	......
μ Aquarii	......	......	......	×	×	......	×	......	×	×	......
ν Cygni	......	×	......	×	×	......	×	......	×	×	......
12-year Catalogue, 1879	......	......	......	......	......	......	......	×	......	......	......
ξ Cygni	......	......	×	......	......	......	......	......	......	......	......
61 Cygni	......	×	......	×	×	......	×	×	......	×	......
ζ Cygni	×	×	×	×	×	×	......	×	......	×	......
τ Cygni	×	×	×	×	×	×	......	......	......	......	......
α Cephei	......	......	×	×	×	×	......	......	......	......	......
1 Pegasi	......	......	......	......	......	......	......	×	......	......	......
β Aquarii	×	......	×	......	......	......	......	×	......	......	......
β Cephei	......	......	×	×	×	×	......	......	......	......	......
ξ Aquarii	×	......	......	......	......	×	......	×	......	......	......
ε Pegasi	......	......	×	×	......	×	......	×	......	......	......
11 Cephei	......	......	×	×	......	×	......	......	......	......	......
μ Capricorni	......	......	×	......	......	......	......	......	......	......	......
16 Pegasi	×	......	......	×	......	......	......	......	......	......	......
79 Draconis	......	......	×	×	......	......	......	......	......	......	......
20 Pegasi	×	......	......	×	......	......	......	......	......	......	......
α Aquarii	......	......	×	×	......	......	......	......	......	......	......
20 Cephei	×	......	......	......	......	......	......	......	......	......	......
π^1 Pegasi	......	......	......	×	......	......	......	......	......	......	......
π^2 Pegasi	......	......	×	×	......	......	......	......	......	......	......

Tabulation of stars, &c.—Continued.

Name of star.	TRINIDAD, COLORADO.						SALT LAKE CITY, UTAH.				
	September 13.	September 14.	September 15.	September 16.	September 17.	September 18.	September 13.	September 15.	September 16.	September 17.	September 19.
ζ Cephei	......	......	×	......	......	......	......	......	......	......	......
24 Cephei	×	......	......	......	......	......	......	......	......	......	......
θ Aquarii	×	......	×	......	......	......	......	......	......	......	......
31 Pegasi	×	......	......	......	......	......	......	......	......	......	......
3 Lacertæ	×	......	......	......	......	......	......	......	......	......	......
ζ Pegasi	×	......	......	......	......	......	......	......	......	......	......

Observations and reductions for time taken at sending station.

TRINIDAD, COLORADO, SEPTEMBER 13, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	ζ Cygni	21 18 05.40	— 0.06	+ 0.19	— 0.02	21 18 05.51	21 07 34.05	— 10 31.46
W.	τ Cygni	20 16.67	0.00	+ 0.20	— 0.02	20 16.85	09 45.51	31.34
W.	β Aquarii	35 26.59	— 0.27	+ 0.15	— 0.02	35 26.45	24 54.91	31.54
W.	ξ Aquarii	41 33.73	— 0.28	+ 0.16	— 0.02	41 33.59	31 02.00	31.59
W.	16 Pegasi	57 50.63	— 0.09	+ 0.22	— 0.02	57 50.74	47 19.38	31.36
E.	20 Pegasi	22 05 28.00	— 0.17	+ 0.10	+ 0.02	22 05 27.95	54 56.62	31.33
E.	20 Cephei	11 42.35	+ 0.35	+ 0.21	+ 0.04	11 42.95	22 01 11.36	31.59
E.	24 Cephei	17 55.16	+ 0.71	+ 0.29	+ 0.06	17 56.22	07 24.82	31.40
E	θ Aquarii	20 42.18	— 0.28	+ 0.07	+ 0.02	20 41.99	10 10.56	31.43
E.	31 Pegasi	25 49.97	— 0.17	+ 0.08	+ 0.02	25 49.90	15 18.49	31.41
E	3 Lacertæ	29 07.74	+ 0.16	+ 0.14	+ 0.03	29 08.07	18 36.00	31.47
E.	ζ Pegasi	22 45 41.66	— 0.18	+ 0.09	+ 0.02	22 45 41.59	22 35 10.17	— 10 31.42
	Mean at $22^h\ 00^m$ local sidereal time							— 10 31.44

NORMAL EQUATIONS.

$$0 = -0.49 + 12.00\,\delta t + 0.72\,a + 5.48\,c \qquad \delta t = +0^s.06$$
$$0 = +2.64 + 0.72\,\delta t + 6.42\,a - 8.09\,c \qquad a = -0^s.39$$
$$0 = -4.02 + 5.48\,\delta t - 8.09\,a + 28.26\,c \qquad c = +0^s.02$$

Observations and reductions for time taken at sending station—Continued.

TRINIDAD, COLORADO, SEPTEMBER 14, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	θ Aquilæ	20 15 19.36	+ 0.13	— 0.02	+ 0.02	20 15 19.49	20 04 47.31	— 10 32.18
W.	31 o¹ Cygni	21 12.01	— 0.05	— 0.02	+ 0.03	21 11.97	09 39.74	32.23
W.	κ Cephei	23 42.03	— 0.63	— 0.04	+ 0.08	23 41.44	13 09.26	32.18
W.	γ Cygni	28 14.26	— 0.02	— 0.01	+ 0.03	28 14.26	17 42.12	32.14
W.	ε Delphini	37 42.97	+ 0.10	0.00	+ 0.02	37 43.09	27 10.86	32.23
W.	Groombr. 3241	41 06.78	— 0.40	+ 0.04	— 0.06	41 06.36	30 34.30	32.06
E.	ε Cygni	51 38.79	+ 0.01	— 0.16	— 0.02	51 38.62	41 06.48	32.14
E.	η Cephei	53 16.80	— 0.18	— 0.23	— 0.04	53 16.35	42 44.25	32.10
E.	ν Cygni	21 03 00.80	— 0.02	— 0.15	— 0.03	21 03 00.60	52 28.37	32.23
E.	61 Cygni	11 47.07	0.00	— 0.16	— 0.02	11 46.89	21 01 14.71	32.18
E.	ζ Cygni	18 06.35	+ 0.03	— 0.17	— 0.02	18 06.19	07 34.04	32.15
E.	τ Cygni	21 20 17.92	0.00	— 0.20	— 0.03	21 20 17.69	21 09 45.49	— 10 32.20
	Mean at $21^h\ 00^m$ local sidereal time							— 10 32.17

NORMAL EQUATIONS.

$$0 = +0.69 + 12.00\,\delta t - 4.76\,a - 4.28\,c \qquad dt = +0^s.03$$
$$0 = -2.42 - 4.76\,\delta t + 13.41\,a + 17.01\,c \qquad a = +0^s.22$$
$$0 = -2.47 - 4.28\,\delta t + 17.01\,a + 49.14\,c \qquad c = -0^s.02$$

TRINIDAD, COLORADO, SEPTEMBER 15, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	κ Aquilæ	19 40 38.22	+ 0.20	+ 0.05	— 0.01	19 40 38.46	19 30 05.61	— 10 32.85
E.	θ Cygni	43 36.50	— 0.10	+ 0.09	— 0.01	43 36.48	33 03.60	32.88
E.	γ Aquilæ	50 47.94	+ 0.13	+ 0.04	— 0.01	50 48.10	40 15.26	32.84
E.	α Aquilæ	55 09.90	+ 0.13	+ 0.02	— 0.01	55 10.04	44 37.21	32.83
E.	ε Draconis	59 10.29	— 0.46	0.00	— 0.02	59 09.81	48 36.88	32.93
W.	τ Aquilæ	20 08 30.90	+ 0.15	+ 0.13	+ 0.01	20 08 31.19	57 58.22	32.97
W.	θ Aquilæ	15 20.02	+ 0.18	+ 0.09	+ 0.01	15 20.30	20 04 47.30	33.00
W.	31 o¹ Cygni	20 20 12.42	— 0.06	+ 0.16	+ 0.02	20 20 12.54	20 09 39.72	— 10 32.82
	Mean at $19^h\ 30^m$ local sidereal time							— 10 32.89

NORMAL EQUATIONS

$$0 = +0.57 + 8.00\,\delta t + 0.63\,a + 4.08\,c \qquad \delta t = -0^s.09$$
$$0 = -1.20 + 0.63\,\delta t + 4.25\,a - 4.30\,c \qquad a = +0^s.29$$
$$0 = +1.67 + 4.08\,\delta t - 4.30\,a + 18.13\,c \qquad c = -0^s.01$$

Observations and reductions for time taken at sending station—Continued.

TRINIDAD, COLORADO, SEPTEMBER 15, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	ξ Cygni	21 10 53.94	— 0.04	— 0.07	— 0.05	21 10 53.78	21 00 20.78	— 10 33.00
W.	ζ Cygni	18 07.14	+ 0.04	— 0.07	— 0.04	18 07.07	07 34.03	33.04
W.	τ Cygni	20 18.55	0.00	— 0.07	— 0.04	20 18.44	09 45.47	32.97
W.	α Cephei	26 08.45	— 0.25	— 0.13	— 0.07	26 08.00	15 35.07	32.93
W.	β Aquarii	35 27.94	+ 0.20	— 0.01	— 0.03	35 28.10	24 54.90	33.20
W.	β Cephei	37 37.00	— 0.45	0.00	— 0.10	37 36.45	27 03.29	33.16
E.	ε Pegasi	48 32.43	+ 0.14	— 0.19	+ 0.03	48 32.41	37 59.34	33.07
E.	11 Cephei	50 39.93	— 0.48	— 0.56	+ 0.10	50 38.99	40 06.00	32.99
E.	μ Capricorni	56 58.08	+ 0.23	— 0.16	+ 0.03	56 58.18	46 24.99	33.19
E.	79 Draconis	22 01 54.56	— 0.57	— 0.70	+ 0.11	22 01 53.40	51 20.17	33.23
E.	α Aquarii	09 51.30	+ 0.18	— 0.20	+ 0.03	09 51.31	59 18.20	33.11
E.	π^2 Pegasi	14 56.52	+ 0.03	— 0.31	+ 0.04	14 56.28	22 04 23.25	33.03
E.	ζ Cephei	17 03.24	— 0.18	— 0.49	+ 0.06	17 02.63	06 29.46	33.17
E.	θ Aquarii	22 20 43.61	+ 0.17	— 0.23	+ 0.03	22 20 43.58	22 10 10.56	— 10 33.02
	Mean at $21^h 30^m$ local sidereal time							— 10 33.08

NORMAL EQUATIONS.

$0 = + 1.97 + 14.00\,\delta t - 3.53\,a + 3.73\,c$ $\qquad \delta t = - 0^s.08$

$0 = - 3.80 - 3.53\,\delta t + 12.79\,a - 4.70\,c$ $\qquad a = + 0^s.28$

$0 = + 0.75 + 3.73\,\delta t - 4.70\,a + 48.92\,c$ $\qquad c = + 0^s.03$

TRINIDAD, COLORADO, SEPTEMBER 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	γ Delphini	20 51 21.61	+ 0.10	— 0.08	+ 0.06	20 51 21.69	20 40 48.01	— 10 33.68
E.	μ Aquarii	56 24.03	+ 0.19	— 0.04	+ 0.06	56 24.24	45 50.59	33.65
E.	ν Cygni	21 03 02.01	— 0.02	— 0.05	+ 0.08	21 03 02.02	52 28.34	33.68
E.	61^1 Cygni	11 48.37	— 0.01	— 0.06	+ 0.07	11 48.37	21 01 14.68	33.69
E.	ζ Cygni	18 07.59	+ 0.03	— 0.07	+ 0.07	18 07.62	07 34.02	33.60
E.	τ Cygni	20 19.11	0.00	— 0.11	+ 0.07	20 19.07	09 45.47	33.60
E.	α Cephei	26 08.96	— 0.23	— 0.14	+ 0.12	26 08.71	15 35.05	33.66
E.	β Cephei	37 37.47	— 0.40	— 0.17	+ 0.17	37 37.07	27 03.26	33.81
W.	ε Pegasi	48 33.00	+ 0.12	0.00	— 0.06	48 33.06	37 59.34	33.72
W.	11 Cephei	50 40.17	— 0.43	0.00	— 0.17	50 39.57	40 05.98	33.59
W.	16 Pegasi	57 53.05	+ 0.06	+ 0.01	— 0.06	57 53.06	47 19.36	33.70
W.	79 Draconis	22 01 54.50	— 0.52	+ 0.06	— 0.20	22 01 53.84	51 20.14	33.70
W.	20 Pegasi	05 30.13	+ 0.11	+ 0.03	— 0.06	05 30.21	54 56.61	33.60
W.	α Aquarii	09 51.84	+ 0.16	+ 0.03	— 0.05	09 51.98	59 18.19	33.79
W.	27 π^1 Pegasi	14 12.13	+ 0.02	+ 0.08	— 0.07	14 12.16	22 03 38.41	33.75
W.	π^2 Pegasi	22 14 56.96	+ 0.03	+ 0.09	— 0.07	22 14 57.01	22 04 23.25	— 10 33.76
	Mean at $21^h 30^m$ local sidereal time							— 10 33.68

NORMAL EQUATIONS.

$0 = + 0.59 + 16.00\,\delta t - 3.07\,a - 0.88\,c$ $\qquad \delta t = + 0^s.02$

$0 = - 3.23 - 3.07\,\delta t + 11.77\,a + 4.64\,c$ $\qquad a = + 0^s.26$

$0 = - 4.02 - 0.88\,\delta t + 4.64\,a + 49.53\,c$ $\qquad c = + 0^s.06$

Observations and reductions for time taken at sending station—Continued.

TRINIDAD, COLORADO, SEPTEMBER 17, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	κ Aquilæ	19 40 39.70	+ 0.16	+ 0.05	— 0.08	19 40 39.83	19 30 05.58	— 10 34.25
W.	θ Cygni	43 37.98	— 0.08	+ 0.09	— 0.13	43 37.86	33 03.56	34.30
W.	γ Aquilæ	50 49.31	+ 0.11	+ 0.06	— 0.08	50 49.40	40 15.23	34.17
W.	α Aquilæ	55 11.28	+ 0.12	+ 0.07	— 0.08	55 11.39	44 37.18	34.21
W.	τ Aquilæ	20 08 32.28	+ 0.12	+ 0.09	— 0.09	20 08 32.40	57 58.19	34.21
W.	θ Aquilæ	15 21.37	+ 0.14	+ 0.10	— 0.08	15 21.53	20 04 47.27	34.26
W.	κ Cephei	23 43.75	— 0.69	+ 0.48	— 0.37	23 43.17	13 08.98	34.19
E.	γ Delphini	51 22.04	+ 0.09	+ 0.03	+ 0.08	51 22.24	40 48.00	34.24
E.	μ Aquarii	56 24.52	+ 0.16	+ 0.01	+ 0.08	56 24.77	45 50.58	34.19
E.	ν Cygni	21 03 02.51	— 0.02	+ 0.01	+ 0.11	21 03 02.61	52 28.32	34.29
E.	61[1] Cygni	11 48.74	0.00	0.00	+ 0.10	11 48.84	21 01 14.67	34.17
E.	ζ Cygni	18 08.10	+ 0.03	— 0.01	+ 0.10	18 08.22	07 34.01	34.21
E.	τ Cygni	20 19.54	0.00	— 0.02	+ 0.10	20 19.62	09 45.46	34.16
E.	α Cephei	26 09.26	— 0.21	— 0.06	+ 0.17	26 09.16	15 35.02	34.14
E.	β Cephei	21 37 37.74	— 0.37	— 0.10	+ 0.24	21 37 37.51	21 27 03.22	— 10 34.29
	Mean at 20h 30m local sidereal time							— 10 34.22

NORMAL EQUATIONS.

$$0 = +0.65 + 15.00\,\delta t - 1.82\,a + 0.94\,c \qquad \delta t = -0^s.02$$
$$0 = -3.83 - 1.82\,\delta t + 14.24\,a + 5.63\,c \qquad a = +0^s.23$$
$$0 = -5.38 + 0.94\,\delta t + 5.63\,a + 49.57\,c \qquad c = +0^s.08$$

TRINIDAD, COLORADO, SEPTEMBER 18, 1873.

Clamp	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	θ Cygni	19 43 38.67	— 0.05	— 0.15	+ 0.09	19 43 38.56	19 33 03.55	— 10 35.01
E.	γ Aquilæ	50 50.18	+ 0.06	— 0.10	+ 0.06	50 50.20	40 15.22	34.98
E.	α Aquilæ	55 12.18	+ 0.07	— 0.11	+ 0.06	55 12.20	44 37.17	35.03
E.	ε Draconis	59 12 17	— 0.22	— 0.32	+ 0.18	59 11.81	48 36.70	35.11
E.	τ Aquilæ	20 08 33.13	+ 0.07	— 0.11	+ 0.06	20 08 33.15	57 58.20	34.95
E.	θ Aquilæ	15 22.21	+ 0.08	— 0.10	+ 0.05	15 22.25	20 04 47.25	35.00
E.	31 o[1] Cygni	20 14.74	— 0.03	— 0.17	+ 0.09	20 14.63	09 39.65	34.98
W.	ζ Cygni	21 18 08.91	+ 0.02	+ 0.20	— 0.07	21 18 09.06	21 07 34.00	35.06
W.	τ Cygni	20 20.29	0.00	+ 0.23	— 0.08	20 20.44	09 45.45	34.99
W.	α Cephei	26 10.04	— 0.12	+ 0.21	— 0.13	26 10.00	15 34.99	35.01
W.	β Cephei	37 38.39	— 0.21	+ 0.25	— 0.18	37 38.25	27 03.18	35.07
W.	ξ Aquarii	41 37.05	+ 0.09	+ 0.06	— 0.06	41 37.14	31 01.97	35.17
W.	ε Pegasi	48 34.29	+ 0.07	+ 0.08	— 0.06	48 34.38	37 59.32	35.06
W.	11 Cephei	21 50 41.04	— 0.22	+ 0.23	— 0.18	21 50 40.87	21 40 05.89	— 10 34.98
	Mean at 20h 45m local sidereal time							— 10 35.03

NORMAL EQUATIONS.

$$0 = +0.95 + 14.00\,\delta t - 2.90\,a - 2.56\,c \qquad \delta t = -0^s.03$$
$$0 = -1.95 - 2.90\,\delta t + 10.65\,a + 6.86\,c \qquad a = +0^s.14$$
$$0 = -3.73 - 2.56\,\delta t + 6.86\,a + 44.35\,c \qquad c = +0^s.06$$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, SEPTEMBER 13, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	α^2 Capricorni	12 04 03.08	− 1.48	+ 0.05	− 0.18	12 04 01.47	20 11 02.81	+8 07 01.34
W.	β Capricorni	06 55.22	− 1.53	+ 0.05	− 0.19	06 53.55	13 54.91	01.36
W.	π Capricorni	13 06.02	− 1.62	+ 0.04	− 0.19	13 04.25	20 05.57	01.32
W.	ω Cygni	16 09.80	+ 0.39	+ 0.11	− 0.27	16 10.03	23 11.36	01.33
W.	ε Delphini	20 10.66	− 0.91	+ 0.06	− 0.18	20 09.63	27 10.87	01.24
E.	α Cygni	30 06.19	+ 0.16	+ 0.16	+ 0.25	30 06.76	37 08.12	01.36
E.	ε Aquarii	33 50.29	− 1.41	+ 0.07	+ 0.18	33 49.13	40 50.45	01.32
E.	u Aquarii	38 50.50	− 1.39	+ 0.06	+ 0.18	38 49.35	45 50.61	01.26
E.	ν Cygni	45 26.78	0.00	+ 0.09	+ 0.23	45 27.10	52 28.38	01.28
E.	61[1] Cygni	54 13.20	− 0.11	+ 0.06	+ 0.23	54 13.38	21 01 14.72	01.34
E.	61[2] Cygni	12 54 14.73	− 0.11	+ 0.06	+ 0.23	12 54 14.91	21 01 16.24	+8 07 01.33
	Mean at $20^h.5$ local sidereal time							+8 07 01.32

NORMAL EQUATIONS.

$$+11.00\,\delta t + 4.49\,a + 1.63\,c = -4.24 \qquad \delta t = +0^s.32$$
$$+4.49\,\delta t + 3.81\,a - 1.27\,c = -5.63 \qquad a = -1^s.780$$
$$+1.63\,\delta t - 1.27\,a + 15.62\,c = +5.56 \qquad c = +0^s.178$$

SALT LAKE CITY, UTAH, SEPTEMBER 15, 1873.

Clamp.	Name of star	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	δ Draconis	11 05 28.73	+ 2.24	+ 0.12	+ 0.39	11 05 31.48	19 12 32.29	+8 07 00.81
E.	δ Aquilæ	12 07.82	− 1.18	+ 0.04	+ 0.15	12 06.83	19 07.60	00.77
E.	α Vulpeculæ	11 16 26.52	− 0.59	+ 0.05	+ 0.16	11 16 26.14	19 23 26.99	+8 07 00.85
	Mean at $19^h.3$ local sidereal time							+8 07 00.81

NORMAL EQUATIONS.

$$+3.00\,\delta t - 0.24\,a = -0.10 \qquad \delta t = -0^s.19$$
$$-0.24\,\delta t + 1.85\,a = -3.50 \qquad a = -1^s.916$$

Adopted $c = +0^s.15$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 15, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	α Cygni	12 30 07.29	+ 0.14	+ 0.06	+ 0.07	12 30 07.42	20 37 08.09	+8 07 00.67
W.	12-Y. C. 1879	46 12.70	+ 5.81	+ 0.22	— 0.29	46 18.44	53 19.25	00.81
W.	61¹ Cygni	54 14.12	— 0.10	+ 0.08	— 0.06	54 14.04	21 01 14.70	00.66
W.	61² Cygni	54 15.53	— 0.10	+ 0.08	— 0.06	54 15.45	01 16.22	00.77
W.	ζ Cygni	13 00 33.80	— 0.35	+ 0.10	— 0.06	13 00 33.49	07 34.03	00.54
E.	1 Pegasi	09 14.61	— 0.62	+ 0.03	+ 0 05	09 14.07	16 15.13	01.06
E.	β Aquarii	17 55.14	— 1.15	+ 0.02	+ 0.05	17 54.06	24 54.90	00.84
E.	ξ Aquarii	24 02.37	— 1.22	+ 0.04	+ 0.05	24 01.24	31 01.99	00.75
E.	ε Pegasi	13 30 59.14	— 0.84	+ 0.08	+ 0.05	13 30 58.43	21 37 59.34	+8 07 00.91
	Mean at $21^h.0$ local sidereal time							+8 07 00.78

NORMAL EQUATIONS.

$$+9.00\,\delta t - 1.01\,a - 6.75\,c = -0.76 \qquad \delta t = -0^s.22$$
$$-0.01\,\delta t + 15.15\,a + 23.41\,c = -22.51 \qquad a = -1^s.575$$
$$6.75\,\delta t + 23.41\,a + 43.93\,c = -32.36 \qquad c = +0^s.050$$

SALT LAKE CITY, UTAH, SEPTEMBER 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	ε Aquilæ	10 46 53.04	— 0.71	+ 0.04	+ 0.16	10 46 52.53	18 53 53.14	+8 07 00.61
E.	ζ Aquilæ	52 36.06	— 0.74	+ 0.04	+ 0.16	52 35.52	59 36.01	00.49
E.	δ Draconis	11 05 29.36	+ 1.84	+ 0.09	+ 0.41	11 05 31.70	19 12 32.24	00.54
E.	δ Aquilæ	12 07.91	— 0.97	+ 0.03	+ 0.16	12 07.13	19 07.59	00.46
E.	α Vulpeculæ	16 26.59	— 0.49	+ 0.04	+ 0.17	16 26.31	23 26.97	00.66
W.	μ Aquilæ	20 55.39	— 0.88	+ 0.03	— 0.16	20 54.38	27 55.01	00.63
W.	θ Cygni	26 02.92	+ 0.39	+ 0.05	— 0.24	26 03.12	33 03.61	00.49
W.	γ Aquilæ	33 15.72	— 0.82	+ 0.03	— 0.16	33 14.77	40 15.24	00.47
W.	α Aquilæ	11 37 37.55	— 0.85	+ 0.03	— 0.16	11 37 36.57	19 44 37.19	+8 07 00.62
	Mean at $19^h.0$ local sidereal time							+8 07 00.55

NORMAL EQUATIONS.

$$+9.00\,\delta t + 2.05\,a + 2.19\,c = +2.07 \qquad \delta t = +0^s.55$$
$$+2.05\,\delta t + 3.20\,a - 2.40\,c = -4.26 \qquad a = -1^s.570$$
$$+2.19\,\delta t - 2.40\,a + 16.64\,c = +7.59 \qquad c = +0^s.156$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 16, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	θ Aquilæ	11 57 47.91	— 1.14	+ 0.08	— 0.13	11 57 46.72	20 04 47.21	+8 07 00.49
W.	α Capricorni	12 04 03.75	— 1.41	+ 0.07	— 0.13	12 04 02.28	11 02.78	00.50
W.	β Capricorni	06 55.76	— 1.46	+ 0.08	— 0.14	06 54.24	13 54.88	00.64
W.	π Capricorni	13 06.66	— 1.55	+ 0.08	— 0.14	13 05.05	20 05.54	00.49
W.	ε Delphini	20 11.24	— 0.87	+ 0.14	— 0.13	20 10.38	27 10.83	00.45
E.	α Cygni	30 06.62	+ 0.15	+ 0.38	+ 0.18	30 07.33	37 08.07	00.74
E.	ε Aquarii	33 51.09	— 1.34	+ 0.12	+ 0.13	33 50.00	40 50.42	00.42
E.	μ Aquarii	38 51.08	— 1.33	+ 0.19	+ 0.13	38 50.07	45 50.59	00.52
E.	ν Cygni	12 45 27.40	0.00	+ 0.42	+ 0.17	12 45 27.99	20 52 28.34	+8 07 00.35
	Mean at 20h.5 local sidereal time							+8 07 00.51

NORMAL EQUATIONS.

$$+9.00\,\delta t + 5.26\,a - 0.39\,c = -4.41 \qquad \delta t = +0^s.51$$
$$+5.26\,\delta t + 4.21\,a - 2.42\,c = -4.83 \qquad a = -1^s.700$$
$$-0.39\,\delta t - 2.42\,a + 11.17\,c = +5.38 \qquad c = +0^s.131$$

SALT LAKE CITY, UTAH, SEPTEMBER 17, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	β Lyræ	10 38 24.74	— 0.28	+ 0.15	+ 0.09	10 38 24.70	18 45 24.86	+8 07 00.16
E.	50 Draconis	43 23.06	+ 3.97	+ 0.29	+ 0.30	43 27.62	50 27.67	00.05
E.	ζ Aquilæ	52 36.66	— 0.84	+ 0.05	+ 0.08	52 35.95	59 35.99	00.04
E.	π Sagittarii	55 16.28	— 1.69	+ 0.01	+ 0.08	55 14.68	19 02 14.77	00.09
E.	δ Draconis	11 05 29.73	+ 2.08	+ 0.10	+ 0.20	11 05 32.11	12 32.18	00.07
W.	δ Aquilæ	12 08.65	— 1.10	+ 0.08	— 0.08	12 07.55	19 07.57	00.02
W.	α Vulpeculæ	16 27.36	— 0.55	+ 0.11	— 0.08	16 26.84	23 26.94	00.10
W.	μ Aquilæ	20 55.85	— 1.00	+ 0.09	— 0.08	20 54.86	27 54.99	00.13
W.	κ Aquilæ	23 06.89	— 1.34	+ 0.07	— 0.08	23 05.54	30 05.58	00.04
W.	θ Cygni	11 26 02.92	+ 0.45	+ 0.17	— 0.12	11 26 03.42	19 33 03.58	+8 07 00.06
	Mean at 19h.0 local sidereal time							+8 07 00.09

NORMAL EQUATIONS.

$$+10.00\,\delta t + 0.17\,a + 4.18\,c = +0.90 \qquad \delta t = +0^s.09$$
$$+0.17\,\delta t + 8.90\,a - 12.05\,c = -16.73 \qquad a = -1^s.780$$
$$+4.18\,\delta t - 12.05\,a + 32.62\,c = +24.29 \qquad c = +0^s.076$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, SEPTEMBER 17, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	β Capricorni	12 06 56.43	− 1.57	+ 0.08	− 0.21	12 06 54.73	20 13 54.87	+8 07 00.14
W.	π Capricorni	13 07.26	− 1.67	+ 0.08	− 0.21	13 05.46	20 05.53	00.07
W.	ω Cygni	16 10.70	+ 0.40	+ 0.21	− 0.30	16 11.01	23 11.22	00.21
W.	ε Delphini	20 11.63	− 0.93	+ 0.11	− 0.20	20 10.61	27 10.82	00.21
E.	α Cygni	30 07.34	+ 0.16	+ 0.28	+ 0.28	30 08.06	37 08.05	06 59.99
E.	ε Aquarii	33 51.55	− 1.45	+ 0.11	+ 0.20	33 50.41	40 50.41	07 00.00
E.	μ Aquarii	38 51.78	− 1.43	+ 0.09	+ 0.20	38 50.64	45 50.58	06 59.94
E.	ν Cygni	45 27.80	0.00	+ 0.13	+ 0.26	45 28.19	52 28.32	07 00.13
E	61¹ Cygni	54 14.17	− 0.10	+ 0.11	+ 0.25	54 14.43	21 01 14.67	00.24
E.	61² Cygni	54 15.71	− 0.10	+ 0.11	+ 0.25	54 15.97	01 16.19	00.22
E.	ζ Cygni	13 00 33.94	− 0.40	+ 0.10	+ 0.23	13 00 33.87	21 07 34.01	+8 07 00.14
	Mean at 20h.5 local sidereal time							+8 07 00.12

NORMAL EQUATIONS.

$$+11.00\,\delta t + 3.88\,a + 3.81\,c = -5.50 \qquad \delta t = +0^s.12$$
$$+3.88\,\delta t + 3.17\,a - 0.18\,c = -5.60 \qquad a = -1^s.830$$
$$+3.18\,\delta t - 0.18\,a + 15.88\,c = +3.58 \qquad c = +0^s.196$$

SALT LAKE CITY, UTAH, SEPTEMBER 19, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	50 Draconis	10 43 23.78	+ 3.81	+ 0.10	+ 0.93	10 43 28.62	18 50 27.49	+8 06 58.87
E.	ζ Aquilæ..........	52 37.92	− 0.80	+ 0.03	+ 0.24	52 38.19	59 35.96	58.57
E.	π Sagittarii	55 17.70	− 1.62	+ 0.03	+ 0.25	55 16.36	19 02 14.75	58.39
E.	δ Draconis	11 05 30.34	+ 2.00	+ 0.18	+ 0.62	11 05 33.14	12 32.07	58.93
E.	δ Aquilæ..........	12 09.84	− 1.06	+ 0.08	+ 0.24	12 09.10	19 07.54	58.44
E.	α Vulpeculæ	16 28.41	− 0.53	+ 0.12	+ 0.26	16 28.26	23 26.92	58.66
W.	μ Aquilæ..........	20 57.41	− 0.96	+ 0.10	− 0.24	20 56.31	27 54.97	58.66
W.	θ Cygni...........	26 04.27	+ 0.43	+ 0.20	− 0.37	26 04.53	33 03.53	59.00
W.	γ Aquilæ..........	33 17.50	− 0.89	+ 0.11	− 0.24	33 16.48	40 15.20	58.72
W.	α Aquilæ..........	37 39 47	− 0.92	+ 0.11	− 0.24	37 38.42	44 37.15	58.73
W.	β Aquilæ..........	11 42 08.78	− 0.92	+ 0.11	− 0.24	11 42 07.73	19 49 06.45	+8 06 58.72
	Mean at 19h.5 local sidereal time							+8 06 58.70

NORMAL EQUATIONS.

$$+11.00\,\delta t + 0.86\,a + 5.15\,c = -14.56 \qquad \delta t = -1^s.30$$
$$+0.86\,\delta t + 9.86\,a - 11.17\,c = -20.67 \qquad a = -1^s.710$$
$$+5.15\,\delta t - 11.17\,a + 33.24\,c = +20.28 \qquad c = +0^s.237$$

The following tables show the corrections and rates of the chronometers used at Trinidad and Salt Lake City:

CHRONOMETER AT TRINIDAD.—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*h. m. s.*	*s.*
Sept. 13	22.0	− 0 10 31.44	+ 0.033
Sept. 14	21.0	10 32.17	+ 0.034
Sept. 15	20.5	10 32.99	+ 0.031
Sept. 16	21.5	10 33.68	+ 0.026
Sept. 17	20.5	10 34.22	+ 0.028
Sept. 18	20.7	− 0 10 35.03	+ 0.033

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*h. m. s.*	*s.*
Sept. 13	20.5	+ 8 07 01.32	+ 0.010
Sept. 15	20.1	07 00.79	+ 0.011
Sept. 16	19.7	07 00.53	+ 0.014
Sept. 17	19.7	07 00.10	+ 0.023
Sept. 19	19.5	+ 8 06 58.70	+ 0.030

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*s.*
September 13, 1873:							
Salt Lake City	Trinidad	20 34 16.97	−0 10 31.39	20 23 45.58			
	Sa Lake City...	11 47 09.30	+8 07 01.33	19 54 10.63	0 29 34.95		
Trinidad	Trinidad	20 42 10.00	−0 10 31.39	20 31 38.61			
	Salt Lake City...	11 55 02.67	+8 07 01.32	20 02 03.99	34.62	0.33	34.785
September 15, 1873:							
Salt Lake City	Trinidad	20 32 47.59	−0 10 32.99	20 22 14.60			
	Salt Lake City...	11 45 38.88	+8 07 00.79	19 52 39.67	34.93		
Trinidad	Trinidad	20 42 40.00	−0 10 32.99	20 32 07.01			
	Salt Lake City...	11 55 31.61	+8 07 00.79	20 02 32.40	34.61	0.32	34.770
September 16, 1873:							
Salt Lake City.	Trinidad	20 32 33.19	−0 10 33.65	20 21 59.54			
	Salt Lake City...	11 45 24.25	+8 07 00.53	19 52 24.78	34.76		
Trinidad	Trinidad	20 36 35.01	−0 10 33.65	20 26 01.36			
	Salt Lake City...	11 49 26.24	+8 07 00.53	19 56 26.77	0 29 34.59	0.17	34.675

Final results of longitude—Continued.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. m. s.	h. m. s.	h. m. s.	h. m. s.	s.	s.
September 17, 1873:							
Salt Lake City.	Trinidad	20 41 20.08	−0 10 34.22	20 30 45.86			
	Salt Lake City....	11 54 10.86	+8 07 00.09	20 01 10.95	0 29 34.91		
Trinidad	Trinidad	20 45 10.00	−0 10 34.22	20 34 35.78			
	Salt Lake City...	11 58 00.96	+8 07 00.09	20 05 01.05	34.73	0.18	34.820
September 18, 1873:							
Salt Lake City.	Trinidad	20 55 07.55	−0 10 35.03	20 44 32.52			
	Salt Lake City....	12 07 58.35	+8 06 59.38	20 14 57.73	34.79		
Trinidad	Trinidad	20 59 15.00	−0 10 35.03	20 48 39.97			
	Salt Lake City....	12 12 05.92	+8 06 59.38	20 19 05.30	0 29 34.67	0.12	34.730

Trinidad east of Salt Lake City .... $0^h\ 29^m\ 34^s.765 \pm 0^s.020$.

NOTE.—September 16, 1873, has the weight $\frac{1}{2}$; the observations for time at Salt Lake City were taken on that date by eye and ear. The signals were repeated on the 13th and 15th of September at Denver and Cheyenne; the last three days they went through to Cheyenne; therefore the difference in the wave-time.

Mean places of stars for 1873.0 *used for determination of latitude of Trinidad, Colorado.*

No. of pair.	No. in B. A. C.	Approximate right ascension.	Declination.	No. of pair.	No. in B. A. C.	Approximate right ascension.	Declination.
		h. m. s.	° ′ ″			h. m. s.	° ′ ″
1..........	6731	19 32 42	44 24 56.3	16..........	7598	21 42 06	48 43 20.7
	6740	34 21	29 51 42.0		7627	47 17	25 19 41.8
2..........	6762	38 43	26 49 58.6	17..........	7641	50 45	11 28 27.5
	6799	43 44	47 35 40.5		7658	53 04	63 01 16.3
3..........	6827	48 04	23 45 01.9	18..........	7696	59 46	59 11 57.7
	6865	53 17	50 33 42.5		7742	22 05 43	15 24 56.0
4..........	6853	56 38	24 35 01.0	19..........	7766	08 25	62 39 50.4
	6895	57 46	49 45 07.3		7796	15 16	11 33 57.3
5..........	6912	20 01 25	23 14 58.4	20..........	7810	17 58	66 03 54.9
	6959	09 00	51 04 56.4		7833	22 48	8 28 52.7
6..........	6990	13 06	37 38 20.8	21..........	7865	28 06	− 0 03 24.1
	7006	15 03	36 44 01.3		7907	34 29	74 42 41.4
7..........	7061	22 52	38 01 27.5	22..........	8010	53 42	− 9 33 35.7
	7084	26 10	36 30 32.7		8026	55 19	83 39 58.8
8..........	7160	35 19	14 07 56.3	23..........	8036	58 29	49 21 43.4
	7176	37 36	60 02 47.6		8052	23 00 56	24 46 59.5
9..........	7198	40 24	46 50 12.6	24..........	8070	03 07	7 59 20.5
	7256	49 08	27 34 33.1		8077	04 55	66 33 09.8
10..........	7268	51 33	46 55 54.0	25..........	8110	11 18	44 28 25.3
11..........	7320	58 09	38 09 23.7		8133	14 36	29 43 19.8
12..........	7337	21 01 15	38 07 27.8	26..........	8152	17 00	− 0 24 20.0
	7373	08 20	36 06 36.2		8187	24 00	74 31 33.0
13..........	7401	13 26	55 15 54.4		8206	27 39	30 37 27.6
	7418	16 13	19 15 43.2	27..........	8223	31 20	43 43 37.0
14..........	7448	19 43	51 06 42.3	28..........	8237	34 09	43 37 51.6
	7474	24 11	23 05 00.2	29..........	8256	37 36	28 39 30.3
15..........	7489	27 11	52 03 36.3		8261	23 39 45	45 42 55.1
	7585	21 40 13	22 21 52.7				

Mean places of stars for 1873.0—Continued.

No. of pair.	No. in B. A. C.	Approximate right ascension.	Declination.	No. of pair.	No. in B. A. C.	Approximate right ascension.	Declination.
		h. m. s.	° ′ ″			*h. m. s.*	° ′ ″
30..........	8277	23 42 31	64 10 16.1	41..........	416	1 17 32	59 34 27.0
	8300	46 08	10 14 27.3		453	24 41	14 41 25.1
31..........	8338	54 16	61 28 14.4		476	28 57	14 00 40.0
	8370	59 10	12 41 21.3	42..........	509	34 03	59 54 19.4
32..........	4	α Andromedæ.		43..........	515	34 45	59 54 33.7
	13	0 03 28	45 41 03.6	44..........	Gr. 374	36 42	45 30 03.2
33..........	48	10 12	13 12 39.2	45..........	540	40 01	45 35 46.4
	80	17 48	61 07 37.6		569	45 51	28 57 32.7
34..........	121	24 46	53 49 15.2	46..........	600	52 38	71 48 18.4
	168	32 45	20 33 57.1		631	56 25	2 44 18.7
35..........	182	35 13	58 03 24.6	47..........	650	2 00 48	17 25 24.2
	223	42 18	16 15 16.3		658	02 39	57 02 42.2
36..........	244	47 28	58 17 04.3	48..........	686	06 49	19 01 06.0
37..........	270	51 44	6 09 26.5	49..........	712	12 05	19 06 19.9
38..........	293	57 02	6 04 57.7		721	2 13 31	55 15 47.3
	327	1 02 05	58 06 07.6				
39..........	349	04 40	29 24 53.4				
40..........	358	06 00	29 23 25.0				
	404	1 14 52	44 51 44.8				

Observations and computations for latitude.

TRINIDAD, COLORADO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
September 4	6731	7 59.6	20.3	19.3	Heavy wind				
	6740	11 90.5	21.0	18.9	from south; tent partly	37 08 31.1	+ 2 13.8	+0.9	37 10 45.8
	6762	7 83.9	21.3	18.8	closed.				
	6799	12 27.2	21.5	18.3		13 01.5	− 2 17.7	+1.6	45.4
	6827	10 97.7	24.6	16.2					
	6865	8 66.0	17.0	22.8		09 34.1	+ 1 12.0	+0.7	46.8
	6883	10 75.0	21.3	18.2					
	6895	9 79.9	19.0	21.0		10 16.2	+ 0 29.5	+0.3	46.0
	6912	10 97.5	21.0	19.0					
	6959	9 71.4	12.9	27.3		10 09.4	+ 0 39.2	−3.4	45.2
	6990	11 05.0	22.0	18.3					
	7006	9 90.5	13.5	26.9		11 23.6	− 0 35.6	−2.6	45.4
	7160	15 14.7	25.9	16.0	Changed inclination.				
	7176	4 99.0	11.0	31.0		05 33.6	+ 5 15.5	−2.8	46.3
	7198	8 76.1	17.8	24.7		12 38.4	− 1 45.9	−2.7	46.8
	7256	5 35.1	19.8	22.8					
	7268	14 29.5	19.0	23.6		37 15 26.1	− 4 37.8	−2.1	37 10 46.2

Observations and computations—Continued.

TRINIDAD, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
September 4	7320	8 81.4	19.0	23.4		37 08 13.9	+ 2 34.2	—0.2	37 10 47.9
	7337	7 07.9	17.9	24.6		07 19.1	+ 3 28.1	—0.9	46.3
	7373	13 78.0	23.4	19.8					
	7401	14 98.9	20.3	22.9					
	7418	4 91.6	18.3	25.1		16 01.2	— 5 12.9	—2.6	45.7
	7448	5 69.1	23.0	20.3					
	7474	14 84.9	17.0	26.3		06 03.8	+ 4 44.5	—1.8	46.5
	7489	12 01.0	18.0	25.3					
	7585	7 94.2	17.9	26.0		12 57.1	— 2 06.4	—4.2	46.5
	7598	0 20.5	19.0	24.8					
	7627	17 70.0	22.4	21.2		01 43.9	+ 9 03.4	—1.3	46.0
	7641	4 63.2	27.0	16.9					
	7658	12 85.8	13.9	29.8		15 03.8	— 4 15.5	—1.6	46.7
	7696	18 37.8	20.0	23.7					
	7742	3 20.6	18.9	24.9		18 39.1	— 7 51.2	—2.7	45.2
	7766	6 55.3	22.0	21.9					
	7796	13 65.2	21.0	22.9		07 05.9	+ 3 40.5	—0.5	45.9
	7810	14 92.6	21.0	23.0					
	7833	3 65.6	23.3	20.8		16 35.6	— 5 50.0	+0.1	45.7
	7865	0 79.0	26.4	17.9					
	7907	18 29.3	19.6	24.7		19 49.6	— 9 03.6	+0.9	46.9
	8036	3 71.4	15.0	29.0					
	8052	15 72.3	27.0	17.0		04 33.6	+ 6 13.0	—1.1	45.5
	8110	4 71.0	21.4	22.8					
	8133	13 83.0	19.3	24.9		06 04.6	+ 4 43.3	—1.9	46.0
	8152	16 60.1	24.9	19.4					
	8187	3 01.0	13.7	30.6		03 47.4	+ 7 02.1	—3.1	46.4
	8206	12 22.2	15.0	29.7					
	8223	12 09.0	24.8	20.3		10 44.1	+ 0 04.1	—2.8	45.4
	8237	6 52.9	24.6	20.5		07 51.4	+ 2 56.8	—2.9	45.3
	8256	9 32.6	19.5	25.0					
	8261	10 59.1	27.6	17.0		11 24.4	— 0 39.3	+1.4	46.5
	8277	11 35.1	21.0	23.6					
	8300	7 32.8	26.9	17.9		12 33.0	— 1 49.4	+1.8	45.4
	8338	5 10.3	21.7	23.4					
	8370	16 29.4	21.8	23.4		04 59.1	+ 5 47.6	—0.9	45.8
	4	17 35.4	25.0	20.2					
	13	1 10.4	17.0	28.4		02 24.0	+ 8 24.7	—1.8	46.9
	48	10 00.0	23.3	22.2					
	80	9 12.8	22.0	23.4		37 10 19.3	+ 0 27.1	—0.1	37 10 46.3

Observations and computations—Continued.

TRINIDAD, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
September 4	121	10 02.8	26.7	19.0					
	168	8 16.5	15.0	30.7		37 11 46.9	— 0 57.9	—2.2	37 10 46.8
	182	3 86.7	21.8	24.2		09 30.9	+ 1 17.2	—1.8	46.3
	223	6 35.1	21.0	25.2					
	244	17 09.0	22.9	23.3		16 20.5	— 5 33.6	—1.2	45.7
	270	9 68.7	25.8	20.2		07 57.1	+ 2 52.0	—2.8	46.3
	293	14 03.2	25.8	20.3		05 42.7	+ 5 06.9	—2.8	46.8
	327	4 15.0	15.2	31.0					
	349	10 93.5	23.2	23.0		08 28.9	+ 2 18.8	—2.1	45.6
	358	12 35.0	23.0	23.2		07 44.7	+ 3 02.8	—2.2	45.3
	404	6 46.6	19.1	27.0					
	416	7 35.5	28.0	18.3					
	453	12 58.9	13.7	32.8		37 08 05.8	+ 2 42.6	—2.6	45.8
	476	22 69.8	22.6	24.0					
	509	— 2 67.0	22.5	24.6		36 57 39.2	+13 07.9	—1.0	46.1
	515	— 2 43.8	22.2	24.9		36 57 46.3	+13 00.7	—1.1	45.9
	Gr. 374	6 36.1	20.2	27.0		37 13 57.0	— 3 06.8	—3.2	47.0
	540	11 92.0	20.8	27.0		16 48.5	— 5 59.5	—3.1	45.9
	569	0 34.6	21.7	26.7					
	650	5 97.2	24.2	25.3					
	658	12 55.2	24.0	25.7		14 11.3	— 3 24.4	—0.8	46.1
	686	13 11.9	24.4	25.4		08 35.1	+ 2 13.0	—1.4	46.7
	712	8 09.2	24.3	25.8		11 11.9	— 0 23.2	—1.5	47.2
	721	8 83.7	23.0	27.0					
September 5	6731	7 66.9	17.0	21.9	Wind N. E.;				
	6740	11 97.1	28.0	10.9	moderate.	08 31.3	+ 2 13.6	+3.3	48.2
	6762	7 92.0	20.0	18.9					
	6799	12 19.3	15.0	23.9		13 01.7	— 2 12.7	—1.9	47.1
	6827	10 33.0	20.2	19.0					
	6865	7 93.3	18.0	21.3		09 34.3	+ 1 14.4	—0.6	48.1
	6883	9 92.0	18.9	20.8					
	6895	8 90.0	18.0	21.4		10 16.4	+ 0 31.7	—1.5	46.6
	6912	11 02.2	22.3	17.2					
	6959	9 71.3	11.0	28.4		10 09.6	+ 0 40.7	—3.4	46.9
	6990	11 13.4	17.4	22.2					
	7006	10 05.4	17.2	22.4		11 23.7	— 0 33.5	—2.8	47.5
	7061	14 66.4	15.8	23.9					
	7084	4 18.6	23.2	16.3	Through clouds.	16 12.9	— 5 25.4	—0.3	47.2
September 9	7766	6 28.8	15.5	23.3	Very cold;				
	7796	13 43.7	19.8	19.0	heavy wind from south.	37 07 06.1	+ 3 42.1	—1.9	37 10 46.3

Observations and computations—Continued.

TRINIDAD, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
September 9	7810	14 88.5	22.7	15.3					
	7833	3 67.1	13.6	26.0		37 16 35.8	− 5 48.3	−1.4	37 10 46.1
	7865	1 21.0	22.0	17.2					
	7907	18 51.8	6.0	33.5		19 50.7	− 8 57.6	−6.2	46.9
	8010	16 91.3	23.3	16.4	Changed inclination.				
	8026	2 68.5	20.0	19.6		03 23.0	+ 7 21.9	+2.0	46.9
	8036	3 30.5	19.1	20.3					
	8052	15 27.2	20.7	18.8		04 35.0	+ 6 11.7	+0.1	46.8
	8110	4 70.0	16.6	23.0					
	8133	13 72.4	25.0	14.5		06 06.0	+ 4 40.3	+1.1	47.4
	8152	16 46.0	21.8	18.0					
	8157	2 90.1	14.1	25.5		03 48.6	+ 7 01.1	−2.1	47.6
	8206	12 56.2	22.8	17.0					
	8223	12 49.1	14.7	25.0		10 45.5	+ 0 02.2	−1.2	46.5
	8237	6 91.9	14.0	25.9		07 52.8	+ 2 55.3	−1.7	46.4
	8256	9 22.8	21.9	18.0					
	8261	10 40.5	14.5	25.4		11 25.7	− 0 36.6	−1.9	47.2
	8277	11 12.2	21.8	18.2					
	8300	7 58.1	22.0	18.0		12 34.3	− 1 50.0	+2.1	46.4
	8338	4 35.0	19.0	21.3					
	8370	15 55.2	18.5	22.0		05 00.4	+ 5 47.9	−1.6	46.7
	4	17 67.8	21.4	19.0					
	13	1 50.5	17.9	22.7		02 25.3	+ 8 22.3	−0.7	46.9
	48	9 47.0	20.3	20.3					
	80	8 68.9	23.7	17.0		10 20.5	+ 0 24.3	+1.8	46.6
	121	9 82.1	19.0	21.9					
	168	7 83.0	24.5	16.6		11 48.2	− 1 01.8	+1.4	47.8
	182	3 52.3	17.8	23.5		09 32.3	+ 1 13.0	+1.8	47.1
	223	5 87.4	27.0	14.6					
	244	16 66.9	13.0	28.5		16 21.9	− 5 35.3	−0.9	45.7
	270	9 94.8	24.0	17.4		07 58.2	+ 2 48.9	−0.8	46.3
	293	14 30.4	24.0	18.0		05 43.9	+ 5 04.2	−1.0	47.1
	327	4 51.0	16.0	25.5					
	349	10 88.4	23.0	18.8		08 30.2	+ 2 17.8	−1.6	46.4
	358	12 28.4	23.0	18.9		07 46.0	+ 3 01.3	−1.7	45.6
	404	6 44.6	15.0	26.0					
	416	6 22.6	17.5	24.3					
	453	11 30.7	26.4	15.9		37 08 07.0	+ 2 37.8	+1.0	37 10 45.8

Observations and computations—Continued.

TRINIDAD, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
September 9	476	22 20.2	24.0	18.0					
	509	— 3 09.5	17.4	24.6		36 57 40.3	+13 05.7	—0.3	37 10 45.7
	515	— 2 85.0	17.4	24.6		36 57 47.4	+12 58.4	—0.3	45.5
	Gr. 374	6 21.6	16.3	25.6		37 13 58.2	— 3 10.7	—0.5	47.0
	540	11 74.9	16.0	25.9		16 49.7	— 6 02.6	—0.7	46.4
	569	0 07.6	24.7	17.3					
	650	6 03.0	22.4	20.0					
	658	12 73.8	25.0	17.4		14 12.8	— 3 28.4	+2.8	47.2
	686	13 21.3	22.0	20.3		08 36.1	+ 2 11.5	—0.7	46.9
	712	8 18.6	22.0	20.3		11 13.0	— 0 24.7	—0.7	47.6
	721	8 98.0	19.0	23.4					
September 10	8110	5 15.0	21.0	20.3	Very heavy wind from S.E.; partly cloudy.				
	8133	14 24.5	17.3	24.2		06 06.2	+ 4 42.5	—1.7	47.0
	8152	16 27.0	23.3	18.4					
	8187	2 78.7	16.0	25.9		03 48.8	+ 6 58.8	—1.4	46.2
	8206	12 24.2	21.0	21.0					
	8223	12 11.8	17.0	24.9		10 45.8	+ 0 03.9	—2.2	47.5
	8237	6 59.5	16.1	25.8		07 53.1	+ 2 55.4	—2.7	45.8
	8256	9 90.2	22.3	19.7					
	8261	11 15.3	19.0	23.0		11 26.0	— 0 38.9	—0.4	46.7
	8277	11 08.5	13.9	28.0					
	8300	7 67.0	26.0	16.0		12 34.5	— 1 46.1	—1.1	47.3
	8338	4 25.7	19.9	22.0					
	8370	15 41.7	20.0	21.9		05 00.6	+ 5 46.6	—1.1	46.1
	4	17 91.9	20.8	21.2					
	13	1 86.6	26.6	15.4		02 25.6	+ 8 18.6	+3.0	47.2
	48	10 27.4	23.3	18.8					
	80	9 34.8	14.0	27.9		10 20.7	+ 0 28.8	—2.6	46.9
	121	9 62.9	13.6	28.3					
	168	7 61.3	30.8	11.4		11 48.5	— 1 02.6	+1.3	47.2
	182	4 25.0	19.0	23.0	Thro' clouds.				
	223	6 55.3	27.9	14.4		09 32.6	+ 1 11.5	+2.6	46.7
	244	17 38.4	15.3	27.0		16 22.1	— 5 36.4	+0.5	46.2
	270	9 81.6	26.3	16.0	Thro' clouds.	07 58.4	+ 2 45.8	+2.2	46.4
	293	14 15.7	26.4	16.0		05 44.1	+ 4 60.6	+2.2	46.9
	327	4 47.9	20.0	22.3					
	349	10 88.1	23.0	19.3		08 30.4	+ 2 17.8	—1.9	46.3
	358	12 29.0	23.4	19.0		07 46.2	+ 3 01.6	—1.7	46.1
	404	6 44.5	15.9	26.4					
	416	7 15.0	18.2	23.2					
	453	12 20.5	26.2	16.2		37 08 07.2	+ 2 37.0	+1.4	37 10 45.6

Observations and computations—Continued.

TRINIDAD, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
September 10	476	22 41.0	26.0	16.3					
	509	– 2 94.8	13.7	28.6		36 57 40.5	+13 07.6	–1.4	37 10 46.7
	515	– 2 68.5	13.7	28.6		57 47.6	+12 59.5	–1.4	45.7
	Gr. 374	6 33.8	19.8	22.2		13 58.4	– 3 10.8	–1.7	45.9
	540	11 86.9	19.8	22.3		16 49.9	– 6 02.6	–1.7	45.6
	569	0 19.6	19.3	22.9					
	650	7 46.4	18.3	23.7					
	658	14 18.1	28.6	13.3		14 13.1	– 3 28.6	+2.7	47.2
	686	13 27.9	22.3	19.6		08 36.3	+ 2 07.3	+2.9	46.5
	712	8 27.0	21.9	20.2		11 13.2	– 0 28.3	+2.6	47.5
	721	9 18.0	25.0	17.1					
September 11	7448	5 11.9	18.0	27.7	Air undulating; wind from E.NE., moderate.				
	7474	14 17.8	29.9	15.8		06 05.4	+ 4 41.4	+1.2	48.0
	7489	12 40.2	28.0	18.0					
	7585	8 19.7	17.0	30.2		12 58.7	– 2 10.6	–0.9	47.2
	7598	1 04.3	19.2	27.8					
	7627	18 35.0	31.9	15.8		01 45.6	+ 8 57.6	+2.1	45.3
	7641	5 29.0	28.6	19.0					
	7658	13 60.0	16.0	31.6		15 05.4	– 4 18.1	–1.6	45.7
	7696	18 45.5	24.0	24.3					
	7742	3 12.0	28.5	20.0		18 40.7	– 7 56.3	+2.3	46.7
	7766	7 10.7	25.3	23.3					
	7796	14 21.5	20.3	29.0		07 07.5	+ 3 40.8	–1.8	46.5
	7810	14 83.8	22.4	27.0					
	7833	3 61.0	24.3	25.2		16 37.2	– 5 48.7	–1.5	47.0
	7865	1 20.1	24.8	25.0					
	7907	18 63.5	19.3	30.6		19 51.2	– 9 01.5	–3.2	46.5
	8010	16 77.9	23.0	19.8	Changed length of bubble.				
	8026	2 50.4	21.0	21.8		03 23.4	+ 7 23.4	+0.7	47.5
	8036	4 39.2	21.7	21.0					
	8052	16 49.0	11.6	31.0		04 35.5	+ 6 15.8	–5.1	46.2
	8110	5 26.0	20.9	22.1					
	8133	14 44.2	12.3	30.9		06 06.5	+ 4 45.2	–5.5	46.2
	8152	16 71.0	24.3	19.0					
	8187	3 13.7	11.9	32.0		03 49.0	+ 7 01.6	–4.1	46.5
	8206	12 05.0	21.0	22.9	Changed inclination.				
	8223	12 08.9	25.1	18.8		10 46.0	– 0 01.2	+1.2	46.0
	8237	6 52.2	25.2	18.8		36 07 53.4	+ 2 51.7	+1.2	37 10 46.3

Observations and computations—Continued.

TRINIDAD, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
		t. d.	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
1873. September 11	8256	9 79.9	22.8	21.3					
	8261	11 21.0	30.8	13.8		37 11 26.2	− 0 43.8	+5.1	37 10 47.5
	8277	12 11.3	19.6	25.0					
	8300	8 50.2	31.9	13.0		12 34.8	− 1 52.2	+3.7	46.3
	8338	5 19.4	22.7	22.3					
	8370	16 25.0	27.3	17.5		05 00.9	+ 5 43.4	+2.8	47.1
	4	18 08.0	21.8	23.6					
	13	2 07.0	30.3	15.8		02 25.8	+ 8 17.3	+3.5	46.6
	48	10 24.6	22.0	24.0	Changed inclination.				
	80	9 48.0	26.6	19.3		10 21.0	+ 0 23.8	+1.5	46.3
	121	10 22.5	22.7	23.3					
	168	8 20.1	26.9	19.0		11 48.7	− 1 02.9	−2.0	47.8
	182	4 04.6	21.6	24.6					
	223	6 51.5	18.3	28.0		09 32.8	+ 1 16.7	−3.5	46.0
	270	10 30.0	26.5	19.4		07 58.7	+ 2 50.4	−2.6	46.5
	293	14 65.8	27.0	19.0		05 44.3	+ 5 05.8	−2.3	47.8
	327	4 81.3	14.8	31.3					
	349	10 70.8	25.0	21.0		08 30.7	+ 2 17.3	−1.4	46.6
	358	12 10.9	25.8	20.2		07 46.5	+ 3 00.8	−1.0	46.3
	404	6 28.8	18.7	27.9					
	416	6 72.9	20.0	26.4					
	453	11 75.5	31.0	15.8		37 08 07.4	+ 2 36.1	+2.4	45.9
	476	22 54.0	29.8	17.0					
	509	− 2 84.3	11.0	35.8		36 57 40.7	+13 08.4	−3.3	45.8
	515	− 2 60.0	11.0	35.8		36 57 47.9	+13 00.9	−3.3	45.5
	Gr. 374	6 62.1	23.3	23.5		37 13 58.7	− 3 10.7	−1.8	46.2
	540	12 14.2	23.0	23.5		16 50.2	− 6 02.1	−1.9	46.2
	569	0 48.3	20.0	26.3					
	650	5 92.3	25.6	21.0					
	658	12 46.8	16.0	30.5		14 13.3	− 3 23.3	−2.7	47.3
	712	8 08.0	27.7	19.6					
	721	8 84.0	14.3	33.0		11 13.4	− 0 23.6	−2.9	46.9
September 12	7810	14 91.0	20.2	18.9	Heavy wind from S. W.				
	7833	3 56.0	20.3	19.0		16 37.4	− 5 52.5	+0.7	45.6
	7865	1 20.0	23.3	16.1					
	7907	18 83.2	21.5	17.8		19 51.4	− 9 07.7	+3.0	46.7
	8036	3 70.0	11.3	27.7					
	8052	15 53.2	34.4	4.7		04 35.7	+ 6 07.5	+3.7	46.9
	8110	4 96.0	16.1	22.9					
	8133	13 90.6	27.7	11.4		37 06 06.8	+ 4 37.9	+2.6	37 10 47.3

Observations and computations—Continued.

TRINIDAD, COLORADO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
September 12	8152	16 70.5	23.3	15.9					
	8187	3 23.5	13.8	25.5		37 03 49.3	+ 6 58.4	−1.2	37 10 46.5
	8206	12 20.3	23.6	15.8					
	8223	12 20.9	15.5	23.9		10 46.3	− 0 00.2	−0.2	45.9
	8237	6 65.0	15.5	24.0		07 53.6	+ 2 52.5	−0.2	45.9
	8256	9 17.0	22.0	17.5					
	8261	10 54.7	23.3	16.2		11 26.5	− 0 42.8	+3.2	46.9
	8277	11 20.8	16.4	23.1					
	8300	7 49.9	33.3	6.2		12 35.0	− 1 55.2	+5.6	45.4
	8338	4 51.9	19.3	20.2					
	8370	15 53.2	26.9	12.8		05 01.1	+ 5 42.1	+3.6	46.8
	4	17 79.6	26.3	13.3					
	13	1 69.0	12.8	27.0		02 26.1	+ 8 20.3	−0.3	46.1
	48	10 61.0	26.5	13.3					
	80	9 77.1	11.9	28.0		10 21.2	+ 0 26.4	−0.8	46.8
	121	9 80.7	20.0	19.8					
	168	7 86.3	17.3	22.6		11.49.0	− 1 00.4	−1.4	47.2
	102	4 09.0	17.4	22.4		09 33.1	+ 1 14.2	−0.6	46.7
	223	6 48.0	21.3	18.6					
	244	17 37.0	21.0	18.7		16 22.6	− 5 38.2	+1.4	45.8
	270	9 88.9	24.5	15.2		07 58.9	+ 2 48.1	−0.3	46.7
	293	14 22.5	24.4	15.3		05 44.5	+ 5 03.0	−0.3	47.2
	327	4 46.9	14.7	25.0					
	416	6 73.9	19.3	20.5					
	453	11 91.9	17.1	22.8		37 08 07.6	+ 2 40.9	−1.9	46.6
	476	22 51.9	21.0	18.9					
	509	− 2 65.4	24.1	15.8		36 57 40.9	+13 01.9	+2.8	45.6
	515	− 2 40.7	24.1	15.8		36 57 48.1	+12 54.2	+2.8	45.1
	Gr. 374	6 75.8	18.7	21.2		37 13 58.9	− 3 12.7	+1.2	47.4
	540	12 29.0	18.8	21.0		16 50.4	− 6 04.6	+1.3	47.1
	569	0 55.3	23.3	16.5					
	650	6 33.3	24.5	16.0					
	658	13 03.5	19.5	21.3		14 13.5	− 3 28.2	+1.8	47.1
	686	13 49.6	23.3	18.0		08 36.7	+ 2 07.5	+2.3	46.5
	712	8 47.6	22.1	19.0		37 11 13.6	− 0 28.4	+1.7	37 10 46.9
	721	9 39.0	22.0	18.9					

In addition to the above, some observations were taken on pair 8070 and 8077 and pair 600 and 631. The results agree very well, but the star-places seem to be bad or wrong. Nevertheless, the observations and results are inserted here, so that they may be used when better star-places are found:—

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d	d.		° ′ ″	′ ″	″	° ′ ″
September 4	8070	4 33.0	26.2	17.9					
	8077	15 27.8	15.0	29.0		37 16 26.5	— 5 40.0	—1.6	37 10 44.9
	600	15 51.8	30.2	18.6					
	631	4 45.2	16.6	32.8		16 24.8	— 5 43.7	—1.3	39.8
September 9	8070	4 29.7	24.0	15.5					
	8077	15 24.7	10.9	28.7		16 27.7	— 5 40.1	—2.6	45.0
	600	15 30.6	20.0	22.3					
	631	4 22.8	18.9	23.7		16 25.9	— 5 44.1	—1.7	40.1
September 10	600	15 73.0	17.7	24.4					
	631	4 50.1	27.2	14.8		16 26.2	— 5 48.8	+1.6	39.1
September 11	8070	4 77.0	25.5	17.1					
	8077	15 67.4	9.0	33.7		16 28.2	— 5 38.7	—4.5	45.0
	600	15 14.5	21.8	24.6					
	631	3 91.3	28.4	18.0		16 26.7	— 5 48.9	—2.1	39.9
September 12	8070	4 52.3	24.6	14.5					
	8077	15 54.7	12.3	26.7		16 28.4	— 5 42.4	—1.2	44.8
	600	15 37.3	23.1	16.8					
	631	4 24.0	15.0	25.0		37 16 26.7	— 5 45.8	—1.0	37 10 39.9

The mean latitude is found to be $37° 10' 46''.53 \pm 0''.02$.

The probable error of one observation is derived from all observations of pairs taken more than twice, and found $= \pm 0''.29$.

ASTRONOMICAL CO-ORDINATES OF TRINIDAD.

Longitude.... $6^h 58^m 00^s.095$ or $104° 30' 01''.42$ west from Greenwich.
Longitude.... $1^h 49^m 47^s.975$ or $27° 26' 59''.62$ west from U. S. Naval Observatory, Washington, D. C.
Latitude .... $37° 10' 46''.53 \pm 0''.02$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY PROF. T. H. SAFFORD AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF FORT UNION, NEW MEXICO.

SEASON OF 1873.

COMPUTATIONS BY

Prof. T. H. SAFFORD and JOHN H. CLARK.

FORT UNION, NEW MEXICO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . 105° 00′ 51″.15 ± 0″.13 west from Greenwich.
Latitude, . . . 35° 54′ 24″.86 ± 0″.22 north.
Barometric altitude of observatory above sea-level, 6744.1 feet.

Fort Union is a military post and supply depot, situated near a branch of Mora Creek. East of it is Turkey Hill, and in the west is a range of mountains which rise between it and Santa Fé. An ordnance depot, in charge of a military storekeeper, lies about 1½ miles west of the post, on the opposite side of the adjacent stream. Some miles northwest is a mesa of picturesque shape, and in a more northerly direction and farther from the post there stands a mountain which is seemingly an extinct volcano. The neighboring tributary of the Mora issues from the mesa by a cañon whose mouth is perhaps 3½ miles from the post in a direction nearly west. It is manifestly an insignificant stream in ordinary circumstances, but subject to heavy freshets.

In latitude the position of this post nearly corresponds with Emory's camp 40, near the crossing of Mora Creek, and in its neighborhood to the town of Mora and in other circumstances it agrees well with Emory's description. The latitude of his camp was 35° 54′ 21″; the chronometric longitude was 6^h 59^m 49^s or 104° 57′ 15″ west of Greenwich. The latter result places his station nearer to the present post than it would be after allowing for the error in the assumed longitude of Fort Leavenworth, and adding, as a correction, 10′ 35″, which would change Emory's determination to 105° 07′ 50″, and place his camp some miles up the cañon to the west.

METEOROLOGICAL CONDITIONS.

The temperature was very equable during the time of occupation. As the astronomer was accompanied by no trained assistant and had no meteorological instruments he could only possess himself of such data as could be extracted from the hospital records, which were obligingly put at his disposal by Captain Peter Moffat, assistant surgeon, U. S. A.

In general, the climate is similar to that of Santa Fé, which station was occupied during the previous month, July. The annual rain-fall at the two places is about equal, and the wet season is of simultaneous occurrence, including the months of July and August. It was observed that the operations at Fort Union, in August, were more interrupted by rainy weather than those at Santa Fé, in July.

So far as noticed, the productions of the country are nearly the same on both sides of the mountains. From Fort Union to Las Vegas the apparent fertility of the country and its opportunities for irrigation increase, as does, apparently, the observed yearly rain-fall.

DESCRIPTION OF OBSERVATORY.

The observatory was a condemned Army wall-tent, with suitable apertures in its sides. The sun-dial of the supply-depot was used as an observing-pier. The stone monument, with an inscription in blank, reached Fort Union the day before the departure of the observer, and was planted about eight feet due south of the sun-dial. The dial, though rather too high for convenience, was very firm and solid. Some inconvenience arose from shifts in azimuth produced by the working of the foot-screws in channels cut in the stone.

In the minor details of the work, such as copying, care of implements, and the preparation of manuscript blanks, of which there were no printed forms in the astronomical outfit, assistance was rendered by Sergeant W. H. Andy of the Fifteenth Infantry, who showed faithfulness and zeal in the discharge of his duties. Lieutenant Eckles, then in command of the post, was kind enough to detail also an additional soldier for a night or two to relieve the sergeant. The lines of the Western Union Telegraph Company, operated by Mr. Theodore Ruthenbeck, were used in the transmission of signals.

The instruments and instrumental values were the same as at Santa Fé, described in the following report on that station.

The length of circuit, from Fort Union to Salt Lake City, was about 1,000 miles. Repeaters were used at Denver, Cheyenne, and Corinne.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

Connection was made with the station at Salt Lake City, John H. Clark, observer, on August 14, 16, 18 and 25. Latitude observations with the zenith telescope were taken upon the nights of August 24, 28, 29 and 30, and with the transit instrument in the prime vertical on August 11 and 12. The latter, however, are not included in the discussion.

The observations at Fort Union were made and computed by Prof. T. H. Safford.

Tabulation of stars used for determination of time at Fort Union, New Mexico, and Salt Lake City, Utah.

Name of star.		Fort Union, New Mexico.							Salt Lake City, Utah.						
		August 14.	August 16.	August 18.	August 19.	August 25.	August 26.	August 27.	August 14.	August 15.	August 16.	August 18.	August 19.	August 25.	August 26.
κ	Ophiuchi								×						
d	Herculis								×						
ε	Ursæ Minoris			×	×		×	×							
ζ	Draconis			×											
a^1	Herculis								×	×	×				
δ	Herculis				×		×	×							
ν	Serpentis								×	×		×			
72	Herculis						×								
	Groombr. 966, S. P.								×	×					
λ	Herculis						×								
α	Ophiuchi			×				×	×	×		×			
ι	Herculis						×	×							
ω	Draconis								×	×	×	×		×	
μ	Herculis				×			×	×	×	×	×			×
ψ	Draconis						×								
88	Herculis													×	×
89	Herculis													×	×
ξ	Draconis							×							
γ	Draconis								×	×	×	×		×	×
67	Ophiuchi				×										
72	Ophiuchi								×	×	×	×	×	×	×
o	Herculis				×		×								
μ^1	Sagittarii								×	×	×	×	×	×	×
A	Herculis							×							
δ	Ursæ Minoris						×	×							
η	Serpentis								×	×	×	×	×	×	×
109	Herculis						×	×							
	Bradl. 2313									×	×	×	×	×	×
ϕ	Draconis							×							
χ	Draconis				×		×								
1	Aquilæ									×	×	×	×	×	×
α	Lyræ			×	×								×	×	×
110	Herculis				×		×	×							
ζ^1	Lyræ													×	×
ζ^2	Lyræ													×	×
β	Lyræ				×		×	×						×	×
50	Draconis													×	×
o	Draconis			×											
ε	Aquilæ			×											
ζ	Aquilæ			×											
θ	Cygni												×		
γ	Aquilæ										×		×		
α	Aquilæ										×				
ε	Draconis										×		×		
β	Aquilæ											×			
τ	Aquilæ										×		×		
θ	Aquilæ										×	×	×		
α^2	Capricorni										×	×	×		
κ	Cephei				×			×							
π	Capricorni											×			
ω^1	Cygni												×		
ε	Delphini							×		×		×	×		×
θ	Cephei	×													
	Groombr. 3741									×				×	×
ζ	Delphini				×										

Tabulation of stars, &c.—Continued.

Name of star.	Fort Union, New Mexico.							Salt Lake City, Utah.						
	August 14.	August 16.	August 18.	August 19.	August 25.	August 26.	August 27.	August 14.	August 15.	August 16.	August 18.	August 19.	August 25.	August 26.
β Delphini				×										
α Delphini	×											×		
α Cygni							×				×		×	×
δ Delphini				×										
γ Delphini	×													
ε Aquarii													×	×
ε Cygni				×										
η Cephei						×								
μ Aquarii											×		×	×
ν Cygni						×	×				×		×	×
ξ Cygni			×			×								
61 Cygni													×	×
ζ Cygni				×			×						×	×
α Equulei						×								
α Cephei		×											×	×
1 Pegasi				×			×							
g Cygni		×												
β Aquarii													×	×
β Cephei	×			×	×	×	×							
74 Cygni		×												
ε Pegasi		×												
κ Pegasi			×		×	×	×							
16 Pegasi	×		×		×	×								
20 Pegasi	×		×		×									
α Aquarii						×								
ι Pegasi		×												
ζ Cephei		×												
24 Cephei			×		×									
31 Pegasi		×			×									
3 Lacertæ	×													
δ Cephei		×												
7 Lacertæ			×		×									
31 Cephei		×	×											
η Pegasi	×				×									
λ Pegasi			×											
μ Pegasi	×		×											
ι Cephei					×									
β Pegasi					×									
α Pegasi		×												
τ Pegasi					×									
υ Pegasi					×									
70 Pegasi		×												
γ Cephei		×												
ω Piscium		×												
α Andromedæ		×												

Observations and reductions for time taken at sending station.

FORT UNION, NEW MEXICO, AUGUST 14, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	θ Cephei	10 51 55.10	+ 6.91	+ 0.82	− 3.54	10 51 59.29	20 27 29.46	+9 35 30.17
E.	α Delphini	58 20.07	− 2.57	+ 0.50	− 1.69	58 16.31	33 46.69	30.38
E.	γ Delphini	11 05 21.87	− 2.56	+ 0.55	− 1.69	11 05 18.17	40 48.20	30.03
W.	β Cephei	51 18.80	+11.64	− 1.26	+ 4.77	51 33.95	21 27 03.97	30.02
W.	16 Pegasi	12 11 49.05	− 1.44	− 0.54	+ 1.81	12 11 48.88	47 19.35	30.47
W.	20 Pegasi	19 28.31	− 2.89	− 0.45	+ 1.67	19 26.64	54 56.54	29.90
W.	3 Lacertæ	43 01.22	+ 3.10	− 0.75	+ 2.63	43 06.20	22 18 36.56	30.36
W.	η Pegasi	13 01 34.62	− 0.90	− 0.58	+ 1.88	13 01 35.02	37 05.34	30.32
W.	μ Pegasi	13 08 25.09	− 1.61	− 0.56	+ 1.79	13 08 24.71	22 43 54.78	+9 35 30.07

NORMAL EQUATIONS.

$0 = +0.023 + 10.535\,\delta t - 2.089\,dc - 0.192\,dc$ $\qquad dt = -0^s.050 \qquad \triangle T_0 = +9^h\,35^m\,30^s.25$

$0 = -0.051 - 2.089\,\delta t + 24.398\,dc - 0.081\,dc$ $\qquad dc = -0^s.052 \qquad c_0 = -\ 1^s.58$

$0 = -0.107 - 0.192\,\delta t - 0.081\,dc + 4.606\,dc$ $\qquad da = +0^s.010 \qquad a_0 = -\ 7^s.11$

Weight of $\triangle T = 6.49$ Weight of $c = 12.08$ Weight of $a = 1.90$

FORT UNION, NEW MEXICO, AUGUST 16, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	α Cephei	11 32 16.98	− 2.95	− 0.13	+ 3.42	11 32 17.32	21 15 35.55	+9 43 18.23
W.	g Cygni	41 28.65	− 0.79	− 0.05	+ 2.30	41 30.11	24 48.11	18.00
W.	74 Cygni	48 34.12	− 0.28	− 0.02	+ 2.09	48 35.91	31 53.90	17.99
W.	ε Pegasi	11 54 38.06	+ 1.42	0.00	+ 1.62	11 54 41.10	21 37 59.30	+9 43 18.20
E.	ι Pegasi	12 17 23.78	+ 14.19	− 0.28	− 1.76	12 17 35.93	22 01 08.28	+9 43 32.35
E.	ζ Cephei	23 46.62	− 45.78	− 0.42	− 3.98	22 57.44	06 29.56	32.12
E.	31 Pegasi	31 19.97	+ 27.97	− 0.20	− 1.63	31 46.11	15 18.38	32.27
E.	δ Cephei	41 47.77	− 46.43	− 0.29	− 3.00	40 58.05	24 30.12	32.07
E.	31 Cephei	51 31.89	−136.96	− 0.27	− 5.47	49 09.19	32 41.30	32.11
E.	α Pegasi	13 14 32.94	+ 25.05	− 0.09	− 1.65	13 14 56.25	58 28.46	32.21
W.	70 Pegasi	38 45.65	+ 27.49	− 0.69	+ 1.64	39 14.09	23 22 46.22	32.13
W.	γ Cephei	53 45.35	−192.85	− 2.90	+ 7.07	50 36.67	34 09.06	32.39
W.	ω Piscium	14 08 43.57	+ 33.18	− 0.76	+ 1.61	14 09 17.60	52 49.59	31.99
W.	α Andromedæ	14 18 08.62	+ 9.88	− 0.86	+ 1.82	14 18 19.46	23 01 51.69	+9 43 32.23

NORMAL EQUATIONS.

First series.

$0 = +0^s.046 + 3.207\,\delta t - 0.346\,da$ $\qquad \delta t = -0.003 \qquad \triangle T_0 = +9^h\,43^m\,18^s.10$ $\qquad$ Weight of $\triangle T = 3.05$

$0 = -0^s.077 - 0.346\,\delta t + 0.748\,da$ $\qquad da = +0.101 \qquad a_0 = +\ 3^s.037$ $\qquad a = 0.71$

Second series.

$0 = +0^s.767 + 7.328\,\delta t + 2.367\,dc + 0.164\,da$ $\qquad \delta t = -0^s.135 \qquad \triangle T_0 = +9^h\,43^m\,32^s.32$

$0 = -1^s.186 + 2.367\,\delta t + 17.752\,dc - 1.118\,da$ $\qquad dc = +0^s.089 \qquad c_0 = -\ 1^s.69$

$0 = -0^s.126 + 0.164\,\delta t - 1.118\,dc + 3.858\,da$ $\qquad da = +0^s.064 \qquad a_0 = +\ 66^s.42$

Weight of $\triangle T = 6\ 99$ Weight of $c = 16.63$ Weight of $a = 3.77$

N. B.—The value of $c = -1^s.601$ was taken from the observations after ε Pegasi. The instrument was somewhat disturbed by the reversal, and, in attempting its adjustment, it was put much more out in azimuth.

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST 18, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	ε Ursæ Minoris....	7 08 46.89	—18.86	+ 0.13	+ 5.62	7 08 33.78	16 59 05.22	+9 50 31.44
W.	ζ Draconis	17 57.02	— 4.29	0.00	+ 1.85	17 54.58	17 08 26.87	32.29
W.	α Ophiuchi........	38 29.75	+ 1.42	— 0.02	+ 0.78	38 31.93	29 04.11	32.18
W.	α Lyræ	8 42 07.48	— 0.22	+ 0.10	+ 0.97	8 42 08.33	18 33 40.23	31.90
E.	ο Draconis	58 52.92	— 2.72	+ 0.72	— 1.48	58 49.44	49 21.56	32.12
E.	ε Aquilæ	9 03 20.67	+ 1.30	+ 0.38	— 0.78	9 03 21.57	53 53.58	32.01
E.	ζ Aquilæ..........	9 09 03.46	+ 1.37	+ 0.37	— 0.78	9 09 04.42	18 59 36.42	+9 50 32.00
E.	ξ Cygni.	11 09 11.29	— 0.63	+ 0.46	— 0.92	11 09 10.20	21 00 21.05	+9 51 10.85
E.	κ Pegasi	47 44.59	+ 0.72	+ 0.44	— 0.74	47 45.01	38 55.97	10.96
E.	16 Pegasi	56 07.92	+ 0.71	+ 0.45	— 0.74	56 81.34	47 19.38	11.04
E.	20 Pegasi	12 03 44.45	+ 1.43	+ 0.41	— 0.68	12 03 45.61	54 56.57	10.96
E.	24 Cephei	16 21.03	— 6.53	+ 1.26	— 2.13	16 13.63	22 07 25.12	11.49
W.	7 Lacertæ..........	34 55.32	— 1.28	+ 0.10	+ 1.03	34 55.17	26 06.08	10.91
W.	31 Cephei	41 35.53	— 7.22	+ 0.13	+ 2.29	41 30.73	32 41.33	10.60
W.	λ Pegasi	49 14.38	+ 0.86	+ 0.03	+ 0.72	49 15.99	40 27.21	11.22
W.	μ Pegasi	12 52 41.85	+ 0.79	+ 0.02	+ 0.73	12 52 43.39	22 43 54.84	+9 51 11.45

NORMAL EQUATIONS.

First series.

$0 = -0^s.321 + 4.544\,\delta t - 0.690\,dc - 0.185\,da$ $\qquad \delta t = +0^s.057 \qquad \triangle T_0 = +9^h\,50^m\,32^s.00$

$0 = +1^s.044 - 0.690\,\delta t + 11.290\,dc + 2.498\,da$ $\qquad dc = +0^s.098 \qquad c_0 = -\ 0^s.66$

$0 = +0^s.149 - 0.185\,\delta t + 2.498\,dc + 2.642\,da$ $\qquad da = +0^s.041 \qquad a_0 = +\ 3^s.477$

Weight of $\triangle T = 4.50$ Weight of $c = 8.89$ Weight of $a = 2.09$

Second series.

$0 = -0^s.007 + 6.091\,\delta t + 0.364\,dc - 0.308\,da$ $\qquad \delta t = +0^s.003 \qquad \triangle T_0 = +9^h\,51^m\,11^s.08$

$0 = +0^s.112 + 0.364\,\delta t + 13.595\,dc - 0.020\,da$ $\qquad dc = -0^s.008 \qquad c_0 = -\ 0^s.66$

$0 = -0^s.075 - 0.308\,\delta t - 0.020\,dc + 2.400\,da$ $\qquad da = +0^s.031 \qquad a_0 = +\ 3^s.471$

Weight of $\triangle T = 6.04$ Weight of $c = 13.57$ Weight of $a = 2.38$

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST, 19, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	ε Ursæ Minoris	7 05 01.36	−11.36	− 1.00	− 5.51	7 04 43.49	16 59 05.02	+9 54 21.53
E.	δ Herculis	15 29.44	+ 0.44	− 0.21	− 0.82	15 28.85	17 09 50.50	21.65
E.	μ Herculis	47 10.10	+ 0.34	− 0.33	− 0.84	47 09.27	41 31.00	21.73
E.	67 Ophiuchi	59 57.34	+ 1.15	− 0.27	− 0.74	59 57.48	54 19.00	21.52
E.	o Herculis	8 08 16.63	+ 0.30	− 0.40	− 0.85	8 08 15.68	18 02 37.10	21.42
W.	χ Draconis	29 08.08	− 9.20	− 0.22	+ 2.50	29 01.16	23 22.81	21.65
W.	α Lyræ	38 18.23	− 0.28	− 0.08	+ 0.95	38 18.82	32 40.21	21.39
W.	110 Herculis	45 50.08	+ 1.30	− 0.05	+ 0.79	45 52.12	40 13.83	21.71
W.	β Lyræ	8 51 02.65	+ 0.26	− 0.04	+ 0.89	8 51 03.76	18 45 25.36	+9 54 21.60
W.	κ Cephei	10 18 29.23	−11.85	− 0.70	+ 3.35	10 18 20.03	20 13 10.99	+9 54 50.96
W.	ζ Delphini	34 31.47	+ 1.50	− 0.16	+ 0.76	34 33.57	29 24.47	50.90
W.	β Delphini	36 44.83	+ 1.50	− 0.16	+ 0.76	36 46.93	31 37.89	50.96
W.	δ Delphini	42 41.07	+ 1.47	− 0.15	+ 0.76	42 43.15	37 34.11	50.96
W.	ε Cygni	46 14.61	+ 0.20	− 0.18	+ 0.88	46 15.51	41 06.68	51.17
E.	ζ Cygni	11 12 43.61	+ 0.18	+ 0.46	− 0.87	11 12 43.38	21 07 34.28	50.90
E.	1 Pegasi	21 24.15	+ 0.45	+ 0.47	− 0.78	21 24.29	16 15.16	50.87
E.	β Cephei	11 32 16.40	− 2.42	+ 1.19	− 2.15	11 32 13.02	21 27 03.93	+9 54 50.91

NORMAL EQUATIONS.

First series.

Before reversal—

$$0 = -0^s.071 + 3.606\,\delta t + 4.365\,dc + 0.581\,da$$
$$0 = -0^s.128 + 4.365\,\delta t + 7.917\,dc - 1.663\,da$$
$$0 = +0^s.037 + 0.581\,\delta t - 1.663\,dc + 2.266\,da$$

$\Delta T_0 = +9^h\,54^m\,21^s.56$
$a_0 = +\ 2^s.136$
$c_0 = -\ 0^s.75$

After reversal—

$$0 = +0^s.094 + 2.824\,\delta t - 3.926\,dc - 0.318\,da$$
$$0 = -0^s.463 - 3.926\,\delta t + 6.623\,dc + 1.576\,da$$
$$0 = -0^s.354 - 0.318\,\delta t + 1.576\,dc + 1.149\,da$$

$\Delta T_0 = +9^h\,54^m\,21^s.56$
$a_0 = +\ 4^s.272$
$c_0 = -\ 0^s.75$

Eliminating both values of *da*—

$$0 = -0^s.084 + 6.193\,\delta t + 1.301\,dc$$
$$0 = -0^s.078 + 1.301\,\delta t + 11.157\,dc$$

$\delta t = +0^s.011$
$dc = +0^s.006$
Before reversal $da = -0^s.015$
After reversal $da = +0^s.303$

Weight of $\Delta T = 6.04$ Weight of $c = 10.88$

Second series.

Before reversal—

$$0 = +0^s.091 + 4.025\,\delta t - 4.876\,dc + 0.684\,da$$
$$0 = +0^s.077 - 4.876\,\delta t + 7.817\,dc + 1.013\,da$$
$$0 = +0^s.631 + 0.684\,\delta t + 1.013\,dc + 1.900\,da$$

$\Delta T_0 = +9^h\,54^m\,50^s.94$
$a_0 = +\ 4^s.272$
$c_0 = -\ 0^s.75$

After reversal—

$$0 = +0^s.103 + 2.268\,\delta t + 3.159\,dc - 0.290\,da$$
$$0 = +0^s.159 + 3.159\,\delta t + 5.444\,dc - 1.305\,da$$
$$0 = -0^s.024 - 0.290\,\delta t - 1.305\,dc + 1.082\,da$$

$\Delta T_0 = +9^h\,54^m\,50^s.94$
$a_0 = +\ 1^s.432$
$c_0 = -\ 0^s.75$

Eliminating both values of *da*—

$$0 = -0^s.039 + 5.970\,\delta t - 2.432\,dc$$
$$0 = -0^s.129 - 2.432\,\delta t + 11.147\,dc$$

$\delta t = +0^s.012$
$dc = +0^s.014$
Before reversal $da = -0^s.344$
After reversal $da = +0^s.042$

Weight of $\Delta T = 5.44$

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST 25, 1873.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	β Cephei	11 09 57.68	−80.25	+ 0.55	− 2.02	11 09 35.96	21 27 03.86	+10 18 27.90
E.	κ Pegasi	20 18.56	+10.16	+ 0.21	− 0.77	20 28.16	38 55.99	27.83
E.	16 Pegasi	28 42.22	+ 9.93	+ 0.17	− 0.76	28 51.56	47 19.41	27.85
E.	20 Pegasi	36 09.53	+19.91	+ 0.13	− 0.71	36 28.86	54 56.61	27.75
E.	24 Cephei	50 30.47	−91.30	+ 0.22	− 2.21	48 57.18	22 07 25.10	27.92
E.	31 Pegasi	56 30.77	+20.59	+ 0.06	− 0.71	56 50.71	15 18.45	27.74
E.	7 Lacertæ	12 07 57.73	−17.93	+ 0.03	− 1.07	12 07 38.76	26 06.13	27.37
E.	η Pegasi	18 31.87	+ 6.22	0.00	− 0.80	18 37.29	37 05.46	28.17
W.	ι Cephei	27 42.68	−59.50	− 0.11	+ 1.67	26 44.74	45 12.80	28.06
W.	β Pegasi	39 02.79	+ 8.31	− 0.08	+ 0.78	39 11.80	57 39.54	27.74
W.	Br. 3077	49 16.37	−31.69	− 0.14	+ 1.25	48 45.79	23 07 13.30	27.51
W.	τ Pegasi	55 42.93	+12.06	− 0.09	+ 0.76	55 55.66	14 23.56	27.90
W.	υ Pegasi	13 00 24.16	+12.33	− 0.10	+ 0.75	13 00 37.14	23 19 04.94	+10 18 27.80

NOTE.—The Y's of the instrument were bent, as noticed in the Santa Fé report. Before the signals, a few stars were observed in the W. position of the clamp; but on reversing the axis it was found that the pivots did not rest properly in the Y's.

NORMAL EQUATIONS.

Before reversal—

$$0 = +0^s.682 + 6.221\,\delta t + 8.341\,dc - 0.087\,da \qquad \triangle T_0 = +10^h\,18^m\,27^s.70$$
$$0 = +1^s.087 + 8.341\,\delta t + 13.500\,dc - 2.507\,da \qquad a_0 = +\,49^s.02$$
$$0 = -0^s.198 - 0.087\,\delta t - 2.507\,dc + 2.538\,da \qquad c_0 = -\,0^s.53$$

After reversal—

$$0 = -0^s.914 + 3.895\,\delta t - 5.368\,dc - 0.465\,da \qquad \triangle T_0 = +10^h\,18^m\,27^s.70$$
$$0 = +0^s.668 - 5.368\,\delta t + 8.250\,dc + 1.556\,da \qquad a_0 = +\,49^s.02$$
$$0 = -0^s.589 - 0.378\,\delta t + 1.556\,dc + 1.076\,da \qquad c_0 = -\,0^s.53$$

Eliminating both values of *da*—

$$0 = -0^s.446 + 9.980\,\delta t + 3.434\,dc \qquad \delta t = +0^s.100$$
$$0 = +2^s.411 + 3.434\,\delta t + 17.022\,dc \qquad dc = -0^s.162$$

Before reversal $da = -0^s.078$

After reversal $da = +0^s.816$

Weight of $\triangle T = 9.29$

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST 26, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	ε Ursæ Minoris	6 37 24.22	+ 4.28	— 1.74	— 5.22	6 37 21.54	16 59 03.80	+10 21 42.26
E.	δ Herculis	48 10.05	— 0.17	— 0.37	— 0.78	48 08.73	17 09 50.37	41.64
E.	72 Herculis	54 15.77	— 0.05	— 0.42	— 0.83	54 14.47	15 56.12	41.65
E.	λ Herculis	7 03 57.66	— 0.15	— 0.41	— 0.78	7 03 56.32	25 37.81	41.49
E.	ι Herculis	14 14.16	+ 0.20	— 0.56	— 1.02	14 12.78	35 54.23	41.45
E.	ψ Draconis	22 33.73	+ 1.55	— 1.08	— 2.30	22 31.90	44 13.32	41.42
W.	ο Herculis	40 54.06	+ 0.13	+ 0.41	+ 0.80	40 55.40	18 02 36.98	41.58
W.	δ Ursæ Minoris	51 36.73	—11.63	+ 3.34	+11.90	51 40.34	13 20.93	40.59
W.	109 Herculis	56 36.05	+ 0.23	+ 0.30	+ 0.76	56 37.34	18 18.96	41.62
W.	χ Draconis	8 01 39.46	— 1.79	+ 0.70	+ 2.36	8 01 40.73	23 22.34	41.61
W.	110 Herculis	18 31.03	+ 0.25	+ 0.18	+ 0.77	18 32.23	40 13.74	41.51
W.	β Lyræ	8 23 42.67	+ 0.05	+ 0.17	+ 0.84	8 23 43.73	18 45 25.24	+10 21 41.51
W.	η Cephei	10 20 26.57	— 0.33	+ 0.72	+ 1.56	10 20 28.52	20 42 44.71	+10 22 16.19
W.	ν Cygni	30 11.38	— 0.04	+ 0.46	+ 0.99	30 12.79	52 28.62	15.83
W.	ξ Cygni	38 03.73	— 0.07	+ 0.44	+ 1.03	38 05.13	21 00 21.01	15.88
W.	α Equulei	47 13.93	+ 0.19	+ 0.25	+ 0.75	47 15.12	09 30.94	15.82
E.	β Cephei	11 04 49.83	— 0.60	+ 0.96	— 2.20	11 04 47.99	27 03.84	15.85
E.	κ Pegasi	16 40.35	+ 0.08	+ 0.51	— 0.83	16 40.11	38 55.99	15.88
E.	16 Pegasi	25 03.76	+ 0.07	+ 0.56	— 0.83	25 03.56	47 19.41	15.85
E.	α Aquarii	11 37 02.19	+ 0.22	+ 0.38	— 0.75	11 37 02.04	21 59 18.18	+10 22 16.14

NORMAL EQUATIONS.

First series.

Before reversal—

$$0 = +0^s.477 + 3.860\,\delta t + 5.466\,dc - 0.531\,da \qquad \triangle T_0 = +10^h\,21^m\,41^s.68$$
$$0 = +0^s.732 + 5.466\,\delta t + 10.098\,dc - 2.950\,da \qquad c_0 = -\;0^s.71$$
$$0 = -0^s.137 - 0.531\,\delta t - 2.950\,dc + 2.142\,da \qquad a_0 = -\;0^s.84$$

After reversal—

$$0 = +0^s.519 + 4.050\,\delta t - 5.173\,dc + 0.039\,da \qquad \triangle T_0 = +10^h\,21^m\,41^s.68$$
$$0 = -0^s.575 - 5.173\,\delta t + 8.606\,dc + 1.684\,da \qquad c_0 = -\;0^s.71$$
$$0 = +0^s.103 + 0.039\,\delta t + 1.684\,dc + 1.760\,da \qquad a_0 = +\;0^s.95$$

Eliminating both values of da—

$$0 = +0^s.960 + 7.777\,\delta t - 0.475\,dc \qquad \delta t = -0^s.123$$
$$0 = -0^s.130 - 0.475\,\delta t + 13.031\,dc \qquad dc = +0^s.006$$

Before reversal $da = +0^s.042$
After reversal $da = -0^s.061$

Weight of $\triangle T = 7.76$ Weight of $c = 13.01$

Second series.

$$0 = -0^s.801 + 6.458\,\delta t - 0.160\,dc + 0.213\,da \qquad \delta t = +0^s.119 \qquad \triangle T_0 = +10^h\,22^m\,15^s.80$$
$$0 = +0^s.539 - 0.160\,\delta t + 12.714\,dc + 0.045\,da \qquad dc = -0^s.041 \qquad c_0 = -\;0^s.71$$
$$0 = -0^s.303 + 0.213\,\delta t + 0.045\,dc + 2.136\,da \qquad da = +0^s.131 \qquad a_0 = +\;0^s.235$$

Weight of $\triangle T = 6.44$ Weight of $c = 12.71$ Weight of $a = 2.13$

Observations and reductions for time taken at sending station—Continued.

FORT UNION, NEW MEXICO, AUGUST 27, 1873.

Clamp.	Name of star.		T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
			h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m s.*	*h. m. s.*
W.	ε	Ursæ Minoris...	6 33 29.06	— 7.26	+ 1.24	+ 4.50	6 33 27.54	16 59 03.62	+ 9 25 36.08
W.	δ	Herculis	44 13.53	+ 0.28	+ 0.26	+ 0.67	44 14.74	17 09 50.35	35.61
W.	α	Ophiuchi.......	7 03 26.98	+ 0.55	+ 0.20	+ 0.62	7 03 28.35	29 03.97	35.62
W.	ι	Herculis	10 17.88	— 0.34	+ 0.30	+ 0.88	10 18.72	35 54.21	35.49
W.	μ	Herculis	15 54.20	+ 0.22	+ 0.23	+ 0.69	15 55.34	41 30.86	35.52
W.′	ζ	Draconis	25 45.57	— 0.89	+ 0.34	+ 1.11	25 46.13	51 21.49	35.36
E.	A	Herculis	41 34.21	+ 0.07	+ 0.04	— 0.71	41 33.61	18 07 09.17	35.56
E.	δ	Ursæ Minoris...	48 03.85	— 9.61	+ 0.68	—10.28	47 44.64	13 20.50	35.86
E.	109	Herculis	52 43.74	+ 0.19	+ 0.09	— 0.65	52 43.37	18 18.94	35.57
E.	φ	Draconis	57 03.80	— 1.33	+ 0.27	— 1.90	57 00.84	22 36.46	35.62
E.	110	Herculis	8 14 38.37	+ 0.21	+ 0.17	— 0.65	8 14 38.10	40 13.73	35.63
E.	β	Lyræ	8 19 50.34	+ 0.04	+ 0.20	— 0.73	8 19 49.85	18 45 25.24	+ 9 25 35.39
E.	κ	Cephei	9 47 10.07	— 2.45	+ 0.78	— 3.34	9 47 05.06	20 13 10.52	+10 26 05.46
E.	ε	Delphini	10 01 06.18	+ 0.35	+ 0.19	— 0.75	10 01 05.97	27 11.01	05.04
E.	α	Cygni..........	11 04.47	— 0.18	+ 0.24	— 1.03	11 03.50	37 08.37	04.87
E.	ν	Cygni..........	26 24.65	— 0.09	+ 0.15	— 0.97	26 23.74	52 28.61	04.87
W.	ζ	Cygni..........	41 27.81	+ 0.10	+ 0.40	+ 0.84	41 29.15	21 07 34.26	05.11
W.	1	Pegasi	50 08.70	+ 0.25	+ 0.31	+ 0.78	50 10.04	16 15.16	05.12
W.	β	Cephei	11 00 57.58	— 1.33	+ 0.62	+ 2.14	11 00 59.01	27 03.82	04.81
W.	κ	Pegasi	11 12 49.73	+ 0.17	+ 0.22	+ 0.81	11 12 50.93	21 38 55.99	+10 26 05.06

NORMAL EQUATIONS.

First series.

Before reversal—

$$0 = +0^s.986 + 4.384\,\delta t - 5.797\,dc - 0.118\,da$$
$$0 = -2^s.301 - 5.797\,\delta t + 9.687\,dc + 2.046\,da$$
$$0 = -1^s.034 - 0.118\,\delta t + 2.046\,dc + 1.838\,da$$

After reversal—

$$0 = -0^s.086 + 3.938\,\delta t + 5.013\,dc + 0.125\,da$$
$$0 = -0^s.571 + 5.013\,\delta t + 8.111\,dc - 1.454\,da$$
$$0 = +0^s.397 + 0.125\,\delta t - 1.454\,dc + 1.528\,da$$

Eliminating both values of da—

$$0 = +0^s.802 + 8.304\,\delta t - 0.534\,dc \qquad \delta t = -0^s.091 \qquad \Delta T_0 = 10^h\,25^m\,35^s.63$$
$$0 = -1^s.343 - 0.534\,\delta t + 14.136\,dc \qquad dc = +0^s.092 \qquad c_0 = -\ 0^s.70$$
$$da' = +0^s.454 \qquad a_0 = +\ 0^s.90$$
$$da'' = -0^s.165 \qquad a_0 = +\ 0^s.90$$

Weight of $\Delta T = 8.28$ Weight of $c = 14.10$

Second series.

$$0 = -0^s.340 + 5.856\,\delta t + 0.023\,dc - 0.349\,da \qquad \delta t = +0^s.053 \qquad \Delta T_0 = 10^h\,26^m\,4^s.96$$
$$0 = +0^s.367 + 0.023\,\delta t + 13.853\,dc - 1.054\,da \qquad dc = -0^s.033 \qquad c_0 = -\ 0^s.70$$
$$0 = +0^s.228 - 0.349\,\delta t - 1.054\,dc + 2.826\,da \qquad da = -0^s.087 \qquad a_0 = +\ 0^s.90$$

Weight of $\Delta T = 5.81$ Weight of $c = 13.46$ Weight of $a = 2.72$

Observations and reductions for time taken at receiving station.

SALT LAKE CITY, UTAH, AUGUST 14, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	κ Ophiuchi........	8 44 35.67	− 0.86	+ 0.06	+ 0.08	8 44 34.95	16 51 41.03	+8 07 06.08
E.	d Herculis	49 50.51	− 0.24	+ 0.12	+ 0.09	49 50.48	56 56.48	06.00
E.	a^1 Herculis	9 01 47.49	− 0.75	+ 0.09	+ 0.08	9 01 46.91	17 08 53.11	06.20
E.	ν Serpentis........	06 38.05	− 1.34	+ 0.06	+ 0.08	06 36.85	13 43.02	06.17
E.	Groom. 966, S. P..	15 45.94	− 5.66	− 0.18	− 0.28	15 39.82	5 22 45.93	06.11
E.	a Ophiuchi........	21 58.62	− 0.73	+ 0.10	+ 0.08	21 58.07	17 29 04.15	06.18
W.	ω Draconis	30 35.49	+ 2.12	+ 0.29	− 0.21	30 37.69	37 43.83	06.14
W.	μ Herculis	34 25.45	− 0.41	+ 0.12	− 0.08	34 25.08	41 31.10	06.02
W.	γ Draconis	46 34.77	+ 0.49	+ 0.17	− 0.12	46 35.31	53 41.43	06.12
W.	72 Ophiuchi........	54 16.55	− 0.86	+ 0.09	− 0.08	54 15.70	18 01 21.65	05.95
W.	μ^1 Sagittarii	59 07.84	− 1.55	+ 0.05	− 0.08	59 06.26	06 12.41	06.15
W.	η Serpentis........	10 07 41.47	− 1.12	+ 0.08	− 0.08	10 07 40.35	18 14 46.33	+8 07 05.98
	Mean at 17h.5 local sidereal time							+8 07 06.08

NORMAL EQUATIONS.

$$
\begin{aligned}
+12.00\,\delta t + 6.70\,a - 7.15\,c &= -10.54 & \delta t &= +0^s.08 \\
+6.70\,\delta t + 16.92\,a - 9.33\,c &= -27.76 & a &= -1^s.630 \\
-7.15\,\delta t - 9.33\,a + 35.18\,c &= +17.31 & c &= +0^s.075
\end{aligned}
$$

SALT LAKE CITY, UTAH, AUGUST 15, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	a^1 Herculis	9 01 47.33	− 0.82	+ 0.03	+ 0.14	9 01 46.68	17 08 53.09	+8 07 06.41
E.	ν Serpentis........	06 37.95	− 1.46	+ 0.03	+ 0.14	06 36.66	13 43.01	06.35
E.	Groom. 966, S. P..	15 46.35	− 6.18	− 0.13	− 0.52	15 39.52	22 46.03	06.51
E.	a Ophiuchi........	21 58.49	− 0.80	+ 0.04	+ 0.14	21 57.87	29 04.14	06.27
E.	ω Draconis	30 34.62	+ 2.31	− 0.10	+ 0.38	30 37.21	37 43.77	06.56
E.	μ Herculis	34 24.96	− 0.45	− 0.09	+ 0.15	34 24.57	41 31.08	06.51
W.	γ Draconis	46 34.73	+ 0.53	0.00	− 0.22	46 35.04	53 41.41	06.37
W.	72 Ophiuchi........	54 16.34	− 0.94	− 0.01	− 0.14	54 15.25	18 01 21.64	06.39
W.	μ^1 Sagittarii	59 07.86	− 1.69	− 0.02	− 0.15	59 06.00	06 12.40	06.40
W.	η Serpentis........	10 07 41.38	− 1.23	− 0.01	− 0.14	10 07 40.00	14 46.33	06.33
W.	Bradl. 2313	14 55.02	− 1.51	+ 0.02	− 0.14	14 53.39	21 59 80	06.41
W.	1 Aquilæ..........	10 21 15.10	− 1.35	+ 0.03	− 0.14	10 21 13.64	18 28 19.91	+8 07 06.27
	Mean at 18h.0 local sidereal time							+8 07 06.40

NORMAL EQUATIONS.

$$
\begin{aligned}
+12.00\,\delta t + 7.63\,a - 3.60\,c &= -9.31 & \delta t &= +0^s.40 \\
+7.63\,\delta t + 17.92\,a - 18.34\,c &= -31.40 & a &= -1^s.780 \\
-3.60\,\delta t - 18.34\,a + 34.80\,c &= -36.10 & c &= +0^s.136
\end{aligned}
$$

Observations and reductions for time taken at receiving station—Continued.

SALT LAKE CITY, UTAH, AUGUST 18, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	ν Serpentis	9 06 38.42	— 1.36	— 0.01	+ 0.15	9 06 37.20	17 13 42.97	+8 07 05.77
E.	α Ophiuchi	21 58.88	— 0.80	— 0.03	+ 0.15	21 58.20	29 04.10	05.90
E.	ω Draconis	30 35.50	+ 2.16	— 0.22	+ 0.39	30 37.83	37 43.61	05.78
E.	μ Herculis	34 25.33	— 0.42	— 0.13	+ 0.16	34 24.94	41 31.03	06.09
W.	γ Draconis	46 35.00	+ 0.50	+ 0.12	— 0.23	46 35.39	53 41.33	05.94
W.	72 Ophiuchi	54 16.79	— 0.88	+ 0.05	— 0.14	54 15.82	18 01 21.61	05.79
W.	μ^1 Sagittarii	59 08.23	— 1.58	+ 0.02	— 0.15	59 06.52	06 12.37	05.85
W.	η Serpentis	10 07 41.77	— 1.15	+ 0.04	— 0.14	10 07 40.52	14 46.30	05.78
W.	Bradl. 2313	14 55.51	— 1.41	+ 0.05	— 0.15	14 54.00	21 59.77	05.77
W.	1 Aquilæ	10 21 15.34	— 1.26	+ 0.07	— 0.14	10 21 14.01	18 28 19.89	+8 07 05.88
	Mean at $17^h.5$ local sidereal time							+8 07 05.85

NORMAL EQUATIONS.

$$+10.00\,\delta t + 3.73\,a - 0.78\,c = -7.75 \qquad \delta t = -0^s.15$$
$$+3.73\,\delta t + 5.70\,a - 5.43\,c = -10.83 \qquad a = -1^s.660$$
$$-0.78\,\delta t - 5.43\,a + 18.92\,c = +11.83 \qquad c = +0^s.142$$

SALT LAKE CITY, UTAH, AUGUST 18, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	β Aquilæ	11 42 01.93	— 1.03	+ 0.06	— 0.15	11 42 00.81	19 49 06.76	+8 07 05.95
W.	θ Aquilæ	57 42.81	— 1.21	+ 0.06	— 0.15	57 41.51	20 04 47.44	05.93
W.	α^2 Capricorni	12 03 58.60	— 1.49	+ 0.06	— 0.15	12 03 57.02	10 02.98	05.96
W.	π Capricorni	13 01.64	— 1.64	+ 0.05	— 0.15	13 59.90	20 05.71	05.81
W.	ε Delphini	20 05.97	— 0.92	+ 0.09	— 0.15	20 04.99	27 11.03	06.04
E.	α Cygni	30 01.90	+ 0.15	+ 0.24	+ 0.21	30 02.50	37 08.45	05.95
E.	μ Aquarii	38 45.91	— 1.40	+ 0.09	+ 0.15	38 44.75	45 50.70	05.95
E.	ν Cygni	12 45 22.35	0.00	+ 0.16	+ 0.20	12 45 22.71	20 52 28.62	+8 07 05.91
	Mean at 20^h local sidereal time							+8 07 05.94

NORMAL EQUATIONS.

$$+8.00\,\delta t + 4.18\,a - 1.37\,c = -8.23 \qquad \delta t = -0^s.06$$
$$+4.18\,\delta t + 3.16\,a - 2.90\,c = -6.42 \qquad a = -1^s.800$$
$$-1.37\,\delta t - 2.90\,a + 9.97\,c = +6.82 \qquad c = +0^s.152$$

The observations for time taken at Salt Lake City August 16, 19, 25 and 26 are printed in the report on Labran, Colorado.

The following tables show the corrections and rates of the chronometers used at Fort Union and Salt Lake City:

CHRONOMETER AT FORT UNION.—FRODSHAM, No. 1974.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	h.	h. m. s. s	s.
Aug. 14	21.5	9 35 30.200±0.041	+9.725
Aug. 16	22.5	43 27.489±0.033	9.766
Aug. 18	20.0	50 51.570±0.033	9.775
Aug. 19	19.0	54 36.352±0.031	9.792
Aug. 25	22.0	10 18 27.800±0.034	9.750
Aug. 26	19.75	21 58.738±0.028	9.752
Aug. 27	19.50	10 25 50.276±0.029	9.772

CHRONOMETER AT SALT LAKE CITY.—NEGUS, No. 1511.

Dato.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	h.	h. m. s.	s.
Aug. 14	17.5	+ 8 07 06.08	— 0.013
Aug. 15	18.0	06.40	....
Aug. 16	19.0	06.05	0.00
Aug. 18	18.8	05.90	0.00
Aug. 19	20.0	06.04	+ 0.006
Aug. 25	19.5	04.37	+ 0.010
Aug. 26	19.5	+ 8 07 04.16	+ 0.009

NOTE.—The probable error of a star at the equator was found to be $\pm 0^s.105$ by the combination of all the observations.

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
August 14, 1873:		h. m. s.	h. m. s.	h. m. s.	m. s.	s.	m. s.
Fort Union	Fort Union	10 02 50.00	+ 9 35 12.05	19 38 02.05			
	Salt Lake City.	11 03 24.66	+ 8 07 06.10	19 10 30.76	27 31.29		
Salt Lake City.	Fort Union	10 13 57.53	+ 9 35 13.86	19 49 11.39			
	Salt Lake City.	11 14 33.76	+ 8 07 06.10	19 21 39.86	31.53	0.24	27 31.410
August 16, 1873:							
Salt Lake City.	Fort Union	9 39 41.54	+ 9 42 56.99	19 22 38.53			
	Salt Lake City.	10 48 00.77	+ 8 07 06.05	18 55 06.82	31.71		
Fort Union	Fort Uniou	9 54 38.18	+ 9 42 59.43	19 37 37.61			
	Salt Lake City.	11 03 00.32	+ 8 07 06.05	19 10 06.37	31.21	0.47	31.475
August 18, 1873:							
Salt Lake City.	Fort Union	10 01 15.35	+ 9 50 50.28	19 52 05.63			
	Salt Lako City.	11 17 28.11	+ 8 07 05.90	19 24 34.01	31.62		
Fort Union	Fort Uniou	10 11 30.00	+ 9 50 52.44	20 05 22.44			
	Salt Lako City.	11 30 45.24	+ 8 07 05.90	19 37 51.14	27 31.30	0.32	27 31.460

Final results of longitude—Continued.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
August 25, 1873:		*h. m. s.*	*h. m. s.*	*h. m. s.*	*m. s.*	*s.*	*m. s.*
Salt Lake City	Fort Union	10 20 18.39	+10 18 14.57	20 38 32.96			
	Salt Lake City.	12 03 56.96	+ 8 07 04.36	20 11 01.32	27 31.64		
Fort Union	Fort Union	10 25 00.00	+10 18 15.30	20 43 15.30			
	Salt Lake City.	12 08 39.68	+ 8 07 04.36	20 15 44.04	27 31.26	0.38	27 31.450

Fort Union east of Salt Lake City.. $0^h\ 27^m\ 31^s.45 \pm 0^s.009$
Adopted longitude of Salt Lake City .... $7^h\ 27^m\ 34^s.86$
Fort Union west of Greenwich......................................$7^h\ 00^m\ 03^s.41$, or $105°\ 00'\ 51''.15$
Fort Union west of Washington ....$1^h\ 51^m\ 51^s.29$, or $27°\ 57'\ 49''.35$

Mean places of stars for 1873.0 *used for determination of latitude of Fort Union, New Mexico.*

No. of pair.	No. in B. A. C.	Right ascension.	Declination.	No. of pair.	No. in B. A. C.	Right ascension.	Declination.
		h. m. s.	° ′ ″			*h. m. s.*	° ′ ″
1........	6006	17 37 42	68 48 58.70	22........	7105	20 28 40	56 20 56.96
	6020	41 31	2 45 24.30		7149	33 44	15 27 55.44
2........	6091	17 53 39	51 30 16.38	23........	7176	20 37 36	60 02 47.64
	6159	18 03 24	20 01 37.50		7223	43 35	12 04 18.22
3........	(Gr. 2494)	17 55 15	45 29 04.32	24........	7188	20 39 23	24 49 02.94
	6151	18 02 42	26 04 55.72		7198	40 25	46 50 12.56
4........	6203	18 11 42	42 07 01.44	25......	(XX 358)	20 46 05	27 46 26.00
	6232	14 58	29 36 45.28		7253	48 45	43 54 26.14
5........	6237	18 16 04	29 47 59.32	26........	7275	20 52 36	21 50 10.30
	(Gr. 2563)	20 15	42 23 58.10		7294	54 26	49 58 09.92
6........	6302	18 23 20	72 40 37.00	27........	7368	21 07 32	29 42 25.30
	6307	25 24	− 1 05 28.20		(Gr. 3424)	12 34	42 09 08.02
7........	6438	18 46 51	21 16 24.66	28........	7324	21 04 10	9 37 15.80
	6470	50 05	50 33 04.20		7416	15 33	62 02 51.86
8........	6500	18 55 23	58 03 02.80	29........	7418	21 16 13	19 15 43.66
	6528	59 35	13 40 34.58		7468	22 34	52 20 50.98
9........	6566	19 05 19	50 09 34.52	30........	7444	21 18 56	25 37 44.78
	6574	07 10	21 20 31.60		7455	20 40	46 09 53.74
10........	6602	19 12 21	22 47 54.24	31........	7493	21 27 01	70 00 11.44
	6626	15 15	49 20 04.46		7527	33 07	1 40 25.38
11........	6678	19 23 48	20 01 10.64	32........	7542	21 34 31	61 30 34.18
	6697	26 30	51 27 35.72		7553	36 21	10 14 46.14
12........	6690	19 25 36	27 41 40.22	33........	7567	21 38 30	16 46 07.36
	6731	32 42	44 24 56.30		7631	47 44	55 12 00.92
13........	(*)	19 32 27	29 19 42.56	34........	7664	21 54 54	12 30 44.60
	6745	35 18	42 31 33.70		7698	22 00 04	59 15 04.56
14........	6762	19 38 44	26 49 58.24	35........	7742	22 05 43	15 24 56.48
	6779	41 00	44 49 18.34		7754	07 14	56 12 30.64
15........	6799	19 43 44	47 35 40.54	36........	7807	22 17 33	20 12 25.96
	6835	49 08	23 59 16.08		7815	18 34	51 35 35.94
16........	6824	19 47 26	52 39 58.84	37........	7850	22 25 00	42 28 22.38
	6858	53 07	19 08 54.82		7923	37 03	29 33 27.72
17........	(Gr. 2977)	19 51 17	47 12 18.48	38........	7961	22 44 32	55 13 45.34
	6883	56 38	24 35 01.68		7975	46 47	16 10 04.62
18........	6895	19 57 46	49 45 07.30	39........	8058	23 01 51	45 42 04.78
	6927	20 03 11	21 47 09.14		8079	05 39	26 09 42.44
19........	6918	20 01 40	51 28 32.38	40........	8097	09 34	27 33 21.26
	6933	04 20	20 32 21.06		8110	11 18	44 28 25.30
20........	6941	20 05 28	20 45 28.82	41........	8153	23 16 53	59 26 14.62
	6959	09 00	51 04 56.40		8182	23 22 44	12 03 35.63
21........	6943	20 06 29	26 25 52.82	5 *bis*....	6231	18 14 56	21 54 33.56
	(Gr. 3110)	11 53	45 11 30.36		6252	17 56	49 39 50.26

* A star following B. A. C. 6714.

Observations and computations for latitude.

FORT UNION, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 24	Gr. 2494	34 30.7	36.0	28.0					
	6151	26 72.2	41.0	43.5					
	6231	29 92.0	35.0	49.5					
	6251	26 93.0	49.5	35.0					
	6438	23 57.5	29.0	57.0					
	6470	24 27.0	52.0	35.0		35 54 53.58	− 0 22,37	− 3.00	35 54 28.21
	6500	21 43.0	42.7	43.7					
	6528	26 08.3	32.5	54.0		35 51 57.36	+ 2 29.76	− 6.40	20.72
	6690	19 70.0	56.0	30.0					
	6731	36 64.2	40.0	47.0		36 03 28.01	− 9 05.28	+ 5.18	27.91
	6762	26 46.0	49.0	37.5					
	6779	17 93.0	41.5	45.0		35 49 48.04	+ 4 34.53	+ 2.18	24.75
	6824	25 79.0	35.5	51.5					
	6858	20 60.3	35.0	52.0		54 36.42	− 0 06.02	− 8.99	21.41
	7105	23 37.2	54.0	6.0					
	7149	22 66.7	27.0	33.0		35 54 35.71	− 0 22.69	+11.44	24.46
	7176	28 27.0	30.5	29.5					
	7223	11 17.7	22.0	38.0		36 03 42.30	− 9 10.14	− 1.36	30.80
	7275	15 43.6	50.0	9.5					
	7294	15 81.1	41.0	18.0		35 54 19.40	− 0 12.07	+17.30	24.63
	7324	23 54.2	23.5	36.0					
	7416	14 94.4	44.0	16.0		50 12.81	+ 4 04.54	+ 4.22	21.57
	7444	20 80.2	32.5	27.0					
	7455	18 90.4	24.0	35.0		53 59.16	+ 0 28.90	− 1.50	26.56
	7493	10 40.5	36.7	22.5					
	7527	17 61.4	32.0	28.0		50 27.18	+ 3 52.02	+ 4.96	24.16
August 28	6438	17 40.0	35.0	38.7					
	6470	18 35.4	39.0	35.0		54 54.27	− 0 30.71	+ 0.08	23.64
	6500	20 39.5	48.0	26.0					
	6528	24 84.6	33.0	41.0		51 57.95	+ 2 23.25	+ 3.82	25.02
	6678	30 52.9	52.5	23.0					
	6697	12 09.5	24.0	52.0		44 33.30	+ 9 53.30	+ 1.77	28.37
	6762	33 08.9	32.0	45.0					
	6779	21 73.7	58.0	18.5		49 48.83	+ 4 28.81	+ 7.22	24.89
	6799	14 85.5	19.0	57.0					
	6835	27 75.5	35.0	41.0		47 38.86	+ 6 55.19	−11.99	22.05
	6895	14 24.2	24.0	53.0					
	6927	28 62.5	35.0	42.3		35 46 18.78	+ 8 15.10	− 9.80	35 51 23.99

Observations and computations—Continued.

FORT UNION, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
August 28	6943	26 70.6	36.0	41.0					
	Gr. 3110	16 45.5	29.2	48.8		35 48 52.33	+ 5 29.93	— 6.70	35 54 15.56
	7105	22 74.0	52.3	26.7					
	7149	22 23.5	35.0	45.0		54 36.60	— 0 16.25	+ 4.25	24.60
	7188	23 57.2	41.0	39.0					
	7198	15 97.4	38.0	42.0		49 48.53	+ 4 36.73	— 0.54	24.72
	P.XX, 358	25 04.0	53.0	27.0					
	7253	28 12.6	31.6	48.2		50 37.02	+ 3 42.53	+ 2.29	21.84
	7275	22 38.4	49.5	30.5					
	7294	22 35.6	37.0	42.8		54 20.36	+ 0 00.90	+ 3.60	24.86
	7324	23 51.7	39.3	20.7					
	7416	15 68.7	44.0	37.0		50 13.74	+ 4 12.01	+ 1.53	27.28
	7444	20 43.7	59.0	21.5					
	7455	20 00.2	45.5	35.0		54 00.18	+ 0 14.00	+13.08	27.26
	7542	18 34.5	45.2	35.5					
	7553	21 03.4	50.3	30.7		52 49.15	+ 1 26.54	+ 7.98	23.67
	7664	23 24.5	49.0	33.0					
	7698	20 81.6	34.0	48.5		53 04.84	+ 1 18.17	+ 0.41	23.42
August 29	6006	— 86.7	32.0	36.0					
	6020	27 23.3	46.0	23.0					
	6091	14 39.7	19.0	51.0					
	6059	30 27.2	27.5	43.0		46 05.98	+ 8 30.93	—12.94	23.97
	6203	19 25.0	39.0	32.0					
	6232	23 50.5	35.0	36.0		52 03.16	+ 2 16.95	+ 1.64	21.75
	6302	14 73.2	37.0	35.0					
	6307	27 47.2	23.3	49.0		47 41.47	+ 6 50.04	— 6.46	25.05
	6438	22 10.0	41.0	32.0					
	6470	22 96.7	29.0	24.0		54 54.44	— 0 27.90	— 1.64	24.90
	6500	20 37.9	41.0	32.0					
	6528	24 75.5	35.5	37.5		51 58.10	+ 2 20.85	+ 1.91	20.86
	6566	62.5	45.0	28.0					
	6574	29 77.5	29.5	43.5		35 45 13.20	+ G. 11.98	+ 0.82	26.00
	6602	11 40.0	35.0	38.0					
	6626	29 49.4	30.0	43.0		36 04 09.68	— 9 42.36	— 4.36	22.96
	6678	30 39.0	23.5	50.0					
	6697	11 76.7	39.0	35.0		35 44 33.48	+ 9 59.38	— 6.13	26.73
	6714	16 40.7	41.0	33.0					
	6745	19 19.6	40.0	34.0		35 55 48.76	— 1 29.77	+ 3.82	35 54 22.81

Observations and computations—Continued.

FORT UNION, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 29	6762 6779	26 04.5 17 05.6	15.0 31.5	59.0 42.0		35 49 49.07	+ 4 49.31	−14.85	35 54 23.53
	6799 6835	21 17.2 28 99.0	38.0 28.0	35.3 46.0		47 39.07	+ 6 52.55	− 4.17	27.45
	Gr. 2977 6883	20 42.3 21 57.8	39.0 46.0	35.0 29.0		53 50.94	+ 0 37.17	+ 5.72	33.83
	6941 6959	21 25.7 23 13.5	44.0 40.0	31.0 35.0		55 23.32	− 1 00.44	+ 4.90	27.78
	7105 7149	21 59.8 21 42.2	44.0 22.0	32.0 54.0		54 36.82	− 0 05.66	− 5.45	25.71
	7188 7198	26 13.5 16 58.5	44.2 40.5	31.6 35.2		49 48.71	+ 4 35.18	− 0.57	23.32
	P.XX, 358 7253	20 38.8 13 12.5	31.0 30.0	45.0 46.0		50 37.25	+ 3 53.76	− 8.18	22.83
	7275 7294	20 75.1 20 52.0	34.0 33.2	42.0 42.2		54 20.60	+ 0 07.44	− 4.63	23.41
	7368	18 81.4 21 58.5	32.0 24.0	44.0 52.0		55 57.90	− 1 21.04	−10.90	25.96
	7418 7468	28 81.4 17 58.5	32.0 40.0	44.0 35.0		48 28.22	+ 6 01.41	− 1.91	27.72
	7493 7527	17 65.5 25 12.6	40.0 47.5	35.2 28.0		50 28.38	+ 4 01.10	+ 6.62	36.10
	7567 7631	12 18.7 20 87.4	35.0 21.0	41.0 56.0		59 14.84	− 4 39.59	−11.17	24.08
	7664 7698	24 81.2 22 22.0	33.5 35.0	43.0 42.0		35 05.17	+ 1 23.42	− 4.50	24.09
	7742 7754	25 64.1 15 42.3	44.5 42.0	33.0 35.0		43 54.31	+ 5 28.87	+ 5.04	28.22
	7807 7815	21 10.5 20 54.5	33.0 34.5	43.5 42.5		35 51 11.54	+ 0 18.02	− 2.32	27.24
	7850 7923	27 23.5 14 83.3	41.5 35.0	35.0 43.0		36 01 05.96	− 6 39.16	− 0.41	26.39
	7961 7975	11 23.8 34 82.4	31.5 31.0	47.0 47.5		35 42 05.58	+12 23.02	− 8.72	19.88
	8058 8079	24 90.2 21 02.0	33.0 35.0	46.0 43.0		35 56 04 17	− 1 32.76	− 5.72	25.69
	8097 8110	16 43.2 28 68.0	35.5 35.0	43.0 43.0		36 01 03.78	− 6 34.20	− 4.22	35 54 25.36

Observations and computations—Continued.

FORT UNION, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 29	8153	11 79.1	31.5	46.5					
	8182	29 21.1	43.0	36.0		35 45 05.41	+ 9 20.63	— 2.18	35 54 23.86
August 30	6091	13 00.0	42.0	55.0					
	6159	28 57.6	49.0	49.0		35 46 06.15	+ 8 21.32	— 3.54	23.93
	6237	12 03.0	28.0	50.0					
	Gr. 2563	30 61.4	28.0	50.0		36 06 08.73	—11 34.68	—11.99	22.06
	6302	16 42.7	35.5	32.0					
	6307	28 82.9	32.0	35.5		35 47 41.64	+ 6 41.31	— 0.00	22.95
	6438	20 21.0	22.5	45.5					
	6470	21 01.7	37.5	30.5		54 54.01	— 0 25.97	— 4.36	24.68
	6500	21 45.8	37.5	30.5					
	6528	26 08.5	13.0	56.0		51 58.25	+ 2 28.85	— 9.81	17.29
	6566	11 91.6	16.0	53.0					
	6574	29 43.0	28.0	41.0		35 45 13.38	+ 9 23.69	—13.62	23.45
	6602	11 75.9	45.0	24.0					
	6626	30 43.0	49.5	20.5		36 04 09.84	—10 00.93	+13.62	22.53
	6690	13 03.0	27.0	43.0					
	6731	29 75.4	35.0	35.0		36 03 29.14	— 8 58.26	— 1.64	29.24
	6762	24 37.0	44.0	26.0					
	6779	15 76.8	24.0	46.0		35 49 49.28	+ 4 36.85	— 1.09	25.04
	6824	22 60.0	35.0	35.0					
	6858	22 24.7	32.0	39.0		35 54 37.54	— 0 11.36	— 1.91	24.27
	6918	28 42.0	36.0	35.0					
	6933	16 92.0	35.0	36.0		36 00 37.63	— 6 10.13	— 0.00	27.50
	7105	20 97.0	19.0	53.0					
	7149	20 73.7	42.0	31.0		35 54 37.04	— 0 07.50	— 6.27	23.27
	7176	27 21.5	34.0	39.0					
	7223	10 07.5	32.0	41.0		36 03 43.61	— 9 11.66	— 3.82	28.13
	Ll. 40335	24 90.0	41.0	32.0					
	7253	18 22.2	45.0	28.0		35 50 37.49	+ 3 34.93	+ 7.09	19.51
	7275	23 04.5	38.5	34.0					
	7294	23 18.9	38.0	34.5		54 20.84	— 0 04.64	+ 1.64	17.84
	7368	18 41.7	38.0	34.0					
	Gr. 3424	21 19.5	29.0	43.0		55 58.14	— 1 29.41	— 2.72	26.01
	7444	19 57.5	35.0	37.0					
	7455	18 83.9	33.5	38.5		54 00.68	+ 0 23.69	— 1.91	22.46
	7493	19 24.1	42.0	30.0					
	7527	26 56.8	26.5	45.5		35 50 28.53	+ 3 55.77	— 0.76	35 54 23.54

Observations and computations—Continued.

FORT UNION, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 30	7567	14 85.1	32.0	40.5					
	7631	23 68.5	29.5	43.0		35 59 15.10	— 4 44.32	— 6.00	35 54 24.78
	7664	21 88.2	42.5	30.0					
	7698	19 51.4	37.5	35.0		53 05.50	+ 1 16.22	+ 4.09	25.81
	7807	20 59.9	35.5	37.5					
	7815	20 09.0	21.0	52.0		35 54 11.98	+ 0 14.77	— 8.99	17.76
	7850	27 51.5	37.0	35.0					
	7923	15 12.5	41.0	31.5		36 01 06.24	— 6 38.77	+ 3.13	35 54 30.60

Notes.

A single observation of pair 1, made August 29, was rejected. The whole number of micrometer readings is not given, and there is probably other error in it.

In pair 3, observed August 24, a wrong star appears to have been taken.

The observations made August 30 on pair 8, August 29 on pair 17, and on pair 31, have been rejected. They differ from the final mean — 7″.5 + 9″.1 + 11″.4 respectively, and their level corrections are — 9″.8 + 5″.7 + 6″.6.

Individual results.

No. of pair.	No. of obs.	Latitude uncorrected.	Δm	$\Delta \phi$	No. of pair.	No. of obs.	Latitude uncorrected.	Δm	$\Delta \phi$
		° ′ ″	′	″			° ′ ″	′	″
38	1	35 54 19.88	+12.4	+ 1.61	32	1	35 54 23.67	+ 1.4	+ 0.18
5	1	22.06	+11.6	+ 1.51	34	3	24.44	+ 1.3	+ 0.17
11	2	27.55	+ 9.9	+ 1.29	30	3	25.43	+ 0.4	+ 0.05
9	2	24.72	+ 9.3	+ 1.21	36	2	22.50	+ 0.3	+ 0.04
41	1	23.86	+ 9.3	+ 1.21	26	4	22.66	0.0	0.00
2	2	23.95	+ 8.4	+ 1.09	16	2	22.84	— 0.1	— 0.01
18	1	23.99	+ 8.3	+ 1.08	22	4	24.51	— 0.2	— 0.03
5 *bis*	1	25.28	+ 7.1	+ 0.92	7	4	25.26	— 0.4	— 0.05
15	2	24.76	+ 6.9	+ 0.90	20	1	27.78	— 1.0	— 0.13
6	2	24.00	+ 6.8	+ 0.88	27	2	25.98	— 1.4	— 0.18
29	1	27.72	+ 6.0	+ 0.78	39	1	25.69	— 1.5	— 0.20
35	1	28.22	+ 5.5	+ 0.72	13	1	22.81	— 1.5	— 0.20
14	4	24.55	+ 4.6	+ 0.60	33	2	24.43	— 4.7	— 0.61
24	2	24.02	+ 4.6	+ 0.60	19	1	27.50	— 6.2	— 0.81
28	2	24.42	+ 4.1	+ 0.53	40	1	25.37	— 6.6	— 0.86
31	2	23.85	+ 3.9	+ 0.51	37	2	28.44	— 6.6	— 0.86
25	3	21.39	+ 3.7	+ 0.48	12	2	28.58	— 9.0	— 1.17
8	3	22.20	+ 2.4	+ 0.31	23	2	29.46	— 9.2	— 1.20
4	1	35 54 21.75	+ 2.3	+ 0.30	10	2	35 54 22.74	— 9.9	— 1.29

In the preceding table $\Delta\varphi$ is obtained by adding 0''.140 for each micrometer revolution, or 0''.130 $\left(=0''.140\frac{60''}{64''.37}\right)$ for each minute of Δm.

Final results corrected for $\Delta\varphi$:

	° ′ ″
14 pairs observed once each	35 54 25.12
16 pairs observed twice each	35 54 25.31
4 pairs observed three times each	35 54 23.62
4 pairs observed four times each	35 54 24.38

Giving each pair once observed a weight of 1; each pair twice observed a weight of $1\frac{1}{2}$; each pair three times observed a weight of 2; and each pair four times observed a weight of $2\frac{1}{2}$, this final result is derived:

Latitude of Fort Union (sun-dial), 35° 54′ 24″.86 Wt. = 56.

Probable error (weight = 1):

From pairs observed once	± 1″.58
From pairs observed twice	± 1″.74
From pairs observed three times	± 1″.89
From pairs observed four times	± 1″.11
Mean result about	± 1″.63

Hence the final probable error of the latitude will be ± 0″.22.

ASTRONOMICAL CO-ORDINATES OF FORT UNION, NEW MEXICO.

Longitude..	$7^h\ 00^m\ 03^s.41$ or 105° 00′ 51″.15 ± 0″.13	west from Greenwich.
" ..	$1^h\ 51^m\ 51^s.29$ or 27° 57′ 49″.35	west from U. S. Naval Observatory, Washington, D. C.
Latitude...	35° 54′ 24″.86 ± 0″.22 north.	

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY PROF. T. H. SAFFORD, JOHN H. CLARK, AND DR. F. KAMPF IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF SANTA FÉ, NEW MEXICO.

SEASON OF 1873.

COMPUTATIONS BY

Prof. T. H. SAFFORD, JOHN H. CLARK, and Dr. F. KAMPF.

SANTA FE, NEW MEXICO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . 105° 56′ 45″.22 ± 0″.32 west from Greenwich.
Latitude, . . . 35° 41′ 19″.29 ± 0″.15 north.
Barometric altitude of observatory above sea-level, 7044.2 feet.

Various determinations of the position of this town have been made, of which the earliest known is Lafora's, given in the astronomical results of Humboldt's Travels, and since repeated year by year in the *Connaissance des Temps.* He places Santa Fé in longitude 107° 13′ west of Paris and latitude 36° 12′ north, which is about a degree east and half a degree north of the true position.

Lieut. W. H. Emory, who accompanied Kearney's column as chief engineer when New Mexico and California were occupied by the United States forces, determined a series of positions along the march which have been of great value in constructing the geography of New Mexico and neighboring regions. Among these occurs Santa Fé, which he fixes in longitude 106° 01′ 23″, and in latitude 35° 41′ 06″. His latitudes are manifestly as accurate as the sextant would give them; any additional discussion, as, for instance, of the difference between north and south stars, would alter the value but a few seconds at most. The longitude he gives as quite uncertain. It is derived from the chronometer, which may not have gone quite regularly in passing over the road to Santa Fé. Moreover, for the longitude of Fort Leavenworth, his starting-point, he has assumed Nicollet's determination, which is 94° 44′ 00″, a value now known to be wide of the truth.

Comparing Nicollet's longitude of Fort Leavenworth with Lieutenant Ruffner's determination of the same, as computed by Professor Safford, the result gives the correction necessary to be applied to Emory's work:—

Ruffner's longitude of Fort Leavenworth		94° 54′ 35″
Nicollet's longitude of Fort Leavenworth		94° 44′ 00″
Correction	+	10′ 35″

Emory's chronometer-longitude of Santa Fé	106° 01′ 23″
Correction of error at Fort Leavenworth	+ 10′ 35″
Emory's corrected longitude	106° 11′ 58″

Lieutenant Emory also determined the longitude of Santa Fé by one night's observations of lunar distances, which gave 106° 04′ 38″.4. This requires a correction for the error in the moon's place as given by Burckhardt's tables, which would be about + 7″, as the lunar tables gave the moon's longitude too great by about 15″.

After Lieutenant Emory had left Santa Fé, his junior officers, Lieutenants Abert and Peck, who were detained by illness, made a reconnaissance of New Mexico, and executed a map from a triangulation of the Territory with the sextant. This gave Lieutenant Whipple the means of locating Santa Fé in nearly its true position with respect to Albuquerque, of which town he determined the longitude by several months of lunar culminations. Upon his map, in the third volume of the Pacific Railway Reports, Santa Fé is placed in longitude 105° 55′, a closer approximation to the truth.

The situation of Emory's station in Santa Fé is no longer known, but that is a matter of comparatively little importance, as the town is not very large. From a comparison of his latitude with Mr. Safford's it may be inferred that it was near the church of St. Francis, or, perhaps, in the plaza.

PHYSICAL GEOGRAPHY DETAILS.

The town is situated on Santa Fé Creek, a tributary of the Rio Grande. During the time of observations here this stream was very diminutive, and its waters were pretty thoroughly used in irrigating, as the season had been one of severe drought. According to Abert's report the creek disappears in the sand a few miles below the town. In exceptional years it sometimes overflows, and has been known to carry away bridges. The houses in Santa Fé bear abundant testimony to the dryness of the climate. One of the churches is said to be over two hundred years old, although built of adobe, like most of the houses in the town.

Santa Fé lies on a plain gradually sloping to the creek, which is surrounded on all sides by hills and mesas. Its situation is very picturesque when seen from a distance. Directly to the east is a chain of high mountains, to be designated upon the published maps of the survey as the Santa Fé range.

The town is the seat of an extensive trade, of which the commodities are brought from the railways of Colorado and Western Kansas by ox and mule teams and distributed throughout New Mexico. The agriculture of this region is quite primitive in its methods, but, with the help of irrigation, produces fair results. The wheat of the Territory is especially good. Great opportunities for pasturage exist, but, as the common beast of burden is the *burro*, or small donkey, it is probably difficult to keep horses in good condition; these are sometimes fed on hay made from a species of rush.

METEOROLOGICAL CONDITIONS.

The yearly rain-fall is about 17 inches, according to Schott's map. This is nearly the same as at San Francisco, and larger than at Los Angeles, to which Schott assigns about 12 inches, or at Denver, where it is about 14 inches. When this station was occupied, it was in the early part of the rainy season. Little rain fell, but the clouds interfered much with observations. Otherwise the climate was extremely agreeable, being dry and mild. The transparency of the atmosphere was not so great as might have been expected. The test-objects employed to determine this have often been seen by the astronomer almost as distinctly at Denver, or even at Fort Hays or Chicago, all of them at less altitudes. The reason for this may be found in the season of the year.

OBSERVATORY.—ASSISTANTS.

The astronomical station is situated upon the military reservation, in that portion which is known as the old Fort Marcy parade-ground. In order to admit of the location of the meridian-line, the monument, since Mr. Safford's determination, has been moved due west 5.83 feet, or $0^\circ\ 00'\ 00''.07$, giving the value for longitude which stands at the head of this report. The new position of the station is marked by a heavy stone pillar, about 4 feet high. On the mesa, 1,926.428 feet north of this monument, a stone meridian-mark was planted.

The customary wall-tent, with suitable openings, was used as an observatory. This was afterwards framed, to guard against accidents. As there were two instruments engaged, and but one observing-pier, the former were set up when their use demanded and were removed every night when work was done.

The astronomer was assisted by Private Winkler, Company D, Battalion of Engineers, who was found very capable and painstaking. The drill of this corps appears to attract good men and make them more competent to perform the duties of an assistant astronomer than any other persons save the very best mathematicians from college classes or technical schools. Mr. Gough, the telegraph-operator, rendered excellent assistance. The line employed was the Western Union; the route was from Santa Fé to Salt Lake City, via Denver and Cheyenne.

DESCRIPTION OF INSTRUMENTS.

The instruments used were a zenith telescope and the Würdemann transit No. 18. They were originally made for the northwestern boundary, some twenty years ago, and were not in the best of repair. The transit was twenty-six inches in focal length and two inches in aperture. Its optical quality was excellent, but its mechanical parts needed a thorough repair. The frame of the transit and the side adjusting-screws of the levels were badly bent. It was with great difficulty that accurate results were obtained, as the level would vary unexpectedly from time to time, although every care was taken to place it correctly and delicately in position. Apparently the motion of the telescope was irregular, and the pivots did not retain a fixed position in the Y's, which were somewhat bent. The probable error of the observations with this instrument, and the difficulty of their reduction, had been constantly increasing during this astronomer's experience with it. The observations were so arranged that the instrumental defects would be thoroughly eliminated from the result. The observed stars were as near the zenith as could be found, including, of course, sufficient polars for the application of the azimuth correction in each group.

As the packing-boxes of the instrument were somewhat out of repair, it may have suffered by transportation over the Kansas Pacific Railway and the roads of New Mexico. Efforts were made to secure some trifling repairs at Santa Fé, but with little success.

The zenith-telescope had a larger aperture, two and three-fourths inches, but was not sensibly better in optical power. The observer found it quite unstable, and would have taken it to pieces had he been sufficiently acquainted with its parts to feel assured of his powers to reconstruct it properly. It is thought that the newer constructions of the zenith-telescope are to be preferred for stability and substantial and lasting firmness.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

Telegraphic connection was made with John H. Clark, at Salt Lake City, on June 25, July 1, 2, 12, 14, and 17, and with Dr. F. Kampf, at Hughes, on July 12, 14, 17, 19, and 21. The longitude of Santa Fé, therefore, depends on eight nights of work. The two nights on which Dr. Kampf, at Hughes, was accessible, and Mr. Clark, at Salt Lake City, could not be reached, undoubtedly strengthen the determinations much, as Dr. Kampf had a chronograph and an admirable transit-instrument of Würdemann's largest size, and his longitude of Hughes is consequently very accurate.

Latitude observations were made by Prof. T. H. Safford, observer at Santa Fé, on June 27, 28, July 4, 23, 26, 27, 28, 29, and 30, nine nights in all. These were much interrupted by the clouds, and affected by instrumental difficulties.

In addition, time-determinations were made on seven nights on which the telegraph failed.

The observations at each station were reduced by the astronomer at that place.

Professor Safford submits the following notes upon the tables of time-reductions for Santa Fé and Fort Union. In all these cases the first operation was to compute approximate values of azimuth and collimation, which was accomplished in the following manner:

Every group of about five stars gave a corresponding number of equations of the form $\alpha = \mathrm{T} + dt + \mathrm{A}a + \mathrm{B}b + \mathrm{C}c$; or $\alpha - \mathrm{T} - \mathrm{B}b = dt + \mathrm{A}a + \mathrm{C}c$, in which $\Delta\mathrm{T}$, a, and c were unknown quantities. These were now so arranged that the equations derived from stars of nearly equal declinations came together, and the means of the right and left hand members of the equations were so taken that each group gave two equations, one with a positive co-efficient of a, the other with a negative co-efficient of the same unknown quantity. Eliminating a, there was left one equation from each group, in which ΔT and c were the unknown quantities. The two groups which make up a complete time-determination then gave, by proper elimination, the values of these quantities. As an example, we may select the last time-determination for Fort Union:

	Name of star.	Clamp.	$a - T - Bb$.	A.	C.
			h. m. s.		
(1)	κ Cephei	E.	10 25 59.67	− 3.02	+ 4.56
(2)	ε Delphini	E.	26 04.64	+ 0.43	+ 1.02
(3)	a Cygni	E.	26 03.66	− 0.22	+ 1.41
(4)	ν Cygni	E.	26 03.81	− 0.11	+ 1.32
(5)	ζ Cygni	W.	26 06.05	+ 0.12	− 1.15
(6)	1 Pegasi.............	W.	26 06.15	+ 0.31	− 1.06
(7)	β Cephei	W.	26 05.62	− 1.64	− 2.92
(8)	κ Pegasi............	W.	10 26 06.04	+ 0.21	− 1.10

The equation from the first star is—

$$10^h\ 25^m\ 59^s.67 = \Delta T - 3.02\,a + 4.56c$$

that from the mean result of (2), (3), (4), is—

$$10^h\ 26^m\ 4^s.04 = \Delta T + 0.03\,a + 1.25c$$

Hence, by elimination—

$$4^s.37 = 3.05\,a - 3.31\,c$$

$$1^s.43 = a - 1.09\,c$$

$$10^h\ 26^m\ 4^s.00 = \Delta T + 1.28\,c$$

Similarly from (5), (6), (8)—

$$10^h\ 26^m\ 6^s.08 = \Delta T + 0.21\,a - 1.10\,c$$

And from (7)—

$$10^h\ 26^m\ 5^s.62 = \Delta T - 1.64\,a - 2.92\,c$$

By elimination—

$$0^s.46 = 1.85\,a + 1.82\,c$$

$$0^s.25 = a + 0.98\,c$$

$$10^h\ 26^m\ 6^s.03 = \Delta T - 1.31\,c$$

The two equations containing a and c only give

$$a = +\,0^{s}.81$$
$$c = -\,0^{s}.57$$

and the two containing

$$\triangle T \text{ and } c$$
$$\triangle T = 10^{h}\ 26^{m}\ 5^{s}.00$$
$$c = \qquad -\,0^{s}.78$$

The difference between the two values of c arises partly from error of observation, partly from small changes in the azimuth at reversal, partly from uncertainty in the adopted rate.

There was a previous time-determination on the same evening; for these provisional values I assumed, *combining the two,*

$$\triangle T_0 = 10^{h}\ 26^{m}\ 4^{s}.96$$
$$a_0 = \qquad +\,0^{s}.90$$
$$c_0 = \qquad -\,0^{s}.70$$

and the least square solution from the eight equations above cited gave

$$\triangle T = 10^{h}\ 26^{m}\ 5^{s}.013 \pm 0^{s}.044$$
$$c = \qquad -\,0^{s}.733 \pm 0^{s}.029$$
$$a = \qquad +\,0^{s}.813 \pm 0^{s}.064$$

In case the values of c had differed much more than $0^{s}.21 = -\,0^{s}.57 +\,0^{s}.78$, I should have assumed a sudden change in a at reversal; this was, indeed, often necessary, because the axis of the telescope did not properly fit its Y's.

The next step was to form and solve the least square equations. I employed the notation

$$a = a_0 + da$$
$$c = c_0 + dc$$

and, of course, made $\triangle_0 T =$ resulting error of the chronometer after the mean of wires is corrected for rate, level, *and approximate azimuth and collimation.* The advantage of this is that there is much less danger of mistake, as the resulting da and dc should be very small, if the instrument is steady at reversal, and, if not, the fact is at once indicated.

As I have always been doubtful about the stability of Würdemann 18, I have arranged the observations so that each group of about five stars contains time-stars as near the zenith as possible, as well as one or two polars; a precaution useful always in giving a resulting $\triangle T$ with a large weight.

The formation of the least square equations was facilitated by tables. I gave as a weight to each observation the quantity

$$w = pp^1$$

where
$$p = \frac{1.3}{1 + 0.3 \sec^2 \delta}$$

and
$$\begin{aligned} p^1 &= 0.2 \text{ for } 1 \text{ wire} \\ &= 0.4 \text{ for } 2 \text{ wires} \\ &= 0.6 \text{ for } 3 \text{ wires} \\ &= 0.8 \text{ for } 4 \text{ wires} \\ &= 0.9 \text{ for } 5 \text{ wires} \\ &= 1.0 \text{ for } 6\text{–}9 \text{ wires} \end{aligned}$$

The values $A\sqrt{p} = \sin(\varphi - \delta)\, c\sqrt{p}$

$$c\sqrt{p} = \sec\delta\sqrt{p} = \sqrt{\frac{1.3}{\cos^2\delta + 0.3}}$$

as well as $\sqrt{p}$, can be readily tabulated. This I did, however, only with their squares and products.

$$\left.\begin{aligned} ee &= p \\ ef &= cp \\ eg &= \mathrm{A}\,p \\ ff &= c^2 p \\ fg &= \mathrm{Al}\,p \\ gg &= \mathrm{A}^2 p \end{aligned}\right\} \text{Changing the signs of } ef \text{ and } fg \text{ for clamp west.}$$

The notations ee, ef, eg, &c., I employed in the solution, following Gauss's model.

If then $\delta\,\mathrm{T}\sqrt{p} = n$, the equation for each star will be

$$0 = n + e\,\delta\,\mathrm{T} + fdc + gda$$

Of the stars quoted as observed August 27, κ Cephei was observed on 5 wires and ζ Cygni on 4; all the others on 6 at least. From these the following squares and products were computed:—

	$\delta T = \frac{n}{e}$.	*nn.*	*en.*	*fn.*	*gn.*	*ee.*	*ef.*	*eg.*	*ff.*	*fg.*	*gg.*
	s.					*Weight.*					
κ Cephei	− 0.61	0.060	−0.099	−0.449	+0.298	0.162	+0.736	−0.488	3.362	−2.224	1.472
ϵ Delphini ..	0.00	0.000	0.000	0.000	0.000	0.992	+1.010	+0.427	1.029	+0.435	0.184
a Cygni	+ 0.11	0.010	+0.090	+0.126	−0.020	0.814	+1.148	−0.178	1.619	−0.255	0 039
ν Cygni	+ 0.13	0.014	+0.111	+0.146	−0.012	0.854	+1.127	−0.094	1.486	−0.124	0.010
ζ Cygni	− 0.16	0.019	−0.119	+0.136	−0.015	0.744	−0.850	+0.092	0.986	−0.106	0.011
1 Pegasi	− 0.18	0.031	−0.175	+0.186	−0.053	0.973	−1.031	+0.293	1.093	−0.310	0.088
β Cephei	− 0.09	0.003	−0.034	+0.096	+0.054	0.365	−1.066	−0.598	3.118	+1.748	0.980
κ Pegasi	− 0.12	0.014	−0.114	+0.126	−0.024	0.952	−1.051	+0.197	1.160	−0.218	0.042
Sums	....	0.151	−0.340	+0.367	+0.228	5.856	+0.023	−0.349	13.853	−1.054	2.826

The total increase of labor owing to the introduction of weights is very trifling, and is fully counterbalanced by the saving in the solution; where the co-efficients [*ef*], [*eg*], [*fg*], are much smaller in proportion to [*ee*] and [*ff*] than they are where the weights are all made = 1.

The opinion has been expressed by good authority (Wagner, of Pulcova) that this last process is no more accurate than the approximate solution itself.

INSTRUMENTAL VALUES.—TELEGRAPHIC COMMUNICATION.

The wires of the transit instrument employed on June 25 were found broken the next morning. A new set was inserted by Lieut. C. C. Morrison. They were rather too fine, it is true, but still they served a good purpose. Their intervals were carefully determined for clamp east, and in the mean were about

$89^s.64$, $67^s.32$, $44^s.32$, $23^s.06$, $-1^s.28$, $-22^s.92$, $-45^s.04$, $-66^s.04$, $-89^s.07$,

with signs changed for clamp west. There were some indications of change in the intervals, and so the reduction to mean of wires was made in the field, giving values slightly different from time to time. These were always very carefully revised.

The value of one division of the level was taken as $1''.00$; it was not in condition to be very accurately determined by the means at hand. The uncertainty remaining in the longitude on this account will be very small and quite fully exhibited in the probable error.

The value of one revolution of the micrometer of the zenith-telescope, as determined by Mr. Safford in 1872 at Denver, was 64″.37. The present observations afford means for correcting this value, which will not affect the result, however, as the stars were so selected that the micrometer-corrections for the different pairs were about as often positive as negative. One division of the zenith-telescope level was equal to 1″.09. The length of the telegraphic circuit, from Santa Fé to Salt Lake, via Corinne, was about 1,100 miles. Repeaters were used at Denver, Cheyenne, and Corinne. From Santa Fé to Hughes the distance is 450 miles.

The batteries used were those of the telegraph company, as there was no electro-magnetic apparatus in the astronomical outfit. On some of the nights the chronometer was carried to the office at the headquarters of the district of New Mexico; on other occasions it was taken to the ordinary telegraph-office at Mr. Gough's house, not quite one-fourth of a mile from the station. No sensible inconvenience was caused by this.

Tabulation of stars used for determination of time at Santa Fé, New Mexico, and Salt Lake City, Utah, 1873.

	Name of star.	SANTA FÉ, NEW MEXICO.								SALT LAKE CITY, UTAH.						
		June 25.	July 1.	July 2.	July 12.	July 14.	July 17.	July 19.	July 21.	June 25.	July 1.	July 2.	July 3.	July 12.	July 14.	July 17.
α	Bootis									×						
	Groombridge 2125	×														
θ	Bootis									×						
5	Ursæ Minoris									×	×					
ζ	Bootis	×														
μ	Virginis									×	×	×	×			
ε	Bootis									×	×					
α^2	Libræ									×	×	×				
	Piazzi XIV, 221	×														
β	Ursæ Minoris									×	×	×				
2 H.	Ursæ Minoris	×														
β	Bootis									×		×				
ψ	Bootis	×														
48	Cephei, S. P.									×	×	×				
β	Libræ										×	×				
δ	Bootis	×	×	×												
o^2	Libræ									×	×	×	×			
μ^1	Bootis									×	×	×	×		×	
γ	Ursæ Minoris	×	×	×	×											×
ζ^3	Libræ										×	×	×		×	
ν	Bootis, pr	×														
α	Coronæ	×	×	×	×						×	×	×		×	×
τ^6	Serpentis										×	×	×		×	×
γ	Coronæ	×	×	×	×											
α	Serpentis											×	×		×	×
κ	Serpentis		×		×											
ε	Serpentis											×	×			×
12 H.	Draconis	×		×												
ζ	Ursæ Minoris		×												×	
γ	Serpentis				×											
δ	Scorpii													×		×
β^1	Scorpii												×	×	×	×
θ	Draconis		×	×	×											
	Groombridge 2320													×		
δ	Ophiuchi			×											×	×
ε	Ophiuchi				×		×									
ε	Herculis													×	×	×
γ	Herculis		×	×	×		×	×								
η	Draconis		×	×	×		×	×						×	×	×
σ	Herculis		×	×	×			×								
ζ	Ophiuchi												×	×	×	×
ζ	Herculis						×	×								
η	Herculis															×
	Groombridge 2377							×								
κ	Ophiuchi						×						×			
ε	Ursæ Minoris						×									
	Groombridge 2415							×								
ζ	Draconis							×								
α	Herculis												×			
72	Herculis							×								
	Groombridge 966, S. P.												×			
α	Ophiuchi							×								
ω	Draconis												×			
μ	Herculis											×				
ψ	Draconis														×	
γ	Draconis														×	×

Tabulation of stars, &c.—Continued.

Name of star.	Santa Fé, New Mexico.								Salt Lake City, Utah.						
	June 25.	July 1.	July 2.	July 12.	July 14.	July 17.	July 19.	July 21.	June 25.	July 1.	July 2.	July 3.	July 12.	July 14.	July 17.
72 Ophiuchi	....	....	....	....	....	....	....	....	....	....	×	×	×	×	×
μ^1 Sagittarii	....	....	....	....	....	....	....	....	....	....	....	....	×	×	×
Groombridge 2533	....	....	....	....	....	×	×	....	....	....	....	....	....	....	....
36 Draconis	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
δ Ursæ Minoris	....	....	....	×	....	....	....	....	....	....	....	....	....	....	....
η Serpentis	....	....	....	....	....	....	....	....	×	....	×	×	×	×	×
109 Herculis	....	×	×	×	....	×	×	....	....	....	....	....	....	....	....
χ Draconis	....	×	....	×	....	×	×	....	....	....	....	....	....	....	....
1 Aquilæ	....	....	....	....	....	....	....	....	×	....	....	....	×	×	×
α Lyræ	×	×	×	×	....	×	×	....	×	....	×	....	×	×	×
Groombridge 2655	×	....	....	....	....	....	....	....	....	....	....	....	....	....	....
110 Herculis	×	×	×	×	×	....	....	×	....	....	....	....	....	....	....
β Lyræ	....	....	....	×	....	×	....	×	×	....	....	....	×	×	×
o Draconis	....	×	×	×	×	×	×	×	....	....	....	....	....	....	....
θ Serpentis	×	....	....	....	....	....	....	....	....	....	....	....	....	....	....
50 Draconis	....	....	....	....	....	....	....	....	×	....	....	....	×	×	×
ε Aquilæ	....	....	....	....	....	....	×	....	....	....	....	....	....	....	....
γ Lyræ	×	....	....	....	....	....	....	....	....	....	....	....	....	....	....
1 Lyræ	....	....	....	....	....	....	....	×	....	....	....	....	....	....	....
ε Draconis	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
ζ Aquilæ	×	×	×	×	×	×	×	....	×	....	....	....	×	×	×
25 Camelopardalis	....	....	....	×	....	....	....	....	....	....	....	....	....	....	....
d Sagittarii	....	....	....	....	....	....	....	....	×	....	×	....	×	....	....
ω Aquilæ	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....
δ Draconis	×	×	....	×	×	×	....	×	....	....	....	....	×	....	....
τ Draconis	....	×	....	....	....	....	....	....	....	....	....	....	×	....	....
δ Aquilæ	....	....	×	....	×	×	....	×	....	....	....	....	....	....	....
β Cygni	....	×	....	....	×	×	....	×	....	....	....	....	....	....	....
δ Draconis	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....
θ Cygni	....	×	....	....	....	....	....	×	....	....	....	....	....	....	....
γ Aquilæ	....	....	....	....	×	....	....	×	....	....	....	....	....	....	....
α Aquilæ	....	....	....	....	×	....	....	×	....	....	....	....	....	....	....
ε Draconis	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....
Groombridge 2984	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....
28 Cygni	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....
31 Cygni	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....
κ Cephei	....	....	....	....	×	....	....	×	....	....	....	....	....	....	....
γ Cygni	....	....	....	....	....	....	....	×	....	....	....	....	....	....	....
39 Cygni	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....
ε Delphini	....	....	....	....	×	....	....	....	....	....	....	....	....	....	....
θ Cephei	....	....	....	....	....	....	....	×	....	....	....	....	....	....	....
α Delphini	....	....	....	....	....	....	....	×	....	....	....	....	....	....	....
γ Delphini	....	....	....	....	....	....	....	×	....	....	....	....	....	....	....

Observations and reductions for time taken at sending station.

SANTA FÉ, NEW MEXICO, JUNE 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	Groombr. 2125..	8 15 06.61	+ 1.13	+ 0.25	− 1.86	8 15 06.13	14 28 18.28	+6 13 12.15
W.	ζ Bootis	21 55.79	− 0.49	+ 0.13	− 0.94	21 54.49	35 06.57	12.08
W.	Piazzi XIV, 221.	37 04.49	− 0.48	+ 0.12	− 0.94	37 03.19	50 15.25	12.06
W.	2 H. Ursæ Minoris...	42 25.27	+ 1.66	+ 0.24	− 2.27	42 24.90	55 37.37	12.47
W.	ψ Bootis	45 50.86	− 0.21	+ 0.10	− 1.02	45 49.73	59 01.93	12.20
E.	δ Bootis	57 11.90	− 0.05	− 0.51	+ 1.09	57 12.43	15 10 24.82	12.39
E.	γ Ursæ Minoris...	9 07 44.44	+ 2.55	− 0.88	+ 2.98	9 07 49.09	21 00.88	11.79
E.	ν Bootis, pr	9 13 10.76	+ 0.17	− 0.44	+ 1.21	9 13 11.70	15 26 24.05	+6 13 12.35
E.	α Coronæ	9 15 38.06	− 0.41	+ 0.47	+ 1.18	9 15 39.30	15 29 20.47	+6 13 41.17
E.	γ Coronæ	23 43.88	− 0.43	+ 0.32	+ 1.17	23 44.94	37 26.46	41.52
E.	12 H. Draconis........	31 01.14	+ 2.49	+ 0.14	+ 2.31	31 06.08	44 47.14	41.06
E.	α Lyræ	12 18 57.57	+ 0.17	+ 0.08	+ 1.34	12 18 59.16	18 32 40.47	41.31
E.	Groombr. 2655..	22 03.63	+ 7.56	+ 0.21	+ 4.82	22 16.22	35 57.96	41.74
E.	110 Herculis	26 31.82	− 0.69	+ 0.06	+ 1.12	26 32.31	40 13.85	41.54
W.	θ Serpentis	36 17.88	− 1.96	+ 0.14	− 1.05	36 15.01	49 56.27	41.26
W.	γ Lyræ	40 33.68	− 0.24	+ 0.07	− 1.24	40 32.27	54 13.66	41.39
W.	ζ Aquilæ	45 57.37	− 1.43	− 0.02	− 1.08	45 54.84	59 36.28	41.44
W.	δ Draconis.......	12 58 50.81	+ 5.11	− 0.13	− 2.74	12 58 53.05	19 12 34.38	+6 13 41.33

NORMAL EQUATIONS.

First series.

$0 = -1.386 + 6.01\,\delta t - 2.18\,c^1 - 0.87\,a^1$ $\quad \delta t = +0^s.144$ $\quad \Delta T_0 = +6^h\,13^m\,12^s.06$

$0 = +1.485 - 2.18\,\delta t + 114.67\,c^1 - 0.52\,a^1$ $\quad c^1 = -0^s.093$ $\quad c_0 = +\ 1^s.00$

$0 = +1.045 - 0.87\,\delta t - 0.52\,c^1 + 2.66\,a^1$ $\quad a^1 = -0^s.364$ $\quad a_0 = -\ 0^s.936$

Second series.

Before reversal—

$0 = -0^s.162 + 4.43\,\delta t + 6.25\,c^1 - 0.54\,a^1$ $\quad a_0 = -2^s.426$

$0 = +0^s.225 - 0.54\,\delta t - 2.96\,c^1 + 2.34\,a^1$ $\quad c_0 = +1^s.000$

After reversal—

$0 = +0^s.427 + 3.33\,\delta t - 4.21\,c^1 + 0.38\,a^1$ $\quad a_0 = -3^s.485$

$0 = +0^s.289 + 0.38\,a^1 + 0.57\,c^1 + 1.24\,a^1$ $\quad c_0 = +1^s.000$

Eliminating a^1 from each—

$0 = -0^s.113 + 4.43\,\delta t + 5.73\,c^1$ $\quad \delta t = -0^s.038$

$0 = +0^s.351 + 3.33\,\delta t - 4.55\,c^1.$ $\quad c^1 = +0^s.049$

Observations and reductions for time taken at sending station—Continued.

SANTA FÉ, NEW MEXICO, JULY 1, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	δ Bootis	8 33 34.65	— 0.06	+ 0.05	+ 1.13	8 33 35.77	15 10 24.77	+6 36 49.00
W.	γ Ursæ Minoris	44 05.76	+ 2.91	+ 0.10	+ 3.10	44 11.87	21 00.58	48.71
W.	α Coronæ	52 30.54	— 0.25	+ 0.04	+ 1.06	52 31.39	29 20.43	49.04
W.	γ Coronæ	9 00 36.42	— 0.26	+ 0.02	+ 1.05	9 00 37.23	37 26.42	49.19
W.	κ Serpentis	06 13.61	— 0.46	+ 0.01	+ 0.99	06 14.15	43 03.19	49.04
W.	ζ Ursæ Minoris	11 44.97	+ 4.91	— 0.02	+ 4.60	11 54.46	48 43.38	48.92
W.	θ Draconis	22 41.36	+ 1.13	— 0.05	+ 1.82	22 44.26	59 33.22	48.96
E.	γ Herculis	39 33.97	— 0.44	— 0.31	— 1.00	39 32.22	16 16 20.95	48.73
E.	η Draconis	45 31.72	+ 1.38	— 1.01	— 1.99	45 30.10	22 19.48	49.38
E.	σ Herculis	9 53 15.78	+ 0.25	— 0.88	— 1.28	9 53 13.87	16 30 02.73	+6 36 48.86
E.	109 Herculis	11 41 01.98	— 0.49	+ 0.07	— 0.79	11 41 00.77	18 18 19.25	+6 37 18.48
E.	χ Draconis	46 04.52	+ 3.77	+ 0.30	— 2.46	46 06.13	23 24.72	18.59
E.	α Lyræ	55 23.12	+ 0.12	+ 0.21	— 0.94	55 22.51	32 40.51	18.00
E.	110 Herculis	12 02 56.42	— 0.52	+ 0.17	— 0.78	12 02 55.29	40 13.91	18.62
E.	ο Draconis	12 03.74	+ 1.46	+ 0.29	— 1.43	12 04.06	49 22.22	18.16
W.	ζ Aquilæ	22 17.69	— 0.72	+ 0.30	+ 0.75	22 18.02	59 36.35	18.33
W.	δ Draconis	35 11.55	+ 2.56	— 0.07	+ 1.91	35 15.95	19 12 34.43	18.48
W.	τ Draconis	40 38.17	+ 3.91	— 0.18	+ 2.52	40 44.42	18 02.81	18.39
W.	β Cygni	48 19.24	— 0.29	— 0.12	— 0.83	48 19.66	25 38.02	18.36
W.	θ Cygni	12 55 44.35	+ 0.71	— 0.18	+ 1.14	12 55 46.02	19 33 04.36	+6 37 18.34

NORMAL EQUATIONS.

First series.

$$0 = +0^s.226 + 6.86\,\delta t - 3.34\,c^1 - 1.01\,a^1 \qquad \delta t = -0^s.008 \qquad \Delta T_0 = +6^h\,36^m\,49^s.00$$
$$0 = +0^s.009 - 3.34\,\delta t + 17.00\,c^1 + 2.72\,a^1 \qquad c^1 = -0^s.062 \qquad c_0 = -\ 0^s.88$$
$$0 = -1^s.024 - 1.01\,\delta t + 2.72\,c^1 + 3.18\,a^1 \qquad a^1 = +0^s.372 \qquad a_0 = -\ 1^s.860$$

Second series.

$$0 = -0^s.832 + 6.85\,\delta t + 0.20\,c^1 - 1.25\,a^1 \qquad \delta t = +0^s.116 \qquad \Delta T_0 = +6^h\,37^m\,18^s.25$$
$$0 = -2^s.666 + 0.20\,\delta t + 17.89\,c^1 + 0.46\,a^1 \qquad c^1 = +0^s.148 \qquad c_0 = -\ 0^s.88$$
$$0 = +0^s.099 - 1.25\,\delta t + 0.46\,c^1 + 3.51\,a^1 \qquad a^1 = -0^s.006 \qquad a_0 = -\ 1^s.860$$

Observations and reductions for time taken at sending station—Continued.

SANTA FÉ, NEW MEXICO, JULY 2, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	δ Bootis	8 29 42.25	− 0.08	+ 0.63	− 0.86	8 29 41.94	15 10 24.76	+6 40 42.82
E.	γ Ursæ Minoris	40 14.10	+ 3.90	+ 1.97	− 2.35	40 17.62	21 00.53	42.91
E.	α Coronæ	48 38.05	− 0.33	+ 0.90	− 0.80	48 37.82	29 20.43	42.61
E.	γ Coronæ	56 45.26	− 0.35	− 0.82	− 0.80	56 43.29	37 26.42	43.13
E.	12 H. Draconis	9 04 05.36	+ 2.01	− 1.96	− 1.57	9 04 03.84	44 46.96	43.12
W.	θ Draconis	18 47.68	+ 1.52	0.00	+ 1.38	18 50.58	59 33.20	42.62
W.	δ Ophiuchi	27 00.87	− 1.26	− 0.03	+ 0.72	27 00.30	16 07 43.33	43.03
W.	γ Herculis	35 37.93	− 0.59	− 0.07	+ 0.76	35 38.03	16 20.95	42.92
W.	η Draconis	41 33.12	+ 1.86	− 0.16	+ 1.51	41 36.33	22 19.45	43.12
W.	σ Herculis	9 49 18.68	+ 0.33	− 0.14	+ 0.97	9 49 19.84	30 02.72	+6 40 42.88
W.	36 Draconis	11 31 57.09	+ 2.34	− 0.30	+ 1.82	11 32 00.95	18 13 13.05	+6 41 12.10
W.	109 Herculis	37 06.92	− 0.55	− 0.13	+ 0.85	37 07.09	18 19.25	12.16
W.	α Lyræ	51 27.63	+ 0.14	− 0.05	+ 1.01	51 28.73	32 40.52	11.79
W.	110 Herculis	59 01.52	− 0.59	− 0.02	+ 0.84	59 01.75	40 13.92	12.17
E.	ο Draconis	12 08 09.92	+ 1.65	+ 0.53	− 1.54	12 08 10.56	49 22.22	11.66
E.	υ Draconis	14 45.52	+ 3.78	+ 1.01	− 2.44	14 47.87	56 00.47	12.60
E.	ζ Aquilæ	18 25.46	− 0.81	+ 0.42	− 0.81	18 24.26	59 36.37	12.11
E.	α Aquilæ	30 42.50	− 0.89	+ 0.52	− 0.81	30 41.32	19 11 53.35	12.03
E.	δ Aquilæ	12 37 57.11	− 1.14	+ 0.53	− 0.79	12 37 55.71	19 19 07.77	+6 41 12.06

NORMAL EQUATIONS.

First series.

$0 = +0^s.857 + 7.44\,\delta t - 0.46\,c^1 - 0.88\,a^1$ $\delta t = -0^s.094$ $\triangle T_0 = +6^h\,40^m\,43^s.00$

$0 = -0^s.851 - 0.46\,\delta t + 17.27\,c^1 - 1.21\,a^1$ $c^1 = +0^s.056$ $c_0 = -\ 0^s.77$

$0 = -0^s.458 - 0.88\,\delta t - 1.21\,c^1 + 2.94\,a^1$ $a^1 = +0^s.149$ $a_0 = -\ 2^s.143$

Second series.

$0 = -0^s.299 + 7.11\,\delta t + 0.81\,c^1 + 0.35\,a^1$ $\delta t = +0^s.046$ $\triangle T_0 = +6^h\,41^m\,12^s.00$

$0 = +0^s.225 + 0.81\,\delta t + 14.00\,c^1 - 0.41\,a^1$ $c^1 = -0^s.020$ $c_0 = -\ 0^s.77$

$0 = -0^s.109 + 0.35\,\delta t - 0.41\,c^1 + 2.54\,a^1$ $a^1 = +0^s.034$ $a_0 = -\ 2^s.143$

Observations and reductions for time taken at sending station—Continued.

SANTA FÉ, NEW MEXICO, JULY 12, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	γ Ursæ Minoris	8 01 10.34	— 0.42	+ 0.61	+ 1.33	8 01 11.86	15 20 59.97	+7 19 48.11
W.	a Coronæ	09 31.57	+ 0.04	+ 0.26	+ 0.46	09 31.33	29 20.33	48.00
W.	γ Coronæ	17 37.55	+ 0.04	+ 0.26	+ 0.45	17 38.30	37 26.33	48.03
W.	κ Serpentis	23 14.87	+ 0.07	+ 0.23	+ 0.43	23 15.60	43 03.10	47.50
W.	γ Serpentis	30 48.52	+ 0.08	+ 0.23	+ 0.42	30 49.25	50 37.00	47.75
W.	θ Draconis	39 44.16	— 0.16	+ 0.41	+ 0.78	39 45.19	59 32.95	47.76
E.	ε Ophiuchi	51 50.24	+ 0.12	+ 0.03	— 0.41	51 49.98	16 11 37.97	47.99
E.	γ Herculis	56 33.19	+ 0.06	+ 0.03	— 0.43	56 32.85	16 20.89	48.04
E.	η Draconis	9 02 32.25	— 0.20	+ 0.06	— 0.86	9 02 31.25	22 19.20	47.95
E.	σ Herculis	9 10 15.58	— 0.04	+ 0.04	— 0.55	9 10 15.03	16 30 02.61	+7 19 47.58
E.	δ Ursæ Minoris	10 53 23.27	— 2.53	+ 2.79	— 6.16	10 53 17.37	18 13 34.12	+7 20 16.75
E.	109 Herculis	58 07.12	+ 0.05	+ 0.28	— 0.39	58 07.06	18 19.29	12.23
E.	χ Draconis	11 03 13.21	— 0.39	+ 0.71	— 1.22	11 03 12.31	23 24.54	12.23
E.	a Lyræ	12 28.40	— 0.01	+ 0.33	— 0.47	12 28.25	32 40.55	12.30
W.	110 Herculis	20 01.17	+ 0.05	— 0.21	+ 0.39	20 01.40	40 13.99	12.59
W.	β Lyræ	25 12.92	+ 0.01	— 0.25	+ 0.44	25 13.12	45 25.60	12.48
W.	o Draconis	29 09.61	— 0.15	— 0.37	+ 0.71	29 09.80	49 22.11	12.31
W.	ζ Aquilæ	39 23.67	+ 0.07	— 0.20	+ 0.38	39 23.92	59 36.46	12.54
W.	25 Camelop., H. sq.	43 54.82	+ 1.33	+ 0.76	— 2.85	43 54.06	19 04 07.51	13.45
W.	δ Draconis	11 52 21.77	— 0.26	— 0.46	+ 0.95	11 52.22.00	19 12 34.45	+7 20 12.45

NORMAL EQUATIONS.

First series.

$$0 = +0^s.227 + 7.32\,\delta t - 1.09\,c^1 + 0.03\,a^1 \qquad \delta t = -0^s.031 \qquad \Delta T_0 = +7^h\,19^m\,47^s.90$$
$$0 = -0^s.234 - 1.09\,\delta t + 15.03\,c^1 + 1.54\,a^1 \qquad c^1 = +0^s.005 \qquad c_0 = -\ 0^s.410$$
$$0 = -0^s.230 + 0.03\,\delta t + 1.54\,c^1 + 2.65\,a^1 \qquad a^1 = +0^s.084 \qquad a_0 = +\ 0^s.131$$

Second series.

$$0 = -0^s.306 + 5.85\,d\,\Delta T - 1.95\,dc - 0.51\,da \qquad da = +0^s.070 \qquad \Delta T_0 = +7^h\,20^m\,12^s.35$$
$$0 = -0^s.631 - 1.95\,d\,\Delta T + 16.87\,dc + 0.33\,da \qquad dc = +0^s.045 \qquad c_0 = -\ 0^s.41$$
$$0 = -0^s.307 - 0.51\,d\,\Delta T + 0.33\,dc + 4.70\,da \qquad d\,\Delta T = +0^s.073 \qquad a_0 = +\ 0^s.123$$

Weight of a = 4.65 Weight of c = 16.17 Weight of ΔT = 5.57

Observations and reductions for time taken at sending station—Continued.

SANTA FÉ, NEW MEXICO, JULY 14, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	110 Herculis	11 12 02.68	— 0.62	+ 0.16	— 0.49	11 12 01.73	18 40 14.00	+7 28 12.27
E.	o Draconis	21 08.88	+ 1.72	+ 1.27	— 0.90	21 09.97	49 22.23	12.26
E.	ζ Aquilæ..........	31 25.02	— 0.85	+ 0.15	— 0.47	31 23.85	59 36.48	12.63
W.	δ Draconis	44 19.04	+ 3.02	— 0.89	+ 1.20	44 22.37	19 12 34.44	12.07
W.	δ Aquilæ	50 56.65	— 1.19	— 0.34	+ 0.46	50 55.58	19 07.90	12.32
W.	β Cygni............	57 25.48	— 0.35	+ 0.05	+ 0.52	57 25.70	25 38.20	12.50
W.	σ Draconis	12 04 21.95	+ 3.19	+ 0.10	+ 1.31	12 04 26.85	32 39.40	12.55
W.	γ Aquilæ..........	12 03.75	— 0.96	+ 0.04	+ 0.47	12 03.30	40 15.48	12.18
W.	a Aquilæ..........	16 25.81	— 1.02	+ 0.04	+ 0.47	16 25.30	44 37.40	12.10
W.	ε Draconis	20 21.16	+ 3.62	+ 0.10	+ 1.35	20 26.23	48 38.94	12.71
W.	Groombr. 2984 ..	24 38.50	+ 0.22	+ 0.06	+ 0.60	24 39.38	52 51.31	11.93
E.	28 Cygni............	36 33.42	+ 0.04	+ 0.19	— 0.57	36 33.08	20 04 44.90	11.82
E.	31 Cygni............	41 28.21	+ 0.59	+ 0.22	— 0.67	41 28.35	09 40.21	11.86
E.	κ Cephei	44 53.84	+ 6.67	+ 0.52	— 2.10	44 58.93	13 11.89	12.96
E.	39 Cygni............	50 37.52	— 0.18	+ 0.18	— 0.55	50 36.97	18 49.44	12.47
E.	ε Delphini	12 58 59.41	— 0.94	+ 0.14	— 0.47	12 58 58.14	20 27 10.81	+7 28 12.67

NORMAL EQUATIONS.

$$0 = -0^s.028 + 11.53\,d\triangle T - 0.52\,dc + 0.11\,da \qquad d\triangle T = +0^s.005 \qquad \triangle T_0 = +7^h\,28^m\,12^s.28$$
$$0 = +0^s.822 - 0.52\,d\triangle T + 24.00\,dc + 1.44\,da \qquad dc = -0^s.044 \qquad c_0 = -\ 0^s.417$$
$$0 = -0^s.444 + 0.11\,d\triangle T + 1.44\,dc + 4.46\,da \qquad da = +0^s.120 \qquad a_0 + -\ 2^s.321$$

Weight of $\triangle T = 11.52$ Weight of $c = 23.51$ Weight of $a = 4.37$

Observations and reductions for time taken at sending station—Continued.

SANTA FÉ, NEW MEXICO, JULY 17, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	ε Ophiuchi	8 32 10.26	+ 0.18	+ 0.14	+ 0.41	8 32 10.99	16 11 37.03	+7 39 26.94
W.	γ Herculis	36 53.92	+ 0.10	+ 0.19	+ 0.43	36 54.64	16 20.85	26.21
W.	η Draconis	42 51.95	− 0.30	+ 0.35	+ 0.86	42 52.86	22 19.06	26.20
E.	ζ Herculis	57 05.67	+ 0.03	+ 0.38	− 0.48	57 05.60	36 31.86	26.26
E.	κ Ophiuchi	9 12 15.04	+ 0.14	+ 0.29	− 0.41	9 12 15.06	51 41.29	26.23
E.	ε Ursæ Minoris	9 19 44.98	− 1.72	+ 1.65	− 2.97	9 19 41.94	16 59 10.05	+7 39 28.11
E.	Groombr. 2533	10 31 59.68	− 0.01	+ 0.08	− 0.83	10 31 58.92	18 11 43.95	+7 39 45.03
E.	109 Herculis	38 34.14	+ 0.02	+ 0.06	− 0.66	38 33.56	18 19.29	45.73
E.	χ Draconis	43 40.43	− 0.13	+ 0.16	− 2.08	43 38.38	23 24.38	46.00
E.	α Lyræ	52 55.87	0.00	+ 0.07	− 0.79	52 55.15	32 40.55	45.40
E.	β Lyræ	11 05 40.79	0.00	+ 0.07	− 0.74	11 05 40.12	45 25.61	45.49
E.	ο Draconis	09 38.07	− 0.05	+ 0.10	− 1.21	09 36.91	49 22.18	45.27
E.	ζ Aquilæ	19 51.32	+ 0.03	+ 0.06	− 0.63	19 50.78	59 36.49	45.71
W.	δ Draconis	32 47.21	− 0.09	+ 0.07	+ 1.61	32 48.80	19 12 34.41	45.61
W.	δ Aquilæ	39 21.81	+ 0.04	+ 0.03	+ 0.62	39 22.50	19 07.92	45.42
W.	β Cygni	11 45 52.01	+ 0.01	+ 0.03	+ 0.70	11 45 52.75	19 25 38.18	+7 39 45.43

Four stars, α Coronæ, γ Coronæ, ζ Ursæ Minoris, θ Draconis, were rejected, owing to an accidental disturbance of the azimuth. This was noted at the time, and care taken that the determination should be completed; but at best the instrument was very unsteady.

NORMAL EQUATIONS.

First series.

$0 = -0^s.590 + 4.13\, d\triangle T - 1.10\, dc + 0.80\, da$ $\qquad d\triangle T = +0^s.106$ $\qquad \triangle T_0 = +7^h\, 39^m\, 26^s.300$

$0 = -0^s.420 - 1.10\, d\triangle T + 7.85\, dc - 0.63\, da$ $\qquad dc = +0^s.094$ $\qquad c_0 = -\ 0^s.500$

$0 = -0^s.666 + 0.80\, d\triangle T - 0.63\, dc + 1.99\, da$ $\qquad da = +0^s.321$ $\qquad a_0 = \ 0^s.000$

Weight of $\triangle T = 3.72$ $\qquad$ Weight of $c = 7.46$ $\qquad$ Weight of $a = 1.81$

Second series.

$0 = +0^s.135 + 7.71\, d\triangle T + 4.22\, dc - 0.24\, da$ $\qquad d\triangle T = +0^s.053$ $\qquad \triangle T_0 = +7^h\, 39^m\, 45^s.43$

$0 = +1^s.864 + 4.22\, d\triangle T + 15.91\, dc - 1.18\, da$ $\qquad dc = -0^s.117$ $\qquad c_0 = -\ 0^s.50$

$0 = -0^s.600 - 0.21\, d\triangle T - 1.18\, dc + 2.50\, da$ $\qquad da = +0^s.189$ $\qquad a^0 = -\ 0^s.123$

Observations and reductions for time taken at sending station—Continued.

SANTA FÉ, NEW MEXICO, JULY 19, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	γ Herculis	8 29 03.20	− 0.81	− 0.04	− 0.48	8 29 01.87	16 16 20.83	+7 47 18.96
E.	η Draconis	34 58.18	+ 2.55	− 0.08	− 0.95	34 59.70	22 18.99	19.29
E.	σ Herculis	42 44.13	+ 0.45	− 0.06	− 0.61	42 43.91	30 02.51	18.60
E.	ζ Herculis	49 13.64	− 0.22	− 0.05	− 0.53	49 12.84	36 31.84	19.00
E.	Groombr. 2377	55 30.38	+ 1.83	− 0.07	− 0.83	55 36.31	42 55.71	19.40
W.	Groombr. 2415	9 16 20.60	+ 0.32	− 0.14	+ 0.59	9 16 21.37	17 03 40.26	18.89
W.	ζ Draconis	27 05.21	+ 3.36	− 0.32	+ 1.10	21 09.35	08 28.18	18.83
W.	72 Herculis	28 37.12	− 0.17	− 0.24	+ 0.53	28 37.24	15 56.50	19.26
W.	α Ophiuchi	9 41 45.94	− 1.10	− 0.24	+ 0.46	9 41 45.06	17 29 04.38	+7 47 19.32
W.	Groombr. 2533	10 24 08.74	+ 0.44	− 0.01	+ 0.70	10 24 09.87	18 11 43.95	+7 47 34.08
W.	109 Herculis	30 45.59	− 0.76	+ 0.05	+ 0.56	30 45.44	18 19.29	33.85
W.	χ Draconis	35 43.01	+ 5.90	+ 0.52	+ 1.73	35 51.16	23 24.32	33.16
W.	α Lyræ	45 05.62	+ 0.20	+ 0.46	+ 0.66	45 06.94	32 40.54	33.60
E.	o Draconis	11 01 47.12	+ 2.28	− 0.19	− 1.01	11 01 48.20	49 22.19	33.99
E.	ε Aquilæ	06 21.97	− 1.07	− 0.10	− 0.53	06 20.27	53 53.68	33.41
E.	ζ Aquilæ	11 12 04.65	− 1.12	− 0.10	− 0.53	11 12 02.90	18 59 36.50	+7 47 33.60

NORMAL EQUATIONS.

First series.

$0 = +0^s.219 + 6.89\,d\triangle T + 1.02\,dc - 0.80\,da \qquad d\triangle T = -0^s.019 \qquad \triangle T_0 = +7^h\,47^m\,19^s.07$

$0 = -0^s.877 + 1.02\,d\triangle T + 14.32\,dc - 0.58\,da \qquad dc = +0^s.071 \qquad c_0 = -\ 0^s.52$

$0 = -0^s.303 - 0.80\,d\triangle T - 0.58\,dc + 1.64\,da \qquad da = +0^s.202 \qquad a_0 = -\ 2^s.938$

Weight of $\triangle T = 6.46$ Weight of $c = 14.03$ Weight of $a = 1.53$

Second series.

$0 = -0^s.024 + 5.33\,d\triangle T - 0.76\,dc - 0.22\,da \qquad d\triangle T = +0^s.006 \qquad \triangle T_0 = +7^h\,47^m\,33^s.70$

$0 = -0^s.066 - 0.76\,d\triangle T + 11.29\,dc + 1.66\,da \qquad dc = +0^s.004 \qquad c_0 = -\ 0^s.52$

$0 = -0^s.037 - 0.22\,d\triangle T + 1.66\,dc + 1.81\,da \qquad da = +0^s.018 \qquad a_0 = -\ 2^s.938$

Observations and reductions for time taken at sending station—Continued.

SANTA FÉ, NEW MEXICO, JULY 21, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	110 Herculis	10 44 45.51	+ 1.26	+ 0.26	− 0.41	10 44 46.62	18 40 14.00	+7 55 27.38
E.	β Lyræ	49 58.37	+ 0.23	+ 0.26	− 0.46	49 58.40	45 25.61	27.21
E.	o Draconis	53 58.34	− 3.52	+ 0.36	− 0.75	53 54.43	49 22.14	27.71
E.	1 Lyræ	58 46.16	+ 0.29	+ 0.21	− 0.46	58 46.20	54 13.80	27.60
W.	δ Draconis	11 17 11.68	− 6.18	+ 0.33	+ 1.00	11 17 06.83	19 12 34.36	27.53
W.	δ Aquilæ..........	23 37.49	+ 2.44	+ 0.15	+ 0.38	23 40.46	19 07.95	27.49
W.	β Cygni..........	30 09.04	+ 0.71	+ 0.26	+ 0.43	30 10.44	25 38.20	27.76
W.	θ Cygni..........	11 37 38.03	− 1.72	+ 0.43	+ 0.59	11 37 37.33	19 33 04.49	+7 55 27.16
W.	γ Aquilæ..........	11 44 35.93	+ 1.72	− 0.09	+ 0.50	11 44 38.06	19 40 15.53	+7 55 37.47
W.	α Aquilæ..........	48 58.02	+ 1.83	− 0.09	+ 0.50	49 00.26	44 37.46	37.22
W.	κ Cephei	12 17 44.50	−11.98	− 0.34	+ 2.24	12 17 34.42	20 13 11.88	37.42
W.	γ Cygni	21 05.30	− 0.38	− 0.13	+ 0.64	21 05.43	17 42.48	37.04
E.	θ Cephei	31 56.12	− 2.49	− 0.37	− 1.06	31 52.30	27 29.57	37.28
E.	α Delphini	38 09.11	+ 0.87	− 0.19	− 0.51	38 09.28	33 46.55	37.27
E.	γ Delphini	12 46 10.63	+ 0.87	− 0.19	− 0.51	12 46 10.80	20 40 48.05	+7 55 37.26

NORMAL EQUATIONS.

First series..

$$0 = -0^s.062 + 6.41\,d\triangle T + 0.03\,dc - 0.18\,da \qquad d\triangle T = +0^s.019 \qquad \triangle T_0 = +7^h\,55^m\,27^s.45$$
$$0 = -0^s.581 + 0.03\,d\triangle T + 12.41\,dc + 0.70\,da \qquad dc = +0^s.027 \qquad c_0 = -\ 0^s.41$$
$$0 = -0^s.588 - 0.18\,d\triangle T + 0.70\,dc + 1.56\,da \qquad da = +0^s.348 \qquad a_0 = +\ 4^s.16$$

Weight of $\triangle T = 6.39$ Weight of $c = 12.10$ Weight of $a = 1.52$

Second series.

The assumed azimuth was different before and after reversal, as a change took place then.

Before reversal—

$$0 = -0^s.416 + 3.01\,d\triangle T - 3.88\,dc + 0.32\,da^{\mathrm{I}} \qquad \triangle T_0 = +7^h\,55^m\,37^s.20$$
$$0 = +1^s.122 - 3.88\,d\triangle T + 6.87\,dc + 1.44\,da^{\mathrm{I}} \qquad c_0 = -\ 0^s.41$$
$$0 = +0^s.489 + 0.32\,d\triangle T + 1.44\,dc + 1.89\,da^{\mathrm{I}} \qquad a_0 = +\ 4^s.16$$

After reversal—

$$0 = +0^s.092 + 2.45\,d\triangle T + 3.09\,dc + 0.23\,da^{\mathrm{II}} \qquad \triangle T_0 = +7^h\,55^m\,37^s.20$$
$$0 = +0^s.124 + 3.09\,d\triangle T + 4.40\,dc - 0.30\,da^{\mathrm{II}} \qquad c_0 = -\ 0^s.41$$
$$0 = \ \ 0^s.000 + 0.23\,d\triangle T - 0.30\,dc + 0.72\,da^{\mathrm{II}} \qquad a_0 = +\ 2^s.494$$

First eliminating da^{I} and da^{II}, and then combining the resulting equations, we get—

$$d\triangle T = +0^s.062 \qquad \triangle T = +7^h\,55^m\,37^s.262$$
$$dc = -0^s.081 \qquad c = -\ 0^s.491$$
$$da^{\mathrm{I}} = -0^s.208 \qquad a^{\mathrm{I}} = +\ 3^s.952$$
$$da^{\mathrm{II}} = -0^s.053 \qquad a^{\mathrm{II}} = +\ 2^s.441$$

Weight of $\triangle T = 5.24$

The observations for time taken at Salt Lake are printed for June 25, July 1, July 2, and July 3, in the report on Georgetown; those for July 12, July 14, and July 17, in the report on Hughes.

The following tables show the corrections and rates of the chronometers used at Santa Fé and Salt Lake City:—

CHRONOMETER AT SANTA FÉ—Frodsham, No. 1974.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*h. m. s.*	*s.*
June 25	16.5	6 13 26.783 ± 0.043	+ 9.772
July 1	17.5	37 03.679 ± 0.043	+ 9.779
July 2	17.5	40 57.476 ± 0.040	+ 9.728
July 12	17.25	7 20 00.146 ± 0.043	+ 9.7-8
July 14	19.5	28 12.285 ± 0.045	+ 9.783
July 17	18.0	39 40.714 ± 0.048	+ 9.680
July 19	17.75	47 26.378 ± 0.045	+ 9.791
July 21	19.50	7 55 32.366 ± 0.045	+ 9.760

CHRONOMETER AT SALT LAKE CITY—Negus, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	*h.*	*h. m. s.*	*s.*
June 25	16.5	+ 8 07 24.61	+ 0.052
July 1	15.0	15.84	+ 0.046
July 2	16.5	14.68	+ 0.049
July 3	16.2	13.50	0.000
July 12	17.5	08.48	+ 0.025
July 14	16.0	07.61	+ 0.021
July 17	17.25	+ 8 07 05.85	+ 0.010

NOTE.—In calculating the probable errors, Professor Safford used the probale error of one star at the equator, $\pm 0^{s}.152$, as derived from the mean of all the observations, considering it always unsafe to employ a probable error derived from a few observations.

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
June 25, 1873:		*h. m. s.*	*h. m. s.*	*h. m. s.*	*m. s.*	*s.*	*s.*
Salt Lake City	Santa Fé	11 18 53.61	+6 13 36.89	17 32 30.50			
	Salt Lake City	9 01 18.03	+8 07 24.58	17 08 42.61	23 47.89	47.885	
	Santa Fé	11 42 46.67	+6 13 40.86	17 56 27.53			
	Salt Lake City	9 25 15.09	+8 07 24.56	17 32 39.65	47.88		
Santa Fé	Santa Fé	11 31 30.00	+6 13 39.02	17 45 09.02			
	Salt Lake City	9 13 56.79	+8 07 24.57	17 21 21.36	47.66	47.715	
	Santa Fé	11 51 30.00	+6 13 42.29	18 05 12.29			
	Salt Lake City	9 33 59.97	+8 07 24.55	17 41 24.52	47.77	0.170	47.80
July 1, 1873:							
Santa Fé	Santa Fé	10 42 40.00	+6 37 02.00	17 19 42.00			
	Salt Lake City	8 48 38.40	+8 07 15.75	16 55 54.15	47.85		
Salt Lake City	Santa Fé	11 00 32.78	+6 37 04.92	17 37 37.70			
	Salt Lake City	9 06 33.85	+8 07 15.74	17 13 49.59	23 48.11	0.26	47.98

Final results of longitude—Continued.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. m. s.	*h. m. s.*	*h. m. s.*	*m. s.*	*s.*	*s.*
July 2, 1873:							
Santa Fé	Santa Fé	10 51 30.00	+6 40 57.87	17 32 27.87			
	Salt Lake City	9 01 25.46	+8 07 14.65	17 08 40.11	23 47.76	(0.19)	47.86
July 12, 1873:							
Salt Lake City.	Santa Fé	10 07 42.55	+7 20 02.22	17 27 44.77			
	Salt Lake City	8 56 48.18	+8 07 08.49	17 03 56.67	48.10		
Santa Fè	Santa Fé	10 13 44.21	+7 20 03.21	17 33 47.42			
	Salt Lake City	9 02 51.08	+8 07 08.49	17 09 59.57	47.85	0.25	47.98
July 14, 1873:							
Salt Lake City.	Santa Fé	10 18 15.96	+7 27 55.36	17 46 11.32			
	Salt Lake City	9 15 15.82	+8 07 07.58	17 22 23.40	47.92		
Santa Fé	Santa Fé	10 23 49.50	+7 27 56.27	17 51 45.77			
	Salt Lake City	9 20 50.43	+8 07 07.58	17 27 58.01	47.76	0.16	47.84
July 17, 1873:							
Salt Lake City.	Santa Fé	9 38 56.07	+7 39 34.02	17 18 30.09			
	Salt Lake City	8 47 36.47	+8 07 05.85	16 54 42.32	47.77		
Santa Fé	Santa Fé	9 48 10.00	+7 39 35.51	17 27 45.51			
	Salt Lake City	8 56 52.01	+8 07 05.85	17 03 57.86	23 47.65	0.12	47.71

Santa Fé east of Salt Lake City........................ 0h 23m 47s.86

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. m. s.	*h. m. s.*	*h. m. s.*	*m. s.*	*s.*	*m. s.*
July 12, 1873:							
Hughes	Hughes	17 05 55.00	—0 10 13.33	16 55 41.67			
	Santa Fé	9 31 14.37	+7 19 56.26	16 51 10.63	4 31.04		
Santa Fé	Hug es	17 48 37.14	—0 10 13.32	17 38 23.82			
	Santa Fé	10 13 49.50	+7 20 03.21	17 33 52.71	31.11	0.07	4 31.075
July 14, 1873:							
Hughes	Hughes	18 21 33.06	—0 10 12.10	18 11 20.96			
	Santa Fé	10 38 51.05	+7 27 58.72	18 06 49.77	31.19		
Santa Fé	Hugges	18 33 33.63	—0 10 12.10	18 23 21.53			
	Santa Fé	10 50 49.50	+7 28 00.73	18 18 50.23	31.30	0.11	31.245
July 17, 1873:							
Hughes	Hughes	18 09 20.00	—0 10 11.34	17 59 08.66			
	Santa Fé	10 14 57.69	+7 39 39.85	17 54 37.54	31.12	(0.08)	31.160
July 21, 1873:							
Hughes	Hughes	17 46 40.00	—0 10 09.96	17 36 30.04			
	Santa Fé	9 36 45.83	+7 55 13.17	17 31 59.00	31.04		
Santa Fé	Hughes	17 58 35.67	—0 10 09.96	17 48 25.71			
	Santa Fé	9 48 39.50	+7 55 15.11	17 43 54.61	4 31.10	0.06	4 31.070

Hughes east of Santa Fé 0h 04m 31s.138
Hughes east of Salt Lake City 0h 28m 18s.938
Santa Fé east of Salt Lake City, (by way of Hughes)..........0h 23m 47s.80
Santa Fé east of Salt Lake City, (by direct connection)........0h 23m 47s.86
Santa Fé east of Salt Lake City, (adopted value) ....0h 23m 47s.85 ± 0s.021
Salt Lake City west of Greenwich 7h 27m 34s.86
Santa Fé west of Greenwich ....7h 03m 47s.01, or 105° 56′ 45″.15
Santa Fé west of Washington ....1h 55m 34s.89, or 28° 53′ 43″.35

Applying the correction, + 0s.07, for change of position of station at Santa Fé—
Longitude of Santa Fé, (present monument).....................105° 56′ 45″.22

Mean places of stars for 1873.0 used for determination of latitude of Santa Fé, New Mexico.

No. of pair.	Number in B. A. C.	Right ascension.	Declination.	No. of pair.	Number in B. A. C.	Right ascension.	Declination.
		h. m. s.	° ′ ″			h. m. s.	° ′ ″
1....	5131	15 47 28	31 47 19.92	27.....	6496	18 54 36	57 38 48 76
	5155	30 35	39 25 59.10		6528	59 34	13 40 34.58
2....	5204	15 38 59	32 55 05.36	28.....	6566	19 05 18	50 09 34.52
	5295	51 10	38 18 54.36		6574	07 10	21 20 31.60
3....	5210	15 39 23	52 45 45.02	29.....	6589	19 10 45	21 10 04.34
	5234	43 01	18 32 07.38		6659	20 04	50 01 25.36
4....	5284	15 50 35	16 04 39.68	30.....	6678	19 23 48	20 01 10.64
	5313	54 47	55 06 33.34		6697	26 30	51 27 35.92
5....	5315	15 55 32	18 10 15.56	31.....	6695	19 26 31	20 39 39.60
	5341	58 51	53 16 09.72		6723	31 02	50 57 54.06
6....	5367	16 02 21	17 23 12.32	32.....	(R. C. 4379)	19 31 10	59 52 53.96
	(Gr. 2325)	12 41	53 33 15.20		6749	36 35	11 31 45.86
7....	5466	16 16 19	19 27 10.52	33....	6740	19 34 22	29 51 42.58
	5503	21 47	52 00 17.76		6769	39 31	41 28 09.62
8....	5520	16 24 31	2 15 49.34	34.....	6762	19 38 44	26 49 58.24
	5545	28 14	69 02 31.08		6779	41 00	44 49 18.34
9....	5530	16 25 47	22 28 12.82	35.....	6794	19 43 20	18 49 30.24
	5596	35 18	49 10 39 40		6824	47 26	52 39 58.84
10....	5604	16 36 30	31 50 03.46	36.....	6800	19 44 00	33 07 15.10
	5617	38 33	39 09 54.04		6813	46 04	38 23 48.62
11....	5629	16 40 22	55 55 24.64	37.....	6835	19 49 08	23 59 16.08
	5674	46 18	15 11 20.00		(Gr. 2977)	51 17	47 12 18.48
12....	5677	16 46 29	24 52 17.40	38.....	6851	19 51 32	34 44 49.86
	5706	50 40	46 44 44.24		6875	55 16	36 41 45.20
13....	5765	16 59 29	12 55 00.94	39.....	6881	19 55 54	51 42 30.36
	5797	17 05 07	58 26 04.90		6901	59 32	19 37 43.02
14....	(Gr. 2431)	17 14 07	38 56 32.36	40.....	6933	20 04 20	20 32 21.06
	5863	15 55	32 37 56.94		6959	09 00	51 04 56.40
15....	5828	17 09 49	24 59 25.30	41.....	6975	20 10 45	21 12 37.60
	5871	16 46	46 21 58.58		6985	12 02	49 50 32.14
16....	5883	17 18 48	23 04 48.22	42.....	6998	20 13 46	34 35 13.28
	5911	23 22	48 22 02.94		7006	15 03	36 44 01.28
17....	5918	17 24 11	58 45 29.84	43.....	7022	20 17 40	39 51 04.58
	5941	29 02	12 39 15.80		7029	18 48	31 46 52.94
18....	5997	17 36 47	43 32 00.84	44.....	7084	20 26 10	36 30 32.70
	6021	41 29	27 47 47.28		7103	28 58	34 49 01.08
19....	6056	17 46 44	48 25 45.06	45.....	*7131	20 32 22	31 07 47.84
	6116	57 12	22 55 26.60		7158	34 54	40 07 53.90
20....	6134	18 00 41	22 12 31.70	46.....	7174	20 37 21	41 15 46.96
	(Gr. 2536)	11 42	49 06 53.22		7194	40 25	30 15 26.08
21....	6147	18 02 12	30 32 42.86	47.....	7241	20 45 34	43 34 54.04
	6218	13 05	40 53 15.48		7256	49 09	27 34 32.32
22....	6231	18 14 56	21 54 33.56	48.....	7275	20 52 36	21 50 10.30
	6252	17 56	49 39 50.26		7294	54 26	49 58 09.92
23....	6302	18 23 20	+72 40 37.00	49.....	7350	21 08 18	9 29 35.94
	6307	25 24	− 1 05 28.20		7416	15 33	62 02 51.86
24....	(Arg. LXIII)	18 27 58	30 27 37.50	50......	7444	21 18 56	25 37 44.78
	6364	35 27	40 49 11.90		7455	20 40	46 09 53.74
25....	6355	18 32 38	38 40 00.02	51.....	7482	21 25 19	66 15 17.80
	6426	45 02	32 40 03.98		7522	32 10	5 11 59.58
26....	6392	18 40 24	37 28 24.52				
	6468	50 13	33 48 27.32				

* On July 26, B. A. C. 7132, A. R. $20^h\ 32^m\ 23^s$ declination 31° 04′ 50″.44, was used instead of 7131.

Observations and computations for latitude.

SANTA FÉ, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
June 27 ..	5131	3 55.5	59.0	14.5					
	5155	4 93.9	11.0	63.0	Set poor.	35 36 41.49	+ 4 37.30	— 2.04	35 41 16.75
	5204	19 33.9	35.5	38.0					
	5295	6 39.3	39.0	35.0		37 01.23	+ 4 15.74	+ 0.41	17.38
	5315	11 02.1	14.0	60.0					
	5341	14 18.5	41.0	33.0		43 13.42	— 1 41.83	—10.35	21.24
	5466	11 74.2	35.0	40.0					
	5503	16 00.4	21.5	54.0		43 44.10	— 2 17.18	—10.22	16.70
	5677	12 89.3	57.5	19.0					
	5706	26 61.0	41.0	35.0		48 29.92	— 7 21.48	+12.13	20.57
	5765	12 24.2	21.0	55.0					
	5797	10 53.5	35.0	41.0		40 31.19	+ 0 54.94	—10.90	15.23
	5828	10 29.0	62.0	13.0					
	5871	9 57.6	40.0	35.0		40 40.14	+ 0 22.98	+14.72	17.84
	5918	12 24.0	54.0	21.0					
	5941	10 93.8	2.5	......		42 20.44	— 0 41.90	—10.68	28.46
	6056	7 90.0	17.0	57.0					
	6116	8 83.4	63.0	11.0		40 32.92	+ 0 30.06	+ 3.27	6.25
	6147	10 56.0	23.0	51.0					
	6218	13 20.0	26.0	48.0		42 55.70	— 1 24.96	—13.62	17.12
	6355	8 16.4	44.5	29.0					
	6426	9 78.8	21.0	53.0		39 57.76	+ 1 24.45	— 4.50	17.71
	6496	8 46.9	41.0	32.0					
	6528	11 99.7	17.0	57.0		39 36.94	+ 1 53.55	— 8.46	22.03
	6566	15 06.2	40.0	33.0					
	6574	8 45.9	21.4	52.0		44 58.06	— 3 32.52	— 6.43	19.11
	6589	20 13.5	14.5	38.5					
	6659	4 t4.5	39.0	35.0		35 39.53	+ 5 53.71	—10.90	22.34
	6678	8 11.2	35.3	39.3					
	6697	13 59.5	40.0	34.0		44 17.84	— 2 56.47	+ 0.54	21.91
	6740	11 66.2	35.0	3[illegible].0					
	6769	8 73.9	11.0	63.0		39 50.30	+ 1 34.08	—15.26	9.12
	6794	10 31.3	28.0	45.0					
	6824	16 43.5	43.0	31.0		44 38.64	— 3 17.04	— 0.14	21.46
	6851	9 69.1	35.0	38.0					
	6875	13 01.8	28.0	45.0		43 11.38	— 1 47.08	— 5.45	18.85
	6933	4 43.6	22.5	50.5					
	6959	17 70.5	41.5	31.7		35 48 32.44	— 7 07.06	— 4.96	35 41 20.42

Observations and computations—Continued.

SANTA FÉ, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
June 27 ..	6998	26 77.2	23.0	50.0					
	7006	13 13.7	38.5	34.5		35 39 30.79	+ 1 57.00	− 6.27	35 40 21.52
	7131	14 77.2	34.0	39.0					
	7158	7 63.3	16.5	57.7		37 44.10	+ 3 49.77	−12.68	41 21.19
	7174	16 26.3	41.5	32.7					
	7194	18 91.0	5.0	......		45 29.70	− 3 56.66	−15.10	17.94
June 28 ..	5131	27 95.4	33.5	11.5					
	5155	19 52.8	22.5	23.3		30 41.68	+ 4 31.19	+ 5.72	18.59
	5210	20 33.2	20.0	29.0					
	5234	24 64.5	35.2	14.8		38 57.62	+ 2 18.82	+ 3.11	19.55
	5284	26 73.1	2.6	48.4					
	5313	16 36.1	57.0	......		35 36.61	+ 5 33.76	+ 4.81	15.18
	5367	33 95.8	41.0	11.0					
	Gr. 2325	9 69.5	20.5	33.0		28 14.14	+13 00.91	+ 4.77	19.82
	5466	16 15.7	35.0	17.0					
	5503	20 76.1	16.5	34.5		43 44.30	− 2 28.18	− 0.00	16.12
	5530	13 18.5	35.3	14.3					
	5596	28 54.1	28.7	17.5		49 25.96	− 8 14.23	+ 8.77	20.50
	5629	13 78.9	11.0	35.2					
	5674	23 54.2	46.0	0.0		33 21.62	+ 7.54.82	+ 5.94	22.38
	5765	21 94.0	34.2	14.2					
	5797	20 55.3	18.4	31.6		40 31.42	+ 0 44.64	+ 1.84	17.90
	Gr. 2431	25 83.8	17.0	35.0					
	5863	14 72.0	35.5	17.0		17 12.95	+ 5 57.83	+ 0.14	15.26
	5918	23 60.0	21.0	31.0					
	5941	21 58.0	35.0	18.0		42 20.66	− 1 05.01	+ 1.91	17.56
	6056	22 30.5	23.5	31.3					
	6116	23 87.5	21.0	35.0		40 33.18	+ 0 50.53	− 5.94	17.77
	6134	23 65.0	21.0	34.0					
	Gr. 2536	20 58.6	43.0	14.0		34 39.24	+ 1 38.61	+ 4.36	22.21
	6231	16 56.0	23.5	33.0					
	6252	27 47.8	37.0	19.5		47 08.43	− 5 51.40	+ 2.18	19.21
	Arg. LXIII	24 23.5	23.5	33.5					
	6364	18 61.3	24.0	33.5		38 20.80	+ 3 00.95	− 5.31	16.44
	6392	17 20.1	30.0	27.0					
	6468	32 02.0	62.0	......		38 21.72	+ 2 35.10	+19.08	15.90
	6496	22 41.5	46.0	11.5					
	6528	25 35.3	22.5	35.0		35 39 37.22	+ 1 34.56	+ 6.00	35 41 17.78

Observations and computations—Continued.

SANTA FÉ, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
June 28 ..	6566	26 23.4	21.5	35.0					
	6574	19 37.6	35.0	21.5		35 44 58.35	— 3 40.73	— 0.00	35 41 17.62
	6589	22 70.7	21.0	37.0					
	6659	12 33.3	47.3	9.5		35 39.82	+ 5 33.89	+ 5.94	19.65
	6695	13 95.9	11.8	25.6					
	6723	27 80.0	52.0	5.0		48 41.52	— 7 25.47	+ 3.60	19.65
	6762	11 64.7	31.0	26.5					
	6779	27 08.6	34.0	23.0		49 32.66	— 8 16.91	+ 4.23	19.98
	6800	12 38.0	33.7	23.0					
	6813	20 15.7	21.5	35.0		45 26.24	— 4 10.30	— 0.49	15.45
	6835	25 95.0	2.5	54.0					
	Gr. 2977	14 80.1	21.4	35.0		35 41.58	+ 5 58.83	—17.74	22.67
July 4....	5131	26 06.0	29.0	33.0					
	5155	17 41.5	36.5	30.5		36 42.68	+ 4 38.24	+ 0.54	21.46
	5210	20 30.9	37.2	29.2					
	5234	24 77.5	26.2	40.6		38 58.66	+ 2 23.74	— 1.74	20.66
	5284	27 13.6	29.7	37.3					
	5313	16 45.2	34.0	34.0		35 37.38	+ 5 43.86	— 2.07	19.17
	5367	29 91.1	35.0	34.0					
	Gr. 2325	5 54.1	35.0	35.0		28 15.22	+13 04.35	+ 0.27	19.84
	5466	25 56.0	62.0	8.0					
	5503	19 88.9	6.5	63.5		43 45.50	— 2 30.40	— 0.82	14.28
	5604	28 39.6	35.0	33.0					
	5617	7 23.5	33.5	35.0		29 59.96	+11 21.06	+ 0.14	21.16
	5765	21 77.0	30.5	39.2					
	5797	20 25.2	41.2	29.0		40 32.78	+ 0 48.86	+ 0.87	22.51
	Gr. 2431	26 16.5	35.2	35.8					
	5863	15 21.5	35.5	35.5		47 14.43	— 5 52.43	— 0.17	21.83
	5883	18 83.2	41.0	30.2					
	5911	22 80.2	36.0	35.0		43 25.20	— 2 07.77	+ 3.22	20.65
	5997	22 95.9	30.2	40.5					
	6021	25 52.3	48.0	22.5		39 53.18	+ 1 22.52	+ 4.14	19.84
	6056	19 73.7	35.0	35.5					
	6116	21 21.0	41.0	30.0		40 34.76	+ 0 47.41	+ 2.86	25.03
	6134	23 38.0	22.0	48.5					
	Gr. 2536	19 90.2	36.0	35.0		39 40.92	+ 1 51.94	— 6.95	25.91
	6231	13 73.0	36.0	36.0					
	6252	24 97.8	45.0	27.0		35 47 10.06	— 6 02.01	+ 4.90	35 41 12.95

Observations and computations—Continued.

SANTA FÉ, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 23...	5828	20 61.3	26.2	34.5					
	5871	19 78.9	45.0	15.8		35 40 45.87	+ 0 26.52	+ 5.69	35 41 18.08
	5918	22 00.2	52.0	9.7					
	5941	19 72.0	22.0	40.0		42 26.00	− 1 13.45	+ 6.62	19.17
	5997	17 55.0	33.5	28.5					
	6021	19 85.9	35.2	27.5		39 57.60	+ 1 14.32	+ 3.46	15.38
	6056	19 77.5	34.5	29.0					
	6116	20 90.0	35.2	27.7		40 39.27	+ 0 36.20	+ 3.54	19.01
	6392	18 55.5	27.8	35.2					
	6468	23 45.5	56.0	6.5		38 28.68	+ 2 37.71	+11.47	17.86
	6496	17 99.6	34.5	28.5					
	6528	20 73.2	35.5	27.3		39 43.98	+ 1 28.06	+ 2.23	14.27
	6566	23 52.5	28.3	35.1					
	6574	16 20.6	48.7	13.8		45 05.31	− 3 55.56	+ 7.66	17.41
	6589	22 12.0	18.7	44.0					
	6659	11 90.8	52.5	10.8		35 46.88	+ 5 28.68	+ 4.47	20.03
July 26...	6566	25 45.8	9.0	35.0					
	6574	18 84.5	23.0	21.5		45 06.12	− 3 32.84	− 6.68	26.60
	6589	21 35.5	21.0	24.0					
	6659	11 09.0	34.0	11.0		35 47.66	+ 5 30.38	+ 5.45	23.49
	6678	17 32.0	13.5	32.0					
	6697	22 94.8	25.3	20.0		44 26.07	− 3 01.14	− 3.60	21.33
	6740	18 55.0	35.0	10.7					
	6769	15 84.2	10.5	35.5		39 58.85	+ 1 27.16	− 0.19	25.82
	6794	18 00.8	20.5	25.0					
	6824	24 15.0	10.5	35.0		44 46.88	− 3 17.68	− 7.90	21.30
	6881	22 47.2	12.4	33.6					
	6901	19 60.6	35.3	11.0		40 09.08	+ 1 08.68	+ 0.84	18.60
	6933	12 11.8	47.2	1.0					
	6959	26 01.0	14.2	32.0		48 40.95	− 7 28.08	+ 8.28	21.15
	7084	19 84.8	11.5	35.0					
	7103	22 54.6	45.5	1.0		39 49.03	+ 1 26.83	+ 5.72	21.58
	7131	15 30.9	23.0	23.0					
	7158	5 89.2	14.0	33.0		36 24.24	+ 5 03.09	− 5.19	22.14
	7174	23 65.3	36.5	10.0					
	7194	15 50.0	10.0	37.0		45 37.82	− 4 22.41	− 0.14	15.27
	7241	13 63.2	14.5	32.0					
	7256	26 15.4	17.0	30.0		35 34 44.82	+ 6 43.02	− 8.31	35 41 19.53

Observations and computations—Continued.

SANTA FÉ, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude
			N.	S.			Microm. and refr.	Level.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 27...	5828	19 17.4	17.0	45.0					
	5871	18 20.5	48.0	13.0		35 40 46.70	+ 0 31.19	+ 1.91	35 41 19.80
	5883	17 22.5	34.0	27.0					
	5911	21 38.0	37.0	23.0		43 30.07	− 2 13.73	+ 5.72	22.06
	6134	24 38.5	35.0	26.0					
	Gr. 2536	21 63.0	34.0	27.0		39 46.94	+ 1 28.67	+ 4.36	19.97
	6355	15 29.0	37.5	23.5					
	6426	17 68.5	17.0	44.0		40 05.95	+ 1 17.08	− 3.54	19.49
	6496	17 72.9	48.0	13.5					
	6528	20 67.4	13.0	48.0		39 44.75	+ 1 34.79	− 0.00	19.54
	6589	20 22.5	35.0	26.0					
	6659	9 77.1	26.0	35.5		35 47.90	+ 5 36.46	− 0.14	24.22
	6794	16 39.8	23.5	39.0					
	6824	22 91.2	37.0	26.0		44 47.17	− 3 29.65	− 1.23	16.29
July 28...	5520	24 81.5	19.0	47.5					
	5545	21 01.0	50.5	16.5		39 15.06	+ 2 02.46	+ 1.50	19.02
	5604	29 97.2	32.0	35.0					
	5617	9 10.6	40.0	26.5		30 04.44	+11 11.57	+ 2.86	18.87
	5677	12 96.4	34.0	33.0					
	5706	26 74.0	37.0	11.0		48 36.02	− 7 23.38	+12.81	25.45
	5828	18 80.8	34.0	35.0					
	5871	17 97.3	46.0	22.5		40 46.90	+ 0 26.88	+ 6.13	19.91
	5883	17 37.0	44.0	24.0					
	5911	21 83.0	48.0	19.0		43 30.28	− 2 23.54	+13.35	20.09
	5997	18 76.8	38.0	30.0					
	6021	21 14.0	35.0	34.0		39 58.48	+ 1 16.35	+ 2.45	17.28
	6056	19 50.0	62.0	7.0					
	6116	20 47.5	17.5	52.0		40 40.30	+ 0 31.38	+ 2.86	14.54
	6134	23 51.0	35.5	34.0					
	Gr. 2536	20 52.0	18.0	52.0		39 47.18	+ 1 36.24	− 8.86	14.56
	6231	14 21.6	36.0	34.0					
	6252	25 13.0	12.5	56.5		47 16.00	− 5 51.27	−11.44	13.29
	6302	24 98.5	34.0	34.0					
	6307	13 09.5	35.0	34.0		47 36.74	− 6 22.68	+ 0.27	14.33
	Arg. LXIII	19 05.4	31.0	37.5					
	6364	13 69.0	39.0	29.0		38 28.80	+ 2 52.64	+ 0.95	22.39
	6566	24 93.0	31.5	35.5					
	6574	17 86.0	35.0	32.0		35 45 06.60	− 3 47.54	− 0.27	35 41 18.79

Observations and computations—Continued.

SANTA FÉ, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 29...	5466	13 20.6	27.0	46.0					
	5503	17 97.2	52.0	21.5		35 43 49.42	− 2 33.39	+ 3.13	35 41 19.16
	5520	22 41.5	23.0	50.0					
	5545	18 60.0	51.0	22.5		39 15.16	+ 2 02.79	+ 0.41	18.36
	Arg. LXIII	22 56.3	28.0	40.0					
	6364	17 19.3	40.5	27.5		38 29.07	+ 2 52.83	− 0.14	22.04
	6566	23 56.0	24.0	44.0					
	6574	16 52.5	35.0	33.0		45 06.85	− 3 46.42	− 4.90	15.53
	6589	24 16.5	32.0	36.0					
	6659	14 15.1	45.0	23.0		35 48.38	+ 5 22.30	+ 4.90	15.58
	6678	16 84.2	32.0	36.0					
	6697	22 73.8	42.0	26.5		44 26.80	− 3 09.76	+ 3.13	20.17
	R. C. 4379	18 45.0	45.0	23.5					
	6749	16 60.6	18.0	51.0		42 23.17	− 0 59.35	− 3.13	20.69
	6762	7 67.0	53.0	16.0					
	6779	23 40.9	25.0	45.0		49 41.80	− 8 26.56	+ 4.63	19.87
	6794	16 59.0	44.5	25.5					
	6824	23 17.5	35.0	35.0		44 47.76	− 3 31.94	+ 5.18	21.00
	6881	17 91.5	36.5	35.0					
	6901	19 93.0	43.0	29.0		40 09.88	+ 1 04.85	+ 4.23	18.96
	6933	10 61.5	36.0	37.0					
	6959	24 30.6	28.0	44.5		48 41.84	− 7 20.64	− 4.77	16.43
	6975	28 45.4	35.0	37.0					
	6985	10 45.0	37.0	35.5		31 37.93	+ 9 39.59	− 0.14	17.38
	7022	28 97.4	38.0	34.0					
	7029	14 64.8	33.0	39.0		49 01.89	− 7 41.08	− 0.54	20.27
	7084	15 37.7	29.0	42.5					
	7103	18 24.4	35.0	36.5		39 49.92	+ 1 32.28	− 4.09	18.11
	7131	19 72.3	23.5	48.5					
	7158	13 42.1	53.0	19.0		37 53.80	+ 3 22.83	+ 2.45	19.08
	7174	21 67.0	36.5	35.5					
	7194	13 62.1	35.5	37.0		45 38.92	− 4 19.06	− 0.27	19.59
	7275	7 04.0	21.5	51.0					
	7294	30 96.0	47.2	25.0		54 12.75	−12 49.86	− 1.99	20.90
July 30...	5520	21 18.5	18.5	59.5					
	5545	17 04.0	43.0	35.0		39 15.27	+ 2 13.40	− 8.99	19.68
	5604	28 31.6	35.0	44.0					
	5617	7 27.6	36.0	43.5		35 30 04.80	+11 17.17	− 4.50	35 41 17.47

Observations and computations—Continued.

SANTA FÉ, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
July 30...	5677 5706	11 01.7 19 74.0	35.5 50.0	44.0 29.0		35 48 36.30	− 7 21.67	+ 3.41	35 41 18.04
	5828 5871	17 40.0 16 39.1	35.5 32.5	32.0 35.0		40 47.20	+ 0 32.47	+ 0.27	19.94
	5918 5941	18 54.7 16 61.8	38.0 29.0	29.0 48.0		42 27.20	− 1 02.08	− 5.18	19.94
	5997 6021	21 15.6 18 62.2	33.0 35.0	35.0 33.0		39 58.98	+ 1 21.55	0.00	20.53
	6056 6116	19 00.8 19 95.0	52.5 29.5	14.5 39.0		40 40.70	+ 0 30.32	+ 7.77	18.79
	6147 6218	21 57.0 19 70.8	35.0 33.0	33.0 35.0		35 43 04.30	− 1 40.99	− 0.00	35 41 23.31

NOTE.—The following observations were rejected:

June 27, pairs 17, 19, 33; deviations, $+9''.0$, $-13''.2$, $-10''.3$.

July 4, pair 22; deviation, $-6''.5$.

July 26, pairs 28, 33; deviations, $+7''.2$, $+6''.4$.

July 28, pair 22; deviation, $-6''.2$.

The limit of rejection was set at $6''.0$.

A preliminary discussion with reference to a correction of one revolution of the micrometer-screw showed that it was insensible for this station; and also that pairs observed n times would give probable errors essentially equal by making the weight of the mean of the n observations $= \frac{1}{2} + \frac{1}{2}n$.

Results for latitude.

Pair.	Latitude.	Number of observations.	Weight.	Pair.	Latitude.	Number of observations.	Weight.
	° ′ ″				° ′ ″		
1	35 41 18.93	3	2	25	35 41 18.60	2	1.5
2	17.38	1	1	26	16.88	2	1.5
3	20.10	2	1.5	27	18.40	4	2.5
4	17.18	2	1.5	28	17.67	5	3
5	21.24	1	1	29	20.88	6	3.5
6	19.83	2	1.5	30	21.14	3	2
7	16.56	4	2.5	31	19.65	1	1
8	19.02	3	2	32	20.69	1	1
9	20.50	1	1	33	....	......	......
10	19.17	3	2	34	19.92	2	1.5
11	22.38	1	1	35	20.01	4	2.5
12	21.34	3	2	36	15.45	1	1
13	18.55	3	2	37	22.67	1	1
14	18.55	2	1.5	38	18.85	1	1
15	19.09	5	3	39	18.78	2	1.5
16	20.93	3	2	40	19.33	3	2
17	19.56	3	2	41	17.38	1	1
18	18.26	4	2.5	42	21.52	1	1
19	19.03	5	3	43	20.27	1	1
20	18.91	3	2	44	19.84	2	1.5
21	20.22	2	1.5	45	20.80	3	2
22	19.21	1	1	46	17.60	3	2
23	14.33	1	1	47	19.53	1	1
24	35 41 20.29	3	2	48	35 41 20.90	1	1

Mean by weights—
35° 41′ 19″.29 (weight 79).
Probable error (weight 1) = ± 1″.35.
Probable error of final result, = ± 0″.152.

I have omitted the trifling meridian correction. Without it the stars observed *late* give a somewhat larger latitude, indicating that the wire was slightly inclined. There were some stars observed before transit, so that both these very nearly counterbalance each other.

ASTRONOMICAL CO-ORDINATES OF SANTA FÉ, NEW MEXICO.

Longitude..	$7^h\ 03^m\ 47^s.015$ or 105° 54′ 45″.22 ± 0″.32	west from Greenwich.
Longitude..	$1^h\ 55^m\ 34^s.895$ or 28° 53′ 43″.42	west from U. S. Naval Observatory, Washington, D. C.
Latitude ...	35° 41′ 19″.29 ± 0″.15 north.	

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY JOHN H. CLARK AND DR. F. KAMPF IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF BOZEMAN, MONTANA.

SEASON OF 1873.

COMPUTATIONS BY

JOHN H. CLARK and Dr. F. KAMPF.

BOZEMAN, MONTANA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . 111° 02′ 36″.64 ± 0″.53 west from Greenwich.
Latitude, . . . 45° 40′ 51″.92 ± 0″.06 north.
Barometric altitude of observatory above sea-level, 4838.6 feet.

The station at Bozeman is situated on the western edge of the village, south of the principal east and west street. It may be easily found by means of the grave of Bozeman, the founder of the town, a well-known spot, which is about 100 feet southwest from the block of wood upon which the transit was mounted. For many miles northward, westward, and southward the country is gently rolling. In the east, not more than two miles away, are the foot-hills of the mountains, along whose base the eastern fork of the East Gallatin River pursues its way, upon which, three miles distant, lies Fort Ellis. The East Gallatin, formed by the junction of this and the western branch, which traverses the eastern limits of Bozeman, continues its course through the Gallatin Valley in a direction generally northwest.

Besides this river there are two other large streams in the Gallatin Valley, called the West Fork and Middle Fork, which contribute to the river of that name. These, of which the West Fork is the largest, carry at all times an abundance of pure water, which could be easily diverted for use in irrigation. In every direction are heavy masses of mountains, which inclose the beautiful and fertile Gallatin Valley and make it an amphitheatre of vast proportions. Its soil yields abundantly of those agricultural products that grow in this latitude, especially potatoes and wheat.

Bozeman has a population of 400 or 500 people. In its private residences, mills, and warehouses it is a place of considerable pretension. Much of this enterprise, previously displayed, was probably due to the anticipation of the introduction of the Northern Pacific Railroad, but at this time the town was laboring under the stagnation consequent upon the failure of this great corporation, and its business affairs were much depressed and its prospects were gloomy. There are no mineral deposits developed as yet in this immediate vicinity, and the settlement is dependent for its prosperity upon the grazing of the surrounding mountains and valleys, the agricultural products of Gallatin Valley, and such trade as is furnished by Fort Ellis, the Crow agency, and the neighboring hunters and stock-raisers.

METEOROLOGICAL CONDITIONS.

The station at Bozeman was occupied from October 12 to November 5, inclusive, a period of twenty-five days. In all this time there were but nine days favorable for observations; they were October 17, 18, 19, 28, 29, 30, 31, and November 1 and 2. Even on these nights the extreme cold prevented any advantageous work after midnight, the fingers of the operator becoming so benumbed by that time that they would no longer obey his will in manipulating the instrument. Such rigorous weather at so early a season had never been experienced before by the oldest inhabitant. Though the days were very short, yet it would be pleasant and comfortable when it was sufficiently clear for the sun to shine. At night, however, the wind would sweep down from the snow-covered mountains, penetrate all ordinary clothing, and chill the stoutest frame.

DESCRIPTION OF OBSERVATORY.

The observatory was an ordinary wall-tent, which was drawn over a frame and furnished with the flaps and curtains necessary to exclude wind and dust. The observations were conducted by Mr. John H. Clark, who was assisted by Mr. L. P. Smith. An hourly meteorological record was kept by Messrs. O'Brien and Storer, soldiers of the Engineer Battalion. The telegraph-line with which transmission of signals was made is an independent branch line, the property of Mr. Largy, connecting at Helena with the Western Union. The operator was Mr. King.

DESCRIPTION OF INSTRUMENTS.

The transit employed was the Würdemann, No. 27, with a focal length of 28 inches, and aperture of object-glass $2\frac{1}{4}$ inches. It was mounted on a block of wood 2 feet across and 6 feet in length, which was firmly planted in the ground. The chronometer in use here was the Negus break-circuit, No. 1499, whose electro-magnetic capacity could not be tested, however, as the observations were made by the eye-and-ear method. The signals were sent and received at the telegraph-office, about a half-mile distant from the observatory, to which place the chronometer was removed for that purpose.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

The connection was made over Largy's line to Helena; thence, by way of Virginia City, over the Western Union, with the observatory at Ogden, at which station Dr. F. Kampf was observer. Exchanges were made for longitude on three days, the 29th and 31st of October and the 1st of November being devoted to that purpose. The nights of October 17, 18, and 19, and November 2 and 4, were given to latitude-work; but, in consequence of interruption by the clouds, one of these series was without valuable results. The computations were made in the office, in the course of the winter, by Mr. John H. Clark, and were subsequently reviewed by Dr. F. Kampf.

INSTRUMENTAL VALUES.—TELEGRAPHIC COMMUNICATION.

Each division of the striding-level had a value of $1''.03$; each division of the zenith-telescope level was equivalent to $0''.93$; one revolution of the micrometer-screw produced an effect of $77''.078$. The signals were all interchanged by sound, and even by this method it was difficult to take them, in consequence of the very imperfect line through which the circuit ran. Its length, in an air-line, was over 300 miles. At Helena there was a heavy battery, and probably a repeater, but at Bozeman the telegraphic process was effected without the use of either.

Tabulation of stars used for determination of time at Bozeman, Montana, and Ogden, Utah, 1873.

Name of star.	BOZEMAN.			OGDEN.			Name of star.	BOZEMAN.			OGDEN.		
	October 29.	October 31.	November 1.	October 29.	October 31.	November 1.		October 29.	October 31.	November 1.	October 29.	October 31.	November 1.
α Andromedæ	....	×	....	....	....	....	226 Cephei	....	....	....	×	×	×
α Aquilæ	....	×	....	....	....	....	ζ Pegasi	×	×	×	....	×	....
κ Cephei	×	×	....	....	....	....	ι Cephei	×	×	....	×	×	....
π Capricorni	×	×	×	....	....	....	λ Aquarii	....	....	×	....	....	....
ε Delphini	×	×	×	....	....	....	α Piscis Aus	×	×	×	....	....	....
Groombr. 3241	×	×	×	....	....	....	ο Andromedæ	....	....	....	×	....	×
α Cygni	×	×	×	....	....	....	α Pegasi	....	....	×	×	×	×
μ Aquarii	×	×	×	....	....	....	φ Aquarii	....	×	....	....	....	....
ν Cygni	×	×	×	....	....	....	γ Piscium	....	×	....	....	...	...
61 Cygni	....	×	×	....	....	×	ο Cephei	....	....	×	×	×	×
ζ Cygni	....	×	×	....	....	×	κ Piscium	....	×	....	....	....	....
α Cephei	....	....	×	....	....	×	θ Piscium	....	....	....	×	×	×
β Cephei	....	....	...	....	....	×	λ Draconis, L. C	×	....	×	....	....	....
ε Pegasi	....	....	....	....	....	×	γ Cephei	....	....	×	....	....	....
θ Aquarii	....	....	....	×	....	....	26 Piscium	....	....	×	....	....	....
π Aquarii	....	....	....	×	....	×	ω Piscium	....	×	×	....	....	....
η Aquarii	×	×	....	....	....	....	c^2 Piscium	....	×	×	....	....	....

Observations and reductions for time taken at sending station—Continued.

BOZEMAN, MONTANA, OCTOBER 29, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	κ Cephei	18 13 01.78	+24.90	0.00	− 0.20	18 13 26.47	20 13 04.70	+1 59 38.23
E.	π Capricorni	20 36.84	− 9.90	+ 0.01	− 0.05	20 26.90	20 04.91	38.01
E.	ε Delphini	27 37.96	− 6.04	+ 0.02	− 0.04	27 31.90	27 10.20	38.30
E.	Groombr. 3241	30 38.16	+15.11	+ 0.17	− 0.15	30 53.29	30 31.25	37.96
E.	α Cygni	37 29.14	− 0.21	+ 0.10	− 0.06	37 28.97	37 07.03	38.06
E.	μ Aquarii	46 20.67	− 8.65	+ 0.05	− 0.05	46 12.02	45 50.02	38.00
E.	ν Cygni	52 50.25	− 1.14	+ 0.11	− 0.06	52 49.16	52 27.43	38.27
W.	η Aquarii	20 29 21.52	− 7.55	− 0.02	+ 0.04	20 29 13.99	22 28 52.12	38.13
W.	ζ Pegasi	35 37.90	− 6.15	− 0.04	+ 0.05	35 31.76	35 09.89	38.13
W.	ι Cephei	45 25.00	+ 8.55	− 0.15	+ 0.11	45 33.51	45 11.69	38.18
W.	α Piscis Aus	51 14.20	−11.67	− 0.02	+ 0.05	51 02.56	50 40.67	38.11
W.	λ Draconis, L. C	20 24 40.66	−27.50	− 0.21	− 0.13	20 24 12.82	22 23 51.01	+1 59 38.19

NORMAL EQUATIONS.

$0 = -0.69 + 12.00\,\delta t + 2.90\,a^1 + 10.99\,c$
$0 = +1.65 + 2.90\,\delta t + 19.52\,a^1 - 5.93\,c$
$0 = +0.45 + 10.99\,\delta t - 5.93\,a^1 + 56.71\,c$

Adopted $a = -10^s.300$
$a^1 = -0^s.117$

Azimuth $= -10^s.447$
$c = -0^s.045$

Observations and reductions for time taken at sending station—Continued.

BOZEMAN, MONTANA, OCTOBER, 31, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	α Aquilæ	17 44 46.37	+ 3.98	+ 0.06	− 0.19	17 44 50.22	19 44 36.48	+1 59 46.26
E.	κ Cephei	18 13 34.14	−15.59	+ 0.31	− 0.83	18 13 18.03	20 13 04.48	46.45
E.	π Capricorni	20 12.48	+ 6.20	+ 0.02	− 0.19	20 18.51	20 04.84	46.33
E.	ε Delphini	27 20.16	+ 3.79	+ 0.01	− 0.19	27 23.77	27 10.17	46.40
E.	Groombr. 3241	30 54.81	− 9.47	+ 0.12	− 0.60	30 44.86	30 31.11	46.25
E.	α Cygni	37 20.62	+ 0.13	+ 0.07	− 0.26	37 20.56	37 06.98	46.42
E.	μ Aquarii	45 58.33	+ 5.42	+ 0.03	− 0.19	45 03.59	44 49.99	46.40
E.	ν Cygni	52 40.40	+ 0.74	+ 0.09	− 0.24	52 40.99	52 27.39	46.40
E.	61 Cygni	19 01 26.45	+ 1.09	+ 0.10	− 0.23	19 01 27.41	21 01 13.86	46.45
E.	ζ Cygni	07 45.09	+ 2.07	+ 0.09	− 0.21	07 47.04	07 33.29	46.25
W.	η Aquarii	20 29 01.02	+ 4.73	− 0.03	+ 0.18	20 29 05.90	28 52.10	46.20
W.	ζ Pegasi	35 19.34	+ 3.85	− 0.03	+ 0.19	35 23.35	35 09.87	46.52
W.	ι Cephei	45 30.28	− 5.35	− 0.07	+ 0.44	45 25.30	45 11.65	46.35
W.	α Piscis Aus	50 46.80	+ 7.34	− 0.01	+ 0.21	50 54.34	50 40.64	46.30
W.	φ Aquarii	21 07 55.43	+ 5.21	− 0.01	+ 0.18	21 07 00.81	22 06 47.28	46.47
W.	γ Piscium	10 46.30	+ 4.46	− 0.01	+ 0.18	10 50.93	10 37.31	46.38
W.	κ Piscium	20 36.69	+ 4.63	− 0.01	+ 0.18	20 41.49	20 27.84	46.35
W.	ω Piscium	52 59.31	+ 4.18	0.00	+ 0.19	52 03.68	51 50.10	46.42
W.	c^2 Piscium	56 12.17	+ 4.04	+ 0.05	+ 0.18	56 16.44	56 02.95	46.51
W.	α Andromedæ	22 02 03.31	+ 2.20	+ 0.14	+ 0.21	22 02 05.86	23 01 52.19	+1 59 46.33

NORMAL EQUATIONS.

$0 = -1.56 + 20.00\,\delta t + 5.15\,a^1 + 5.34\,c$

$0 = -1.15 + 5.15\,\delta t + 15.56\,a^1 - 16.29\,c$

$0 = +6.93 + 5.34\,\delta t - 16.29\,a^1 + 58.49\,c$

Adopted $a = +6^s.700$
$a^1 = -0^s.174$

Azimuth $= +6^s.526$
$c = -0^s.183$

BOZEMAN, MONTANA, NOVEMBER 1, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	π Capricorni	18 20 07.51	+ 6.42	+ 0.05	+ 0.17	18 20 14.15	20 20 04.37	+1 59 50.72
W.	ε Delphini	27 14.86	+ 3.92	+ 0.06	+ 0.16	27 19.00	27 10.15	51.15
W.	Groombr. 3241	30 49.49	− 9.78	+ 0.32	+ 0.51	30 40.54	30 31.03	50.49
W.	α Cygni	37 15.42	+ 0.14	+ 0.15	+ 0.22	37 15.93	37 06.95	51.02
W.	μ Aquarii	45 53.31	+ 5.61	+ 0.06	+ 0.16	45 59.14	45 49.98	50.84
W.	ν Cygni	52 35.35	+ 0.77	+ 0.14	+ 0.20	52 36.46	52 27.36	50.90
W.	61 Cygni	19 01 21.29	+ 1.13	+ 0.15	+ 0.20	19 01 22.77	21 01 13.84	51.07
W.	ζ Cygni	07 39.75	+ 2.13	+ 0.13	+ 0.18	07 42.19	07 33.27	51.08
W.	α Cephei	15 45.87	− 4.06	+ 0.25	+ 0.33	15 42.39	15 33.36	50.97
E.	ζ Pegasi	20 35 15.12	+ 3.98	+ 0.01	− 0.16	20 35 18.95	22 35 09.85	50.90
E.	λ Aquarii	46 05.47	+ 5.51	+ 0.06	− 0.16	46 10.88	46 01.70	50.82
E.	α Piscis Aus	50 92.30	+ 7.59	+ 0.03	− 0.18	50 49.74	50 40.63	50.89
E.	α Pegasi	58 34.09	+ 3.60	+ 0.18	− 0.16	58 37.71	58 28.45	50.74
E.	ο Cephei	21 13 43.37	− 6.52	+ 0.31	− 0.41	21 13 36.75	23 13 27.53	50.78
E.	λ Draconis, L. C.	23 42.74	+17.80	− 0.16	+ 0.45	23 00.83	22 51.18	50.35
E.	γ Cephei	34 37.66	−15.49	+ 0.17	− 0.69	34 21.65	34 12.26	50.61
E.	26 Piscium	48 45.78	+ 4.25	− 0.02	− 0.15	48 49.86	48 40.61	50.75
E.	ω Piscium	52 55.00	+ 4.32	+ 0.01	− 0.16	52 59.17	52 50.09	50.92
E.	c^2 Piscium	21 56 08.17	+ 4.18	+ 0.02	− 0.15	21 56 12.22	23 56 02.95	+1 59 50.74

NORMAL EQUATIONS.

$0 = +1.31 + 19.00\,\delta t + 5.27\,a^1 - 2.28\,c$

$0 = -2.39 + 5.27\,\delta t + 21.42\,a^1 - 11.34\,c$

$0 = +10.97 - 2.28\,\delta t - 11.34\,a^1 + 68.04\,c$

Adopted $a = +6^s.700$
$a^1 = +0^s.055$

Azimuth $= +6^s.755$
$c = -0^s.156$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, OCTOBER 29, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	θ Aquarii	22 52 44.10	+ 0.94	+ 0.01	+ 0.39	22 52 45.44	22 10 10.22	— 42 35.22
E.	π Aquarii	23 01 23.64	+ 0.79	+ 0.02	+ 0.38	23 01 24.83	18 49.72	35.11
E.	226 Cephei	12 39.78	— 2.74	+ 0.16	+ 1.53	12 38.73	30 03.65	35.08
E.	ι Cephei	27 47.18	— 1.20	+ 0.24	+ 0.92	27 47.14	45 11.69	35.45
W.	o Andromedæ	38 42.68	0.00	+ 0.14	— 0.51	38 42.31	56 07.03	35.28
W.	α Pegasi	41 03.26	+ 0.57	+ 0.11	— 0.40	41 03.54	58 28.50	35.04
W.	o Cephei	56 04.89	— 1.46	+ 0.33	— 0.99	56 02.83	23 13 27.63	35.20
W.	θ Piscium	0 04 08.91	+ 0.72	+ 0.12	— 0.39	0 04 09.36	23 21 34.06	— 42 35.30

NORMAL EQUATIONS.

$0 = +7.05 + 8.00\,\delta t - 1.92\,a + 2.44\,c \qquad a = +1^s.215$
$0 = -9.18 - 1.92\,\delta t + 8.99\,a - 8.12\,c \qquad c = +0^s.382$
$0 = -1.60 + 2.44\,\delta t - 8.12\,a + 34.57\,c$

OGDEN, UTAH, OCTOBER 31, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	226 Cephei	23 12 40.88	+ 3.70	+ 0.13	+ 1.53	23 12 38.84	22 30 03.51	— 42 35.33
E.	ζ Pegasi	17 44.08	+ 0.85	+ 0.05	+ 0.39	17 45.37	35 09.87	35.50
E.	ι Cephei	27 47.66	— 1.62	+ 0.18	+ 0.92	27 47.14	45 11.61	35.53
E.	α Pegasi	41 02.59	+ 0.77	+ 0.10	+ 0.40	41 03.86	58 28.49	35.37
E.	o Cephei	56 04.04	— 1.88	+ 0.30	+ 0.99	56 03.45	23 13 27.56	35.89
E.	θ Piscium	0 04 08.14	+ 0.97	+ 0.12	+ 0.39	0 04 09.62	23 21 34.04	— 42 35.58

NORMAL EQUATIONS.

$0 = + 4.21 + 6.00\,\delta t - 2.82\,a \qquad a = +1^s.638$
$0 = -13.32 - 2.82\,\delta t + 8.25\,a \qquad c = +0^s.382$ adopted.

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, NOVEMBER 1, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	61 Cygni	21 43 48.56	+ 0.08	+ 0.20	+ 0.50	21 43 49.34	21 01 13.84	— 42 35.50
E.	ζ Cygni	50 07.90	+ 0.27	+ 0.17	+ 0.45	50 08.79	07 33.27	35.52
E.	α Cephei	58 08.87	— 0.91	+ 0.24	+ 0.83	58 09.03	15 33.36	35.67
E.	β Cephei	22 09 36.71	— 1.68	+ 0.26	+ 1.14	22 09 36.43	27 00.90	35.53
E.	ε Pegasi	20 33.05	+ 0.65	+ 0.07	+ 0.39	20 34.16	37 58.83	35.33
W.	π Aquarii	23 01 24.68	+ 0.78	+ 0.17	— 0.39	23 01 25.24	22 18 49.68	35.56
W.	226 Cephei	12 42.39	— 2.70	+ 0.72	— 1.56	12 38.85	30 03.44	35.41
W.	ο Andromedæ	38 42.86	0.00	+ 0.28	— 0.52	38 42.62	56 06.97	35.65
W.	α Pegasi	41 03.82	+ 0.56	+ 0.18	— 0.40	41 04.16	58 28.47	35.69
W.	ο Cephei	56 05.11	— 1.37	+ 0.45	— 1.01	56 03.18	23 13 27.52	35.66
W.	θ Piscium	0 04 09.01	+ 0.71	+ 0.14	— 0.39	0 04 09.47	23 21 34.03	— 42 35.44

NORMAL EQUATIONS.

$$0 = + 5.03 + 11.00\,\delta t - 3.03\,a - 2.50\,c \qquad a = + 1^s.195$$
$$0 = - 14.60 - 3.03\,\delta t + 10.33\,a + 5.47\,c \qquad c = + 0^s.390$$
$$0 = - 24.09 - 2.50\,\delta t + 5.47\,a + 44.76\,c$$

The following tables show the corrections and rates of the chronometers used at Bozeman and Ogden:—

CHRONOMETER AT BOZEMAN—NEGUS, No. 1499.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	h.	h. m. s.	s.
October 29	22.0	+ 1 59 38.13	— 0.171
October 31	23.0	46.37	— 0.179
November 1	20.0	+ 1 59 50.83	— 0.186

CHRONOMETER AT OGDEN—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1873.	h.	h. m. s.	s.
October 29	22.6	— 0 42 35.21	0.00
October 31	23.0	35.53	0.00
November 1	22.0	— 0 42 35.54	0.00

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
October 29, 1873:		h. m. s	h. m. s.	h. m. s.	m. s.	s.	m. s.
Bozeman	Ogden	22 23 40.42	− 0 42 35.21	21 41 05.21			
	Bozeman	19 45 16.32	+ 1 59 38.09	21 44 54.41	3 49.20		
Ogden	Ogden	22 28 45.15	− 0 42 35.21	21 46 09.94			
	Bozeman	19 50 20.84	+ 1 59 38.10	21 49 58.94	49.00	0.20	3 49.10
October 31, 1873:							
Bozeman	Ogden	22 23 05.47	− 0 42 35.53	21 40 29.94			
	Bozeman	19 44 33.10	+ 1 59 46.14	21 44 19.24	49.30		
Ogden	Ogden	22 37 35.25	− 0 42 35.53	21 54 59.72			
	Bozeman	19 59 02.69	+ 1 59 46.19	21 58 48.88	49.16	0.14	49.23
November 1, 1873:							
Bozeman	Ogden	22 25 55.52	− 0 42 35.54	21 43 19.98			
	Bozeman	19 47 18.17	+ 1 59 51.16	21 47 09.33	49.35		
Ogden	Ogden	22 33 44.49	− 0 42 35.54	21 51 08.95			
	Bozeman	19 55 06.96	+ 1 59 51.18	21 54 58.14	3 49.19	0.16	3 49.27

Bozeman east of Ogden .... $0^h\ 03^m\ 49^s.20 \pm 0^s.035$

Observations and computations for latitude.

BOZEMAN, MONTANA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
October 18..	7029	27 09.5	24.0	31.0						
	7060	9 21.5	40.0	16.0		45 29 18.8	+11 29.2	+ 3.9	......	45 40 51.9
	7337	20 85.3	0.0	0.0						
	7365	12 45.0	0.0	0.0		35 26.4	+ 5 23.9	+ 3.7	......	54.0
	7373	17 94.0	47.0	9.0						
	7401	19 15.5	17.0	39.0		41 36.4	− 0 46.7	+ 3.7	......	53.4
	7428	18 79.5	16.0	39.0						
	7461	16 78.0	51.0	4.0		42 03.6	− 1 17.7	+ 5.6	......	51.5
	7505	7 75.0	35.5	20.0						
	7530	11 88.0	26.5	31.0		43 26.9	− 2 39.2	+ 2.6	......	50.3
	7593	20 85.5	43.0	13.0						
	7598	13 82.5	21.0	35.0		36 16.5	+ 4 31.0	+ 3.7	......	51.2
	7621	21 96.5	25.0	31.0						
	7627	13 40.0	42.0	14.5		46 17.0	− 5 30.2	+ 5.0	+ 1.0	52.8
	7658	17 49.0	16.0	40.0						
	7693	16 51.0	44.0	13.0		45 41 25.9	− 0 37.8	+ 1.6	......	45 40 49.7

Observations and computations—Continued.

BOZEMAN, MONTANA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
October 18..	7820	17 17.5	26.0	30.0						
	7850	19 15.5	34.0	22.0		45 39 33.1	+ 1 16.7	+ 1.9	....	45 40 51.7
	7995	2 34.0	9.0	48.5		21 22.4	+19 26.9	+ 3.6	....	52.9
	8023	32 61.0	0.0	0.0		30 33.9	+10 13.3	+ 3.6	....	50.8
	8036	16 70.0	0.0	0.0						
	8076	20 72.0	40.0	17.0						
	8114	13 18.8	29.0	29.0		35 53.8	+ 4 50.4	+ 5.3	+ 0.5	50.0
	8126	11 22.0	24.0	33.0						
	8135	22 40.0	41.0	16.0		33 36.8	+ 7 11.0	+ 3.7	....	51.5
	8180	19 39.3	28.0	28.0						
	8203	14 16.5	37.5	19.5		44 08.6	− 3 21.6	+ 4.1	....	51.1
	8231	18 81.3	4.0	53.0		43 13.6	− 2 23.0	+ 2.8	....	53.4
	8326	17 19.8	8.0	50.0						
	8345	15 10.3	0.0	−2.0		42 07.8	− 1 20.8	+ 2.8	....	49.8
	28	23 79.0	27.0	30.0						
	54	10 41.5	39.0	19.0		32 12.9	+ 8 35.6	+ 3.9	....	52.4
	67	23 98.0	29.0	29.0						
	121	11 79.0	43.0	14.5		32 56.0	+ 7 49.9	+ 6.6	....	52.5
October 19..	6640	23 65.5	25.5	30.0						
	6698	12 65.3	28.5	29.0		47 57.2	− 7 04.8	− 1.2	....	51.4
	6730	18 97.0	23.0	35.0		43 00.2	− 2 09.4	+ 1.5	....	52.3
	6734	17 70.8	23.0	35.0						
	6769	15 61.3	38.5	20.0		42 11.7	− 1 20.8	+ 1.5	....	52.4
	6806	23 13.5	39.0	21.0		32 01.1	+ 8 47.7	+ 2.7	+ 1.0	52.5
	6813	22 88.0	39.0	21.0						
	6824	9 44.5	27.0	33.5		32 11.1	+ 8 37.9	+ 2.7	+ 1.0	52.7
	6879	9 32.0	32.0	28.5						
	6913	24 70.5	34.0	26.5		50 42.9	− 9 53.1	+ 2.6	....	52.4
	6930	29 28.0	16.0	35.0						
	6957	6 67.8	47.0	15.0		55 20.8	−14 31.3	+ 3.0	....	52.5
	6973	5 66.5	29.0	33.0						
	6994	26 67.0	37.0	24.5		54 19.2	−13 29.8	+ 2.0	....	51.4
	7041	25 19.5	41.0	21.0		34 54.7	+ 5 52.7	+ 2.6	....	50.0
	7062	16 04.5	27.0	35.5						
	7091	8 07.5	27.0	36.0		29 48.0	+11 00.0	+ 2.6	....	50.6
	7112	13 27.0	33.0	30.0		44 39.6	− 3 50.1	+ 1.9	....	51.4
	7161	7 30.0	34.0	29.0						
	7171	25 61.2	34.0	29.0		32 54.9	+ 7 55.8	+ 1.8	....	52.5
	7188	25 40.5	30.0	33.0						
	7211	9 62.2	35.0	28.0		45 30 42.5	+10 08.5	+ 0.9	....	45 40 51.9

Observations and computations—Continued.

BOZEMAN, MONTANA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	″ ′	″	″	° ′ ″
October 19..	7336	19 23.5	47.0	16.0						
	7337	19 32.5	47.0	16.0		45 35 30.7	+ 5 20.2	+ 1.4	....	45 40 52.3
	7365	10 93.0	19.0	44.0		35 26.4	+ 5 23.6	+ 1.4	....	51.4
	7373	23 28.8	34.5	29.0						
	7401	24 45.0	30.0	33.0		41 36.5	− 0 44.8	+ 0.6	....	52.3
	7455	19 30.5	24.0	39.0		44 02.8	− 3 13.5	+ 2.8	....	52.1
	16159	12 02.5	24.0	39.0		36 14.5	+ 4 36.2	+ 2.8	− 0.4	53.1
	7480	10 73.0	24.0	39.0		39 22.1	+ 1 27.1	+ 2.8	....	52.0
	7501	14 28.5	45.0	18.0		31 33.8	+ 9 15.6	+ 2.8	− 0.4	51.8
	7503	26 47.0	45.0	18.0		38 32.1	+ 2 17.0	+ 2.8	....	51.9
	7593	19 90.0	30.0	32.0						
	7598	12 80.5	35.0	27.0		36 16.6	+ 4 33.9	+ 1.4	....	51.9
	7621	21 13.0	32.0	30.0						
	7627	12 71.8	30.0	31.0		46 17.1	− 5 24.3	+ 0.2	....	53.0
	7658	18 11.0	15.5	46.0						
	7693	17 28.0	43.0	18.0		41 26.1	− 0 32.0	− 1.3	....	52.8
	7749	15 16.2	22.0	39.0						
	7753	5 53.2	42.5	19.0		47 01.9	− 6 11.2	+ 1.5	....	52.2
	7820	17 45.8	22.0	40.0						
	7850	19 51.3	38.0	24.0		39 33.3	+ 1 19.2	− 0.9	....	51.6
	7945	30 63.8	34.5	28.0						
	7963	4 69.0	28.0	35.5		24 11.2	+16 40.5	− 0.2	....	51.5
	7995	2 19.3	29.5	34.0		21 22.4	+19 31.5	− 0.9	....	53.0
	8023	32 58.2	32.0	31.5		34 18.5	+ 6 34.0	− 0.9	− 1.0	50.6
	8028	12 41.3	32.0	31.5		30 33.6	+10 16.6	− 0.9	+ 0.2	49.5
	8036	16 58.6	32.0	31.5		43 29.7	− 2 40.9	− 0.9	+ 1.0	48.9
	8076	21 44.5	31.0	33.0						
	8114	13 69.5	33.0	31.0		35 54.0	+ 4 58.7	0.0	− 1.0	51.7
	8126	12 49.5	32.0	32.0						
	8135	23 83.0	33.0	31.5		33 37.0	+ 7 17.0	+ 0.1	− 0.5	53.6
	8180	19 34.2	24.0	40.0						
	8203	14 18.8	42.5	21.5		44 08.8	− 3 18.7	+ 1.2	....	51.3
	8231	18 87.0	21.0	43.0		43 14.2	− 2 22.0	0.0	....	52.2
	8326	17 16.0	17.0	48.0		42 08.1	− 1 16.1	0 0	....	52.0
	8345	15 18.5	46.0	19.0						
	13	10 23.0	25.0	40.5						
	16	24 39.5	38.0	29.5		31 51.8	+ 9 05.9	− 1.6	− 4.0	52.1
November 2.	6879	9 82.2	30.0	33.0						
	6913	25 06.5	28.0	33.0		50 42.7	− 9 47.6	− 1.9	....	53.2
	6930	28 80.8	20.5	42.0						
	6957	6 31.5	35.0	29.0		45 55 20.7	−14 27.1	− 3.6	....	45 40 50.0

Observations and computations—Continued.

BOZEMAN, MONTANA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
November 2.	6973	5 31.0	37.0	27.5						
	6994	26 28.5	29.0	35.5		45 54 18.9	−13 28.6	+ 0.7	....	45 40 51.0
	7041	25 93.5	28.5	36.0						
	7062	16 64.8	35.5	30.0		34 54.7	+ 5 58.0	− 0.5	....	52.2
	7112	13 72.0	34.0	32.0						
	7161	7 89.8	26.0	40.0		44 39.8	− 3 44.4	− 2.8	....	52.6
	7171	26 17.0	26.0	40.0		32 55.2	+ 7 59.9	− 2.8	....	52.3
	7188	26 52.0	33.5	32.5						
	7211	10 69.0	29.0	38.0		30 42.9	+10 10.3	− 1.9	....	51.3
	7336	19 86.0	38.0	29.0						
	7337	19 96.5	38.0	29.0		35 31.7	+ 5 21.4	− 0.9	....	52.2
	7365	11 52.2	27.0	40.0		35 27.4	+ 5 25.5	− 0.9	....	52.0
	7373	15 89.8	44.0	23.0						
	7401	17 03.0	20.0	48.0		41 37.4	− 0 43.6	− 1.6	....	52.2
	7455	19 69.5	34.0	34.0		44 04.0	− 3 08.7	− 2.8	....	52.5
	16159	12 40.5	34.0	34.0		36 15.7	+ 4 39.3	− 2.8	....	52.2
	7480	11 09.5	34.0	34.5		39 23.2	+ 1 32.3	− 2.8	....	52.7
	7501	14 80.0	28.0	40.0		31 34.9	+ 9 20.3	− 2.8	....	52.4
	7503	26 94.0	28.0	40.0		38 33.8	+ 2 22.8	− 2.8	....	53.8
	7593	21 13.2	31.5	36.0						
	7598	14 05.0	36.0	37.0		36 18.0	+ 4 33.0	− 1.3	....	49.7
	7621	21 89.5	18.0	49.5						
	7627	13 53.0	45.0	23.0		46 18.5	− 5 22.5	− 2.2	....	53.8
	7658	18 83.2	26.0	42.0						
	7693	17 99.0	34.0	34.0		41 27.6	− 0 32.5	− 3.7	....	51.4
	7749	14 47.0	34.0	34.0						
	7753	4 95.0	27.0	40.0		47 03.6	− 6 07.0	− 3.0	....	53.6
	7945	30 99.5	35.5	32.0						
	7963	5 16.5	32.0	35.5		24 13.3	+16 35.8	+ 0.0	....	49.1
	7995	3 68.5	31.0	35.5						
	8023	34 01.8	31.0	36.0		21 24.7	+19 29.3	− 2.7	....	51.3
	8028	13 87.0	31.0	36.0						
	8036	17 95.5	30.5	37.0		43 32.0	− 2 37.5	− 2.7	....	51.8
	8076	20 97.3	34.0	32.5						
	8114	13 28.8	32.0	35.5		35 56.5	+ 4 56.3	− 0.5	....	52.3
	8180	21 48.5	26.0	40.5						
	8203	16 43.5	32.0	35.0		44 11.3	− 3 14.7	− 4.0	....	52.6
	8231	19 07.5	35.0	31.5						
	8326	17 38.2	36.0	32.0		43 17.0	− 2 20.6	− 3.7	....	52.7
	8345	15 42.8	24.5	44.0		45 42 11.0	− 1 15.3	− 3.7	....	45 40 52.0

Observations and computations—Continued.

BOZEMAN, MONTANA.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1873.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
November 2.	28	24 43.0	33.5	35.0						
	54	10 99.5	33.0	36.0		45 32 16.2	+ 8 37.9	— 1.0	....	45 40 53.1
November 4.	7621	22 82.3	20.0	35.5						
	7627	14 48.8	29.0	27.0		45 46 17.6	— 5 21.3	— 3.2	....	45 40 53.1

The final result for latitude is obtained by giving each double pair the weight of a single result.

ASTRONOMICAL CO-ORDINATES OF STATION AT BOZEMAN, MONTANA.

Longitude.. $7^h\ 24^m\ 10^s.443 \pm 0^s.035$ or $111°\ 02'\ 36''.64 \pm 0''.53$ west from Greenwich.
Longitude.. $2^h\ 15^m\ 58^s.323$ or $33°\ 59'\ 34''.84$ west from U. S. Naval Observatory at Washington, D. C.
Latitude ... $45°\ 40'\ 51''.92 \pm 0''.06$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF LAS VEGAS, NEW MEXICO.

SEASON OF 1874.

COMPUTATIONS BY

DR. F. KAMPF.

LAS VEGAS, NEW MEXICO.

GEOGRAPHICAL POSITION OF STATION.

Longitude . . . . 105° 13′ 27″.57 ± 0″.10 west from Greenwich.
Latitude . . . . 35° 35′ 27″.66 ± 0″.07 north.
Barometric altitude of observatory above sea-level, 6418.0 feet.

Las Vegas, situated in the county of San Miguel, is a village of nearly 2,000 inhabitants, two-thirds of whom are Mexicans. The astronomical monument is in the center of the plaza, occupying a position which affords an open view to the east, so that this point can be connected with natural objects by geodetical work. In the east, south, and west the country is nearly level, but on the north side the neighboring mountains rise to a considerable height. The Gallinas River crosses the eastern part of the town, but is dry except in the rainy season or after a summer freshet.

METEOROLOGICAL CONDITIONS.

This station was occupied from the 22d of July to the 17th of August, 1874. During that time the weather was very unfavorable for observations, which had to be discontinued and resumed three or four times in the course of the night. As a rule it became cloudy at two o'clock in the afternoon, followed, two or three hours later, by a heavy rain-storm. At eleven o'clock the clouds would break away for a brief period, only to return again and obscure the sky until three o'clock in the morning, when it would become clear for the remainder of the night, throughout which the observations were continued until daylight interfered. On examination of the books of record, the work of the two meteorological assistants is found to be lacking in system and correctness.

OBSERVATORY AND OBSERVERS.

The observations were made in a common wall-tent, supported by a very slender but strong frame-work. The observing pier in the center of the tent was of limestone, and was built upon a very good foundation, so that its position can always be discovered, even should the superstructure be removed by accident or malicious design.

The observations were conducted by Dr. F. Kampf, who was assisted in the details of meteorological records and the care of implements by Charles Morrison and Ireno Chavez. Mr. Rutenbeck, operator of the Western Union Telegraph office, kindly gave his aid in the transmission of signals to the connected station.

There was but one wire from Pueblo to Las Vegas; it was the property of the Western Union Company, and had been kept in repair for the last two years by employés of the Army. In the season of 1873 there was already report that the line worked badly and was grounded in many places, but this year, 1874, it was still worse. Between 10 a.m. and 1 p.m. the line was apparently in good order, but after that, on the approach of electrical storms from the south and east, it was almost impossible to communicate with the adjacent offices at Fort Union and Santa Fé. Through the kindness of Mr. Woodward, superintendent of this division, resident at Denver, the use of the line was granted for any time of day or night, and so it became possible to exchange at least three times with Ogden, the connected station.

DESCRIPTION OF INSTRUMENTS.

Würdemann's combined transit instrument, No. 27, was used at Las Vegas. It had a focal length of 28 inches; aperture, $2\frac{1}{2}$ inches; and magnifying power of 40. In its focus nine wires were placed, grouped in numbers of 1, 2, 3, 2, and 1, successively; but, as the observations had to be made by eye and ear, only the wires 1, 2, 5, 8, and 9, clamp east, were utilized. From observations on pole-stars the distances of those wires is computed to be

$$+ 24^s.14, + 12^s.17, 0^s.07, - 12^s.27, - 23^s.98.$$

The observations for time at Ogden were made with Würdemann's transit instrument, No. 29, which was provided with three sets of focal wires, five in each set. This instrument was placed on the east (normal) pier, and Würdemann's combined transit, No. 28, occupied the western pier. Although the entire number of wires were used in the observations, only the results from the middle group of five were retained. A chronograph was used in recording observations at Ogden. The exchange of signals was by sound at each station. In each exchange there were nineteen signals sent and received at intervals of 10″.

The chronometer used at Las Vegas was the Negus, No. 1344; at Ogden, the Negus, No. 1491.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

Exchanges of time with Ogden were made on the nights of August 8 and 15, 1874, and also at noon of August 15. Observations for latitude took place July 31, and August 1, 2, 3, and 4. Mr. John H. Clark was in charge of the connected station; his observations were computed by Dr. F. Kampf after his return to the office. The computations for the work of the latter gentleman, for both latitude and time, were also made by himself, partially while in the field.

INSTRUMENTAL VALUES—TELEGRAPHIC COMMUNICATION.

The value of one division of the striding-level used at Las Vegas was 1″.00; of the zenith-level, 0″.93; and of one revolution of the micrometer screw, 77″.078.

The length of the telegraphic circuit was about 900 miles. In the transmission of signals use was made of the local battery in the office at Las Vegas; it was an apparatus of ordinary force. The only repeater on the circuit was at Cheyenne.

Tabulation of stars used for determination of time at Las Vegas, New Mexico, and Ogden, Utah, 1874.

Name of star.	LAS VEGAS.			OGDEN.				Name of star.	LAS VEGAS.			OGDEN.			
	August 8.	August 15.	August 16.	August 7.	August 8.	August 15.	August 16.		August 8.	August 15.	August 16.	August 7.	August 8.	August 15.	August 16.
α Andromedæ	....	×	....	....	....	....	....	μ Herculis	....	....	....	....	×	....	×
γ Pegasi	....	×	....	....	....	....	....	γ Draconis	....	....	....	....	....	....	×
ι Ceti	....	×	....	....	....	....	....	δ Draconis	×	....	....	....	....	....	....
κ Cassiopeiæ	....	×	....	....	....	....	....	τ Draconis	×	....	....	....	....	....	....
ζ Cassiopeiæ	....	×	....	....	....	....	....	β Cygni	×	....	....	....	....	....	....
η Cassiopeiæ	....	×	....	....	....	....	....	κ Aquilæ	×	....	....	....	....	....	....
γ Cassiopeiæ	....	×	....	....	....	....	....	θ Cygni	×	×	....	....	....	....	....
ε Piscium	....	×	....	....	....	....	....	γ Aquilæ	×	×	....	....	....	....	....
β Andromedæ	....	×	....	....	....	....	....	ε Draconis	×	....	....	....	....	....	....
τ Piscium	....	×	....	....	....	....	....	ψ Cygni	×	×	....	....	....	....	....
α Scorpii	....	....	....	×	....	×	×	τ Aquilæ	×	....	....	....	....	....	....
β Herculis	....	....	....	×	....	×	×	θ Aquilæ	×	×	....	....	....	....	....
A Draconis	....	....	....	×	×	×	....	α^2 Capricorni	×	×	....	....	....	....	....
ζ Herculis	....	....	....	×	....	×	×	θ Cephei	....	×	....	....	....	....	....
η Herculis	....	....	....	....	×	×	×	β Delphini	....	×	....	....	....	....	....
9 Camelop., L. C.	....	....	....	×	....	....	×	α Delphini	....	×	....	....	....	....	....
κ Ophiuchi	×	....	....	×	×	×	×	α Cygni	....	×	....	....	....	....	....
ε Herculis	×	....	....	....	....	....	....	γ Delphini	....	×	....	....	....	....	....
d Herculis	....	....	....	×	×	×	×	μ Aquarii	....	×	....	....	....	....	....
60 Herculis	×	....	....	....	....	....	....	ζ Pegasi	....	....	×	....	....	....	....
Groom. 2415	×	....	....	....	....	....	....	λ Pegasi	....	....	×	....	....	....	....
ζ Draconis	×	....	....	....	....	....	×	ι Cephei	....	....	×	....	....	....	....
α^1 Herculis	....	....	....	×	×	×	....	α Piscis Aus	....	....	×	....	....	....	....
π Herculis	....	....	....	×	....	×	....	Bradley 3077	....	....	×	....	....	....	....
44 Ophiuchi	×	....	....	×	×	×	×	υ Pegasi	....	....	×	....	....	....	....
Groom. 966, L.C	....	....	....	....	×	×	....	72 Pegasi	....	....	×	....	....	....	....
χ Herculis	×	....	....	....	....	....	....	γ Cephei	....	....	×	....	....	....	....
β Draconis	×	....	....	....	....	×	×	41 Cassiopeiæ (H)	....	....	×	....	....	....	....
ω Draconis	....	....	....	....	....	×	×	ψ Pegasi	....	....	×	....	....	....	....

Observations and reductions for time taken at sending station.

LAS VEGAS, NEW MEXICO, AUGUST 8, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	κ Ophiuchi	16 58 03.94	− 0.54	+ 0.18	− 0.38	16 58 03.20	16 51 44.18	− 6 19.02
E.	ε Herculis	17 01 49.44	− 0.11	+ 0.23	− 0.44	17 01 49.12	55 30.06	19.06
E.	60 Herculis	05 53.91	− 0.49	+ 0.19	− 0.38	05 53.23	59 34.15	19.08
E.	Groombr. 2415	10 01.20	+ 0.15	+ 0.26	− 0.49	10 01.12	17 03 41.87	19.25
E.	ζ Draconis	14 45.56	+ 1.51	+ 0.42	− 0.92	14 46.57	08 27.58	18.99
W.	44 Ophiuchi	25 02.69	− 1.16	+ 0.11	+ 0.41	25 02.05	18 43.05	19.00
W.	χ Herculis	29 43.76	+ 0.41	+ 0.32	+ 0.56	29 45.05	23 25.78	19.27
W.	β Draconis	17 33 54.50	+ 0.58	+ 0.39	+ 0.61	17 33 56.08	17 27 37.19	− 6 18.89
W.	δ Draconis	19 18 49.68	+ 1.47	+ 0.82	+ 1.00	19 18 52.97	19 12 33.92	− 6 19.05
W.	τ Draconis	24 15.50	+ 2.25	+ 1.17	+ 1.32	24 20.24	18 00.81	19.43
W.	β Cygni	31 59.28	− 0.17	+ 0.43	+ 0.43	31 00.02	24 40.79	19.23
W.	κ Aquilæ	36 28.90	− 0.74	+ 0.32	+ 0.39	36 28.87	30 09.42	19.45
W.	θ Cygni	39 23.68	+ 0.42	+ 0.66	+ 0.60	39 25.36	33 06.08	19.28
W.	γ Aquilæ	46 37.66	− 0.46	+ 0.40	+ 0.39	46 37.99	40 18.67	19.32
E.	ε Draconis	54 55.64	+ 1.77	+ 1.22	− 1.12	54 57.51	48 38.18	19.33
E.	ψ Cygni	58 43.44	+ 0.49	+ 0.69	− 0.63	58 43.99	52 24.73	19.26
E.	τ Aquilæ	20 04 21.44	− 0.51	+ 0.37	− 0.39	20 04 20.91	58 01.65	19.26
E.	θ Aquilæ	11 10.86	− 0.64	+ 0.34	− 0.38	11 10.18	20 04 50.87	19.31
E.	α² Capricorni	20 17 26.72	− 0.82	+ 0.30	− 0.39	20 17 25.81	20 11 06.61	− 6 19.20

NORMAL EQUATIONS.

First series.

$$0 = -1.16 + 8.00\,\delta t - 0.28\,a + 2.75\,c \qquad a = -1^{s}.23$$
$$0 = +3.15 - 0.28\,\delta t + 3.09\,a - 1.97\,c \qquad c = -0^{s}.374$$
$$0 = +3.49 + 2.75\,\delta t - 1.97\,a + 17.37\,c$$

Second series.

$$0 = -5.56 + 11.00\,\delta t - 2.84\,a - 3.17\,c \qquad a = -1^{s}.070$$
$$0 = +14.83 - 2.84\,\delta t + 11.24\,a + 6.37\,c \qquad c = -0^{s}.384$$
$$0 = +22.05 - 3.17\,\delta t + 6.37\,a + 38.65\,c$$

Observations and reductions for time taken at sending station—Continued.

LAS VEGAS, NEW MEXICO, AUGUST 15, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	θ Cygni	19 39 38.14	+ 0.39	— 0.04	— 0.53	19 39 37.96	19 33 05.96	— 6 32.00
E.	γ Aquilæ	46 51.46	— 0.43	— 0.01	— 0.35	46 50.67	40 18.65	32.02
E.	ψ Cygni	58 56.76	+ 0.45	— 0.01	— 0.55	58 56.65	52 24.61	32.04
E.	θ Aquilæ	20 11 23.76	— 0.60	— 0.03	— 0.34	20 11 22.79	20 04 50.86	31.93
E.	a^2 Capricorni	17 39.60	— 0.76	— 0.04	— 0.35	17 38.45	11 06.62	31.83
W.	θ Cephei	34 00.54	+ 0.97	— 0.04	+ 0.74	34 02.21	27 30.38	31.83
W.	β Delphini	38 12.86	— 0.37	+ 0.04	+ 0.35	38 12.88	31 40.92	31.96
W.	a Delphini	40 21.62	— 0.36	+ 0.07	+ 0.35	40 21.68	33 49.69	31.99
W.	a Cygni	43 41.87	+ 0.23	+ 0.15	+ 0.48	43 42.73	37 10.61	32.12
W.	γ Delphini	47 23.06	— 0.35	+ 0.15	+ 0.35	47 23.21	40 51.18	32.03
W.	μ Aquarii	20 52 26.48	— 0.71	+ 0.16	+ 0.34	20 52 26.27	20 45 54.24	— 6 32.03
W.	a Andromedæ	0 08 26.84	— 0.10	+ 0.08	+ 0.46	0 08 27.28	0 01 54.96	— 6 32.32
W.	γ Pegasi	13 19.26	— 0.26	+ 0.08	+ 0.41	13 19.49	06 47.29	32.20
W.	ι Ceti	19 35.30	— 0.50	+ 0.06	+ 0.40	19 35.26	13 03.00	32.26
W.	κ Cassiopeiæ	32 24.20	+ 0.67	+ 0.19	+ 0.86	32 25.92	25 53.66	32.26
W.	ζ Cassiopeiæ	36 30.88	+ 0.36	+ 0.22	+ 0.67	36 32.13	30 00.01	32.12
E.	η Cassiopeiæ	48 03.96	+ 0.47	+ 0.34	— 0.74	48 04.03	41 31.62	32.41
E.	γ Cassiopeiæ	55 41.58	+ 0.58	+ 0.27	— 0.80	55 41.63	49 09.49	32.14
E.	ε Piscium	1 02 59.38	— 0.33	+ 0.08	— 0.40	1 02 58.73	56 26.51	32.22
E.	β Andromedæ	09 15.76	— 0.01	+ 0.08	— 0.49	09 15.34	1 02 43.10	32.24
E.	τ Piscium	1 11 18.38	— 0.08	+ 0.06	— 0.46	1 11 17.90	1 04 45.80	— 6 32.10

NORMAL EQUATIONS.

First series.

$$0 = -3.57 + 11.00\,\delta t + 1.55\,a - 1.47\,c \qquad a = -0^s.994$$
$$0 = +3.12 + 1.55\,\delta t + 3.41\,a + 1.10\,c \qquad c = -0^s.340$$
$$0 = +8.20 - 1.47\,\delta t + 1.10\,a + 19.11\,c$$

Second series.

$$0 = +1.56 + 10.00\,\delta t - 1.14\,a + 0.22\,c \qquad a = -0^s.697$$
$$0 = +1.74 - 1.14\,\delta t + 3.25\,a - 0.63\,c \qquad c = -0^s.401$$
$$0 = +8.43 + 0.22\,\delta t - 0.63\,a + 22\,01\,c$$

Observations and reductions for time taken at sending station—Continued.

LAS VEGAS, NEW MEXICO, AUGUST 16, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	ζ Pegasi	22 41 47.30	− 0.32	+ 0.05	− 0.30	22 41 46.73	22 35 13.23	− 6 33.50
E.	λ Pegasi	47 04.24	− 0.17	+ 0.05	− 0.32	47 03.80	40 30.26	33.54
E.	ι Cephei	51 47.88	+ 0.87	+ 0.06	− 0.71	51 48.10	45 14.70	33.40
E.	α Piscium Aus.	57 18.86	− 0.76	+ 0.01	− 0.34	57 17.77	50 44.35	33.42
E.	Bradley 3077	23 13 49.38	+ 0.47	+ 0.03	− 0.54	23 13 49.34	23 07 16.04	33.30
W.	υ Pegasi	25 41.14	− 0.17	+ 0.04	+ 0.32	25 41.33	19 08.00	33.33
W.	72 Pegasi	34 17.68	− 0.07	+ 0.08	+ 0.34	34 18.03	27 44.57	33.46
W.	γ Cephei	40 44.80	+ 2.10	+ 0.40	+ 1.31	40 48.61	34 15.10	33.51
W.	41 Cassiopeæ (H)	48 27.78	+ 0.96	+ 0.37	+ 0.76	48 29.87	41 56.62	33.25
W.	ψ Pegasi	23 52 40.30	− 0.22	+ 0.23	+ 0.31	23 52 40.62	23 46 07.19	− 6 33.43

NORMAL EQUATIONS.

$$0 = -\ 3.38 + 10.00\,\delta t - 3.73\,a - 2.80\,c \qquad a = -0^s.719$$
$$0 = +\ 13.83 - 3.73\,\delta t - 13.75\,a + 13.48\,c \qquad c = -0^s.296$$
$$0 = +\ 22.22 - 2.80\,\delta t + 13.48\,a + 42.40\,c$$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, AUGUST 7, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	α Scorpii	16 26 25.10	− 6.27	+ 0.13	+ 0.03	16 26 18.89	16 21 43.20	− 4 35.69
E.	β Herculis	29 27.96	− 2.13	+ 0.09	+ 0.02	29 25.94	24 50.05	35.89
E.	A Draconis	32 43.81	+ 7.98	+ 0.32	+ 0.07	32 52.18	28 16.36	35.82
E.	ζ Herculis	41 10.82	− 1.10	+ 0.20	+ 0.03	41 09.95	36 34.07	35.88
E.	9 Camelop., L. C.	46 23.25	−14.31	− 0.15	− 0.06	46 08.73	41 32.95	35.78
W.	κ Ophiuchi	56 23.23	− 3.23	+ 0.12	− 0.02	56 20.10	51 44.22	35.88
W.	d Herculis	17 01 35.65	− 0.98	+ 0.18	− 0.03	17 01 34.82	56 59.03	35.79
W.	a^1 Herculis	13 34.66	− 2.74	+ 0.14	− 0.02	13 32.04	17 08 56.18	35.86
W.	π Herculis	15 17.65	− 0.55	+ 0.17	− 0.03	15 17.24	10 41.58	35.66
W.	44 Ophiuchi	17 23 25.10	− 6.03	+ 0.07	− 0.03	17 23 19.11	17 18 43.06	− 4 36.05

NORMAL EQUATIONS.

$$0 = +\ 1.78 + 10.00\,\delta t + 4.82\,a^1 - 1.92\,c \qquad \text{Adopted } a = -6^s.00$$
$$0 = +\ 1.78 + 4.82\,\delta t + 9.95\,a^1 - 10.11\,c \qquad a^1 = -0^s.091$$
$$0 = -\ 1.75 - 1.92\,\delta t - 10.11\,a^1 + 24.00\,c \qquad c = +0^s.024$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, AUGUST 8, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	A Draconis	16 32 49. 62	+ 3. 15	+ 0. 02	+ 0. 15	16 32 52. 94	16 28 16. 29	— 4 36. 65
W.	η Herculis	43 13. 19	— 0. 12	— 0. 04	+ 0. 07	43 13. 10	38 36. 43	36. 67
W.	κ Ophiuchi	56 22. 22	— 1. 28	— 0. 07	+ 0. 06	56 20. 93	51 44. 21	36. 72
W.	d Herculis	17 01 36. 16	— 0. 38	+ 0. 07	+ 0. 06	17 01 35. 91	56 59. 02	36. 89
E.	a^1 Herculis	13 34. 03	— 1. 08	+ 0. 05	— 0. 06	13 32. 94	17 08 56. 17	36. 77
E.	44 Ophiuchi	23 22. 10	— 2. 38	+ 0. 04	— 0. 06	23 19. 70	1843. 05	36. 65
E.	Groom. 966, L. C.	27 38. 89	— 8. 35	— 0. 17	+ 0. 21	27 30. 58	22 53. 95	36. 63
E.	μ Herculis	17 46 11. 04	— 0. 63	+ 0. 18	— 0. 06	17 46 10. 53	17 41 33. 74	— 4 36. 79

NORMAL EQUATIONS.

$$0 = +0.17 + 8.00\,\delta t + 4.60\,a^1 - 6.90\,c$$
$$0 = -1.58 + 4.60\,\delta t + 15.32\,a^1 - 13.14\,c$$
$$0 = +2.04 - 6.90\,\delta t - 13.14\,a^1 + 30.31\,c$$

Adopted $a = -2^s.5$
$a^1 = +0^s.093$
$c = -0^s.055$

OGDEN, UTAH, AUGUST 15, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α Scorpii	16 26 22. 45	+ 0. 92	0. 00	— 0. 05	16 26 23. 32	16 21 43. 09	— 4 40. 23
W.	β Herculis	29 29. 83	+ 0. 31	+ 0. 01	— 0. 05	29 30. 10	24 49. 93	40. 17
W.	A Draconis	32 57. 04	— 1. 18	+ 0. 05	— 0. 13	32 55. 78	28 15. 88	39. 90
W.	ζ Herculis	41 13. 93	+ 0. 16	+ 0. 03	— 0. 05	41 14. 07	36 33. 93	40. 14
W.	η Herculis	43 16. 33	+ 0. 04	+ 0. 05	— 0. 06	43 16. 36	38 36. 28	40. 08
E.	κ Ophiuchi	56 24. 01	+ 0. 48	+ 0. 13	+ 0. 05	56 24. 67	51 44. 12	40. 55
E.	d Herculis	17 01 39. 19	+ 0. 14	+ 0. 18	+ 0. 06	17 01 39. 57	56 58. 89	40. 68
E.	a^1 Herculis	13 36. 01	+ 0. 40	+ 0. 14	+ 0. 05	13 36. 60	17 08 56. 08	40. 52
E.	π Herculis	15 21. 54	+ 0. 08	+ 0. 16	+ 0. 06	15 21. 84	10 41. 44	40. 40
E.	44 Ophiuchi	23 22. 59	+ 0. 89	+ 0. 05	+ 0. 05	23 23. 58	18 42. 97	40. 61
E.	Groom. 966, L. C.	26 32. 07	+ 3. 11	— 0. 17	— 0. 18	26 34. 83	21 54. 61	40. 22
E.	β Draconis	32 17. 54	— 0. 28	+ 0. 16	+ 0. 07	32 17. 49	27 36. 97	40. 52
E.	ω Draconis	17 42 24. 68	— 1. 16	+ 0. 25	+ 0. 13	17 42 23. 90	17 37 43. 43	— 4 40. 47

NORMAL EQUATIONS.

$$0 = +0.63 + 13.00\,\delta t + 4.39\,a - 1.28\,c$$
$$0 = -14.02 + 4.39\,\delta t + 18.23\,a - 17.99\,c$$
$$0 = +13.67 - 1.28\,\delta t - 17.99\,a + 44.74\,c$$

$a = +0^s.897$
$c = +0^s.046$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, AUGUST 16, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	α Scorpii	16 26 22.10	+ 1.34	0.00	0.00	16 26 23.44	16 21 43.08	— 4 40.36
E.	β Herculis	29 29.89	+ 0.46	— 0.02	0.00	29 30.33	24 49.92	40.41
E.	ζ Herculis	41 14.17	+ 0.23	— 0.05	0.00	41 14.35	36 33.91	40.44
E.	η Herculis	43 16.82	+ 0.07	— 0.07	0.00	43 16.82	38 36.26	40.56
E.	9 Camelop., L. C.	45 10.94	+ 3.06	+ 0.06	0.00	45 14.06	40 33.50	40.56
E.	κ Ophiuchi	56 24.00	+ 0.69	— 0.10	0.00	56 24.59	51 44.11	40.48
E.	d Herculis	17 01 39.49	+ 0.21	— 0.21	0.00	17 01 39.49	56 58.87	40.62
W.	ζ Draconis	13 07.05	+ 1.32	— 0.47	0.00	13 07.90	17 08 27.24	40.66
W.	44 Ophiuchi	23 25.00	— 1.29	— 0.10	0.00	23 23.61	18 42.95	40.66
W.	β Draconis	32 17.52	+ 0.40	— 0.40	0.00	32 17.52	27 36.94	40.58
W.	ω Draconis	42 22.80	+ 1.67	— 0.62	0.00	42 23.85	37 43.38	40.47
W.	μ Herculis	46 14.57	— 0.34	— 0.30	0.00	46 13.93	41 33.62	40.31
W.	γ Draconis	17 58 23.33	+ 0.36	— 0.43	0.00	17 58 23.26	17 53 42.89	— 4 40.37

NORMAL EQUATIONS.

For E.: $0 = -1.93 + 7.00\,\delta t + 4.65\,a$
$0 = -6.42 + 4.65\,\delta t + 7.04\,a$ $\qquad a = +1^s.300$

For W.: $0 = +1.53 + 6.00\,\delta t - 1.65\,a$
$0 = +4.09 - 1.05\,\delta t + 3.93\,a$ $\qquad a = +1^s.298$

The following tables show the corrections and rates of the chronometers used at Las Vegas and Ogden:

CHRONOMETER AT LAS VEGAS—NEGUS, No. 1344.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1874.	h.	h. m. s.	s.
August 8	17.2	— 0 06 19.07	+ 0.080
August 8	19.7	19.28	
August 15	20.1	31.98	+ 0.055
August 15	0.6	32.23	
August 16	23.2	— 0 06 33.41	+ 0.055

CHRONOMETER AT OGDEN—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1874.	h.	h. m. s.	s.
August 7	16.8	— 0 04 35.83	+ 0.040
August 8	17.1	36.72	
August 15	17.0	40.35	+ 0.006
August 16	17.1	— 0 04 40.50	

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
August 8, 1874:		*h. m. s.*	*h. m. s.*	*h. m. s.*	*m. s.*	*s.*	*m. s.*
Ogden	Las Vegas	18 47 42.33	— 0 06 19.18	18 41 23.15			
	Ogden	18 18 53.92	— 0 04 36.76	18 14 17.16	27 05.99		
Las Vegas	Las Vegas	18 51 40.25	— 0 06 19.18	18 45 21.07			
	Ogden	18 22 52.26	— 0 04 36.77	18 18 15.49	05.58	0.41	27 05.785
August 15, 1874:							
Ogden	Las Vegas	19 02 26.26	— 0 06 31.91	18 55 54.35			
	Ogden	18 33 28.78	— 0 04 40.36	18 28 48.42	05.93		
Las Vegas	Las Vegas	19 10 45.11	— 0 06 31.92	19 24 13.19			
	Ogden	18 41 47.84	— 0 04 40.36	18 37 07.48	05.71	0.22	05.820
August 15, 1874:							
Ogden	Las Vegas	9 01 16.34	— 0 06 32.65	8 54 43.69			
	Ogden	8 32 18.15	— 0 04 40.45	8 27 37.70	05.99		
Las Vegas	Las Vegas	9 14 28.94	— 0 06 32.66	9 07 56.28			
	Ogden	8 45 31.09	— 0 04 40.45	8 40 50.64	27 05.64	0.35	27 05.815

Las Vegas east of Ogden .... $0^h\ 27^m\ 05^s.807 \pm 0^s.007$
Or, $6^\circ\ 46'\ 27''.10$

Observations and computations for latitude.

LAS VEGAS, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1874.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
July 31...	6553	6 92.6	23.0	13.8						
	6581	9 42.0	10.5	27.0		35 37 06.2	— 1 36.1	—1.7	......	35 35 28.4
	6654	9 91.7	19.8	18.4		30 30.1	+ 4 57.9	—0.2	......	27.8
	6697	2 18.3	18.0	20.2						
	6709	12 43.9	18.0	20.0		28 53.8	+ 6 35.4	—1.0	......	28.2
	6731	11 06.0	20.0	17.3						
	6762	7 80.7	5.7	32.4		37 38.2	— 2 05.3	—5.5	......	27.4
	6799	11 21.0	19.3	18.0		40 32.7	— 5 00.1	—3.8	......	
	6827	3 42.6	10.0	27.5						
	6830	11 77.0	24.0	13.4	25ˢ p. m.	40 51.3	— 5 21.6	—1.6	+0.1	28.2
	6851	2 04.0	23.5	13.7						
	6875	14 55.3	12.3	24.8		43 30.1	— 8 02.3	—0.6	......	27.2
	6893	3 41.2	16.0	21.0						
	6905	13 38.0	29.0	8.7		35 41 48.4	— 6 24.3	+3.6	......	35 35 27.6

Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
1874. July 31...	6937	8 01.2	17.0	19.8		35 31 51.1	+ 3 41.3	−5.5	......	35 35 26.9
	6967	5 74.0	16.2	21.2		30 21.1	+ 5 09.5	−6.0	......	27.6
	6998	13 76.8	8.3	29.4						
	7067	13 49.3	22.3	15.2	Changed inclination.					
	7101	4 94.3	38.0	0.3		29 51.1	+ 5 29.5	+10.3	......	30.9
	7119	13 04.7	33.5	4.3						
	7152	5 08.7	10.4	27.0		40 30.9	− 5 06.8	+2.9	......	27.0
	7166	9 88.5	25.7	12.0						
	7200	7 23.5	27.2	10.7		37 02.1	− 1 42.1	+7.0	......	27.0
	7241	2 63.0	17.0	20.5	Changed inclination.	34 59.6	+ 0 35.0	−8.6	......	26.0
	7256	3 53.7	2.3	36.0						
	7290	21 24.0	26.0	12.9		46 52.2	−11 22.2	−4.8	......	25.2
	7309	10 01.8	17.8	20.0		38 52.3	− 3 32.8	−2.8	......	26.7
	7334	− 1 25.0	18.0	20.0		46 04.9	−10 37.0	−2.8	......	25.1
	7381	15 28.0	14.2	24.2						
	7394	3 49.5	18.2	20.2		43 05.0	− 7 37.2	+0.9	.....	28.7
	7404	5 68.0	17.8	20.7		41 41.6	− 6 13.0	+0.6	......	29.2
	7438	15 35.6	22.2	16.5						
	7450	7 91.0	18.2	20.0						
	7483	10 34.0	11.0	27.9		37 05.2	− 1 33.6	−4.3	......	27.3
	7488	12 68.0	5.3	33.5	30s p. m.					
	7528	5 54.2	18.8	21.0		40 07.9	− 4 35.1	−6.8	+0.1	26.1
	7548	19 46.3	10.3	29.0		44 27.6	− 8 59.9	−2.0	......	25.7
	7585	5 45.9	25.0	14.8						
	7598	1 42.0	7.3	33.0		32 55.1	+ 2 35.7	−3.6	......	27.2
	7605	18 55.7	19.8	19.9						
	7641	− 0 30.0	5.5	34.7		47 40.5	−12 06.9	−6.8	......	26.8
	7788	7 39.2	21.8	19.0						
	7810	9 49.5	11.7	30.4		36 53.7	− 1 21.1	−3.7	......	28.9
August 1.	6553	6 85.6	23.3	18.0						
	6581	9 42.0	20.0	22.0		37 06.4	− 1 38.8	+0.8	......	28.4
	6654	8 86.3	18.5	23.0		30 30.3	+ 4 51.4	+6.8	......	28.5
	6697	1 30.4	37.5	4.0						
	6709	11 46.5	8.0	33.0		28 54.0	+ 6 31.7	+2.0	......	27.7
	6731	10 62.5	20.2	20.7						
	6762	7 21.0	56.4	15.0		37 38.4	− 2 11.6	+2.5	.....	29.3
	6799	11 60.0	21.3	19.8						
	6827	3 79.0	12.0	29.7		40 33.0	− 5 01.1	−3.8	......	28.1
	6851	2 66.0	19.0	22.0						
	6875	15 23.5	29.4	12.0		35 43 30.4	− 8 04.7	+3.3	......	35 35 29.0

Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
August 1.	6893	3 83.0	21.3	19.7						
	6905	13 82.2	31.0	10.3		35 36 48.6	— 6 25.2	+5.2	......	35 35 28.6
	6937	8 23.3	19.2	22.0		31 51.5	+ 3 33.2	+3.6	......	28.3
	6967	5 96.8	17.9	23.6		30 24.4	+ 5 00.6	+2.9	......	27.9
	6998	13 76.5	30.0	11.7						
	7067	12 97.3	22.3	20.0						
	7101	4 40.0	36.8	5.6		29 50.5	+ 5 30.5	+7.8	......	28.8
	7119	13 49.9	19.5	22.5						
	7152	5 64.2	22.8	18.9		40 31.2	— 5 02.9	+0.2	......	28.7
	7166	9 86.9	18.0	23.9						
	7200	7 28.3	33.0	9.0		37 02.3	— 1 39.7	+4.2	......	26.8
	7241	3 19.9	22.5	20.0		34 59.9	+ 0 34.0	—6.4	......	27.5
	7256	4 08.2	6.0	36.0						
	XX, 401	17 71.6	40.0	2.0		44 10.6	— 8 45.5	+1.9	......	27.0
	7309	9 87.0	21.6	19.8		38 52.5	— 3 29.2	+5.6	......	28.9
	7334	— 1 42.5	23.0	18.9		46 05.2	—10 44.7	+6.1	......	26.6
	7381	15 29.9	32.6	10.2						
	7394	2 61.3	20.0	22.0		43 05.1	— 7 36.2	—2.0	......	26.9
	7404	4 79.0	19.0	22.2		41 41.7	— 6 12.3	—2.2	......	27.2
	7438	14 44.8	17.4	24.0						
	7450	7 41.5	20.7	19.8						
	7483	9 97.8	20.4	20.0		37 05.5	— 1 38.8	+0.3	......	27.0
	7488	12 78.5	23.0	17.3						
	7528	5 52.5	12.0	29.0		40 08.2	— 4 39.8	—3.0	......	25.4
	7548	20 13.6	19.7	21.0		44 27.9	— 8 57.0	—3.8	......	27.1
	7585	6 20.5	12.6	27.6						
	7598	2 32.9	33.0	8.0		32 55.5	+ 2 29.4	+2.3	.....	27.2
	7605	17 08.2	21.3	19.2						
	7641	— 1 94.4	19.0	22.7		47 40.9	—12 13.4	—0.4	......	27.1
	7695	12 82.9	22.2	20.2						
	7706	4 73.1	21.5	21.2		40 37.6	— 5 12.1	+0.5	......	26.0
	7721	— 2 27.7	25.0	17.2		49 29.9	—14 04.3	+2.6	......	28.2
	7731	— 2 43.0	25.0	17.3		49 34.6	—14 10.2	+2.6	......	27.0
	7765	19 62.0	23.3	19.8						
	7788	7 49.5	20.3	22.3						
	7810	9 84.5	36.0	7.0		36 54.0	— 1 30.6	+6.3	......	29.7
	7843	10 [illegible].0	23.0	19.5						
	7858	5 51.7	32.0	11.2		31 52.7	+ 3 29.8	+5.6	......	28.1
	7875	13 21.5	18.0	24.8						
	7908	7 50.8	25.5	18.0		35 39 05.6	— 3 39.8	+0.2	......	35 35 26.0

Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
August 1.	7963	5 23.6	21.8	22.3						
	7996	11 76.0	33.2	11.0		35 31 09.6	+ 4 11.4	+5.0	......	35 35 26.0
	8034	15 77.3	15.0	29.0						
	8083	7 51.0	36.0	8.8		30 04.8	+ 5 18.6	+3.1	......	26.5
	8114	13 61.6	21.2	23.0						
	8131	4 45.7	13.0	31.0		41 24.1	− 5 53.1	−4.6	......	26.4
August 2.	6967	6 68.4	21.2	21.9						
	6998	14 44.2	29.3	13.8		30 24.7	+ 4 59.1	+3.4	......	27.2
August 3.	6553	7 14.3	17.0	17.0	Cloudy again.					
	6581	9 84.0	32.0	2.0		37 06.9	− 1 43.9	+7.0	......	30.0
	6654	9 53.0	21.0	13.0		30 30.8	+ 4 57.5	−1.1	......	27.2
	6697	1 81.0	11.2	23.9						
	6709	12 04.0	20.2	14.5		28 54.5	+ 6 34.4	−1.6	......	27.3
	6731	10 22.0	19.3	15.0						
	6762	6 84.2	17.7	17.3		37 38.9	− 2 10.2	+1.1	......	29.8
	6799	11 56.7	21.2	13.8						
	6827	3 82.4	−0.3	35.7		40 33.5	− 4 58.4	−6.6	......	28.5
	6851	2 89.2	15.0	20.0						
	6875	15 50.5	28.2	7.0		43 31.0	− 8 06.2	+3.7	......	28.5
	6893	2 20.9	17.0	17.6						
	6905	11 92.9	5.8	29.0		41 49.1	− 6 14.7	−5.5	......	28.9
	6937	7 84.0	18.1	16.0		31 52.0	+ 3 38.1	−1.2	......	28.9
	6967	5 58.5	17.9	17.0		30 25.0	+ 5 05.0	−1.4	......	28.6
	6998	13 50.0	14.0	21.1						
	7067	12 08.5	12.3	22.6						
	7101	3 37.5	23.6	11.6		29 51.2	+ 5 35.8	+0.4	......	27.4
	7119	12 53.4	14.8	20.0						
	7152	4 77.1	12.2	22.7		40 31.7	− 4 59.2	−3.7	......	28.8
	7166	10 27.0	17.1	17.4						
	7200	7 95.6	7.0	27.7		37 03.0	− 1 29.2	−4.9	......	28.9
	7241	2 82.2	18.7	16.0		35 00.5	+ 0 32.3	−7.0	......	25.8
	7256	3 66.0	1.0	34.0						
	XX, 401	17 21.9	31.9	3.6		44 11.2	− 8 42.7	−1.1	......	27.4
	7309	9 48.8	12.3	22.7		38 52.9	− 3 27.1	+2.9	......	28.7
	7334	−− 1 81.0	14.0	21.1		46 05.6	−10 42.7	+3.6	......	26.5
	7381	14 86.1	29.7	6.9						
	7394	1 83.5	22.7	13.7		43 05.6	− 7 34.1	−3.5	......	28.0
	7404	3 99.7	......	......		35 41 42.2	− 6 10.8	−3.6	......	35 35 27.8
	7438	13 61.9	6.3	30.5						

Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
August 3.	7450	6 35.0	21.3	15.6						
	7483	8 96.0	18.0	20.0		35 37 06.0	− 1 40.6	+0.9	......	35 35 26.3
	7585	5 84.2	1.0	36.7						
	7598	1 86.8	33.3	4.7		32 56.0	+ 2 33.2	−1.7	......	27.5
	7605	18 00.4	15.3	22.5						
	7641	− 0 89.6	9.8	28.0		47 41.4	−12 08.6	−5.9	......	26.9
	7695	11 94.0	16.0	22.7						
	7706	3 81.7	23.3	15.3		40 38.2	− 5 13.1	+0.3	......	25.4
	7721	− 2 80.0	......	......		49 30.6	−14 06.3	+2.2	......	26.5
	7731	− 2 94.0	21.5	16.0		49 35.3	−14 11.7	+2.2	......	25.8
	7765	19 15.0	21.3	17.2						
	7788	6 43.5	17.0	21.2						
	7810	8 76.0	28.1	11.0		36 54.5	− 1 29.6	+3.0	......	27.9
	7829	8 02.8	18.0	20.1						
	7833	8 33.2	15.0	23.0		35 17.9	+ 0 11.7	−2.3	......	27.3
	7843	10 80.3	20.0	18.0	25ˢ p. m.					
	7858	5 11.3	7.9	30.3		31 53.3	+ 3 39.3	−4.7	+0.1	28.0
	7875	11 57.1	17.9	20.0						
	7908	6 07.5	2.3	36.0		39 06.2	− 3 31.8	−8.3	......	26.1
	7963	4 37.6	17.7	20.5						
	7996	11 21.5	7.3	31.0		31 10.2	+ 4 23.6	−6.1	......	27.1
	8024	4 71.8	18.3	20.0		28 46.3	+ 6 48.5	−7.6	......	27.2
	8034	15 31.5	3.8	34.8						
	8083	6 90.7	27.0	12.3		30 05.4	+ 5 24.1	−3.5	......	26.0
	8114	13 12.1	19.8	19.0						
	8131	3 85.9	19.0	20.0		41 24.3	− 5 57.0	0.0	......	27.3
August 4.	6553	6 50.0	24.5	24.0						
	6581	9 08.7	24.0	23.6		37 07.2	− 1 39.7	+0.2	......	27.7
	6654	9 16.5	24.0	22.8		30 31.1	+ 4 58.5	−1.6	......	28.0
	6697	1 42.0	19.6	27.9						
	6700	11 59.2	29.0	18.2		28 54.8	+ 6 32.1	+0.6	......	27.5
	6731	10 44.6	20.6	26.4						
	6762	7 09.3	26.0	21.0		37 38.7	− 2 09.2	−0.2	......	29.3
	7241	2 71.9	22.5	13.1		35 00.8	+ 0 25.2	−2.6	......	28.6
	7256	3 37.4	18.2	16.3						
	7290	21 21.0	17.1	17.4		46 53.4	−11 27.5	+0.4	......	26.3
	7309	9 64.2	17.0	17.2						
	7381	14 89.7	13.7	21.9		35 38 53.2	− 3 22.5	−2.0	......	35 35 28.7

Observations and computations—Continued.

LAS VEGAS, NEW MEXICO.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.			Latitude.
			N.	S.			Microm. and refr.	Level.	Merid.	
		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
1874.										
August 4.	7394	2 55. 1	17. 0	18. 0		35 43 05. 8	— 7 42. 4	+5. 5	......	35 35 28. 9
	7404	4 70. 1	17. 7	17. 7		41 42. 4	— 6 19. 4	+5. 7	......	28. 7
	7438	14 54. 3	30. 1	5. 5						
	7450	6 72. 3	17. 9	17. 0						
	7483	9 42. 9	28. 2	7. 4		35 37 06. 4	— 1 44. 3	+5. 0	......	35 35 27. 1

As ascertained by observations at Ogden, the longitude of the observatory at that place is $7^h\ 27^m\ 59^s.643$ west of Greenwich. Adopting this result in the determination for station at Las Vegas, we have—

Longitude.. $7^h\ 00^m\ 53^s.836$ or 105° 13′ 27″.57 ± 0″.10 west from Greenwich.
Longitude.. $1^h\ 52^m\ 41^s.716$ or 28° 10′ 25″.77 west from U. S. Naval Observatory, Washington, D. C.

with a probable error of $0^s.007$ in relation to Ogden.

Latitude ... 35° 35′ 27″.66 ± 0″.07 north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF CIMARRON, NEW MEXICO.

SEASON OF 1874.

COMPUTATIONS BY

DR. F. KAMPF AND JOHN H. CLARK.

CIMARRON, NEW MEXICO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, ... $104° 54' 59''.04 \pm 0''.20$ west from Greenwich.
Latitude, ... $36° 30' 10''.01 \pm 0''.09$ north.
Barometric altitude of observatory above sea-level, 6384.5 feet.

Cimarron, Colfax County, New Mexico, is a settlement of 500 inhabitants, half of whom are Mexicans. The town is surrounded on the west and north by high mountains and by mesas in the east and south. It is crossed by the Cimarron River, which flows from west to east. The principal part of the town and an extensive tract of the adjacent territory are the property of an association of English capitalists called the Maxwell Land-Grant and Railway Company. The country is rich in coal and gold, and is well adapted for agriculture and the raising of cattle.

By permission of Mr. Morley, vice-president of the Maxwell Company, the astronomical monument was fixed in the corner of a lot in the southern part of the town, from which there is good opportunity to make connection with natural objects. The meridian is marked by two pillars of solid stone planted in the earth and extending three feet below and one and a half feet above the surface of the same. The center of the south meridian-mark is exactly in the meridian of the middle point between the two iron pieces which connect the platform and the foundation of the astronomical station; the center of the cross on the north mark is about $0''.7$ east of the meridian line.

METEOROLOGICAL CONDITIONS.

The weather was exceedingly bad. It rained incessantly from August 21 to August 27, and although the observer arrived at this point on the 18th of the month, he found no night suitable for observations until the 31st. Regularly at 11 p. m. a heavy wind arose, blowing from the west.

The observatory, instruments, &c., were the same as at the previous station, Las Vegas. The telegraph-line was in the same bad condition as at Las Vegas. In sending and receiving signals, assistance was kindly rendered by Mr. McCullough, postmaster. Mr. Charles Morrison was meteorological assistant and also in charge of lamps and other material.

Exchanges for time were made with Mr. John H. Clark, at Ogden, on September 6, in the daytime, and on the nights of September 7 and 8. Observations for latitude were taken August 31, September 4, and September 5. The observer at Cimarron was Dr. F. Kampf. Each astronomer made the computations necessary for his own work.

The only explanation for the irregularity of seventeen seconds in the chronometer on September 6 is, that the chain may have slipped a little from its cylinder.

Tabulation of stars used for determination of time at Cimarron, New Mexico, and Ogden, Utah, 1874.

	CIMARRON.				OGDEN.		
	September 5.	September 6.	September 7.	September 8.	September 6.	September 7.	September 8.
α Scorpii	....	....	....	....	....	×	....
β Herculis	....	....	....	....	...	×	....
ζ Ophiuchi	....	....	....	....	....	×	....
ζ Herculis	....	....	....	....	....	×	....
κ Ophiuchi	....	....	....	....	....	×	×
ζ Draconis	....	....	....	....	....	×	....
α¹ Herculis	....	....	....	....	....	....	×
π Herculis	....	....	....	....	....	....	×
44 Ophiuchi	....	....	....	....	....	×	....
β Draconis	....	....	....	....	....	×	×
α Ophiuchi	....	....	....	....	....	×	×
ι Herculis	....	....	....	....	....	×	×
ω Draconis	....	....	....	....	....	×	×
u Herculis	...	....	....	....	...	×	×
ψ¹ Draconis	....	....	....	....	....	....	×
γ Draconis	....	....	....	....	....	×	×
22 Camelop., L. C.	....	...	....	....	....	×	×
χ Draconis	×	....	....	....	....	....	....
1 Aquilæ	×	....	....	....	.. .	....	....
α Lyræ	×	....	...	....	....	....	....
110 Herculis	....	....	×	....	....	....	....
β Lyræ	×	....	×	....	....	....	....
ο Draconis	×	....	....	....	....	....	....
50 Draconis	...	....	×	....	....	....	....
ε Aquilæ	×	....	×	....	....	....	....
ζ Aquilæ	....	....	×	....	....	....	....
d Sagittarii	....	....	×	. ..	....	....	....
δ Draconis	....	...	....	...	×	....	....
τ Draconis	...	....	×	....	....	....	....

	CIMARRON.				OGDEN.		
	September 5.	September 6.	September 7.	September 8.	September 6.	September 7.	September 8.
δ Aquilæ	....	....	....	....	×	....	....
β Cygni	....	....	×	....	×	....	....
κ Aquilæ	....	....	×	....	×	....	....
γ Aquilæ	....	....	×	....	×	....	....
α Aquilæ	....	....	....	....	×	....	....
ε Draconis	....	....	....	....	×	....	....
α Delphini	....	....	....	×	....	....	....
α Cygni	...	....	....	×	....	....	....
γ Delphini	....	....	....	×	....	....	....
μ Aquarii	....	....	....	×	....	....	....
76 Draconis	....	....	....	×	....	....	....
ζ Cygni	....	....	....	×	....	....	....
α Equulei	....	....	×	...	....	....	....
τ Cygni	....	..	....	×	....	....	....
α Cephei	....	....	×	×	....	....	....
β Aquarii	....	....	×	....	....	....	....
β Cephei	....	....	....	×	....	....	....
ξ Aquarii	....	....	×	....	....	....	....
ε Pegasi	....	....	×	×	....	...	....
μ Capricorni	....	....	×	....	....	....	....
79 Draconis	....	....	×	....	....	....	....
α Aquarii	....	...	×	....	....	....	....
ι Pegasi	....	...	×	....	....	....	....
θ Aquarii	....	....	×	....	....	....	....
γ Piscium	....	×	....	....	....	....	....
ο Cephei	....	×	....	....	....	....	....
4 Cassiopeiæ	....	×	....	....	....	....	....
72 Pegasi	....	×	....	....	....	....	....
ι Piscium	....	×	....	....	....	....	....

Observations and reductions for time taken at sending station.

CIMARRON, NEW MEXICO, SEPTEMBER 5, 1874.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	χ Draconis	18 28 39.48	+15.88	— 0.16	— 1.75	18 28 53.45	18 23 20.44	— 5 33.01
E.	1 Aquilæ	34 02.18	— 5.69	— 0.04	— 0.53	34 55.92	29 23.23	32.69
E.	α Lyræ	38 15.22	+ 0.40	— 0.07	— 0.67	38 14.88	32 42.06	32.82
W.	β Lyræ	51 00.64	— 0.56	— 0.17	+ 0.62	51 00.53	45 27.51	33.02
W.	ο Draconis	54 48.64	+ 6.10	— 0.23	+ 1.01	54 55.52	49 22.85	32.67
W.	ε Aquilæ	18 59 32.12	— 3.05	— 0.11	+ 0.54	18 59 29.50	18 53 56.32	— 5 33.18

NORMAL EQUATIONS.

$$0 = -12.91 + 6.00\,\delta t - 1.63\,a + 1.47\,c \qquad a = -8^{s}.02$$
$$0 = +38.83 - 1.63\,\delta t + 5.14\,a - 4.98\,c \qquad c = -0^{s}.52$$
$$0 = -29.56 + 1.47\,\delta t - 4.98\,a + 20.25\,c$$

Observations and reductions for time taken at sending station—Continued.

CIMARRON, NEW MEXICO, SEPTEMBER 6, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	γ Piscium	23 16 12.28	+ 2.93	— 0.23	+ 0.39	23 16 15.37	23 10 40.86	— 5 34.51
W.	o Cephei	19 11.96	— 7.02	— 0.58	+ 1.01	19 05.37	13 30.84	34.53
W.	4 Cassiopeiæ	24 56.76	— 4.66	— 0.44	+ 0.82	24 52.48	19 17.85	34.63
W.	72 Pegasi	33 18.70	+ 0.63	— 0.23	+ 0.45	33 19.55	27 44.83	34.72
W.	ι Piscium	23 39 02.70	+ 2.78	— 0.15	+ 0.39	23 39 05.72	23 33 31.08	— 5 34.64

NORMAL EQUATIONS.

c taken from the next day's observations $= -0^s.39$
a from high and low stars $= +5^s.24$

CIMARRON, NEW MEXICO, SEPTEMBER 7, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	110 Herculis	18 46 08.36	— 0.56	— 0.01	+ 0.38	18 46 08.17	18 40 16.35	— 5 51.82
W.	β Lyræ	51 19.10	— 0.13	— 0.06	+ 0.43	51 19.34	45 27.47	51.87
W.	50 Draconis	56 12.64	+ 4.61	— 0.27	+ 1.41	56 18.39	50 26.40	51.99
W.	ε Aquilæ	59 48.72	— 0.71	— 0.12	+ 0.37	59 48.26	53 56.30	51.96
W.	ζ Aquilæ	19 05 31.64	— 0.75	— 0.16	+ 0.37	19 05 31.10	59 39.15	51.95
E.	d Sagittarii	16 12.40	— 1.63	— 0.08	— 0.38	16 10.31	19 10 18.36	51.95
E.	τ Draconis	23 49.10	+ 3.83	— 0.75	— 1.23	23 50.95	17 59.11	51.84
E.	β Cygni	31 33.28	— 0.32	— 0.32	— 0.41	31 33.23	25 40.46	51.77
E.	κ Aquilæ	36 03.08	— 1.42	— 0.20	— 0.36	36 01.10	30 09.24	51.86
E.	γ Aquilæ	19 46 11.88	— 0.84	— 0.29	— 0.37	19 46 10.38	19 40 18.46	— 5 51.92
E.	α Equulei	21 15 27.98	— 1.05	— 0.19	— 0.43	21 15 26.31	21 09 34.16	— 5 52.15
E.	α Cephei	21 28.52	+ 1.82	— 0.54	— 0.92	21 28.88	15 36.66	52.22
E.	β Aquarii	30 52.36	— 1.34	— 0.23	— 0.44	30 50.35	24 58.39	51.96
E.	ξ Aquarii	36 59.62	— 1.40	— 0.23	— 0.43	36 57.56	31 05.52	52.04
E.	ε Pegasi	43 56.28	— 0.91	— 0.28	— 0.44	43 54.65	38 02.57	52.08
W.	μ Capricorni	52 22.08	— 1.58	— 0.26	+ 0.44	52 20.68	46 28.61	52.07
W.	79 Draconis	57 08.40	+ 4.05	— 1.02	+ 1.49	57 12.92	51 20.88	52.04
W.	α Aquarii	22 05 14.76	— 1.20	— 0.27	+ 0.43	22 05 13.72	59 21.57	52.15
W.	ι Pegasi	07 03.90	— 0.43	— 0.32	+ 0.47	07 03.62	22 01 11.33	52.29
W.	θ Aquarii	22 16 07.40	— 1.40	— 0.22	+ 0.44	22 16 06.22	22 10 14.04	— 5 52.18

NORMAL EQUATIONS.

First series.

$$0 = -8.36 + 10.00\,\delta t - 1.12\,a - 0.61\,c \qquad a = -1^s.868$$
$$0 = +24.87 - 1.12\,\delta t + 12.26\,a + 3.82\,c \qquad c = -0^s.359$$
$$0 = +19.89 - 0.61\,\delta t + 3.82\,a + 36.51\,c$$

Second series.

$$0 = +1.01 + 10.00\,\delta t + 1.75\,a - 1.42\,c \qquad a = -1^s.974$$
$$0 = +17.80 + 1.75\,\delta t + 8.06\,a + 5.11\,c \qquad c = -0^s.432$$
$$0 = +21.02 - 1.42\,\delta t + 5.11\,a + 24.72\,c$$

Observations and reductions for time taken at sending station—Continued.

CIMARRON, NEW MEXICO, SEPTEMBER 8, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Delphini	20 39 43.94	− 0.28	− 0.06	+ 0.51	20 39 44.11	20 33 49.59	− 5 54.52
W.	α Cygni	43 04.26	+ 0.15	− 0.08	+ 0.55	43 04.88	37 10.36	54.52
W.	γ Delphini	46 45.60	− 0.28	− 0.05	+ 0.51	46 45.78	40 51.09	54.69
W.	μ Aquarii	51 49.12	− 0.55	− 0.03	+ 0.39	51 48.93	45 54.19	54.74
W.	76 Draconis	57 26.10	+ 3.88	− 0.20	+ 2.82	57 32.60	51 38.05	54.55
E.	ζ Cygni	21 13 31.92	− 0.11	− 0.08	− 0.45	21 13 31.28	21 07 36.83	54.45
E.	τ Cygni	16 43.14	+ 0.01	− 0.10	− 0.49	16 42.56	10 48.06	54.50
E.	α Cephei	21 31.38	+ 0.69	− 0.19	− 0.83	21 31.05	15 36.64	54.41
E.	β Cephei	32 59.10	+ 1.21	− 0.24	− 1.14	32 58.93	26 04.13	54.80
E.	ε Pegasi	21 43 57.90	− 0.35	− 0.09	− 0.39	21 43 57.07	21 37 02.57	− 5 54.50

NORMAL EQUATIONS.

$$0 = -5.17 + 10.00\,\delta t - 5.85\,a - 3.81\,c \qquad a = -0^s.751$$
$$0 = +34.71 - 5.85\,\delta t + 31.25\,a + 29.95\,c \qquad c = -0^s.389$$
$$0 = +51.76 - 3.81\,\delta t + 29.95\,a + 75.87\,c$$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, SEPTEMBER 6, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	δ Draconis	19 17 29.54	− 0.68	+ 0.21	0.00	19 17 29.07	19 12 32.73	− 4 56.34
E.	δ Aquilæ	24 07.01	+ 0.37	+ 0.07	0.00	24 07.45	19 11.01	56.44
E.	β Cygni	30 36.52	+ 0.16	+ 0.10	0.00	30 36.78	25 40.47	56.31
E.	κ Aquilæ	35 05.24	+ 0.45	+ 0.07	0.00	35 05.76	30 19.25	56.51
E.	γ Aquilæ	45 14.57	+ 0.31	+ 0.09	0.00	45 14.97	40 18.47	56.50
E.	α Aquilæ	49 36.56	+ 0.32	+ 0.09	0.00	49 36.97	44 40.50	56.47
E.	ε Draconis	19 53 34.15	− 0.83	+ 0.28	0.00	19 53 33.60	19 48 37.03	− 4 56.57

NORMAL EQUATIONS.

$$0 = +1.64 + 7.00\,\delta t + 0.17\,a \qquad a = +0^s.592$$
$$0 = -2.85 + 0.17\,\delta t + 4.88\,a \qquad c \text{ adopted } 0^s.0$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, SEPTEMBER 7, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	α Scorpii	16 26 39.40	+ 0.66	− 0.08	− 0.13	16 26 39.85	16 21 42.72	− 4 57.13
E.	β Herculis	29 46.66	+ 0.23	− 0.19	− 0.13	29 46.57	24 49.53	57.04
E.	ζ Ophiuchi	35 11.78	+ 0.51	− 0.13	− 0.12	35 12.04	30 14.91	57.13
E.	ζ Herculis	41 30.70	+ 0.12	− 0.23	− 0.14	41 30.45	36 33.46	56.99
E.	κ Ophiuchi	56 40.92	+ 0.34	− 0.18	− 0.12	56 40.96	51 43.76	57.20
W.	ζ Draconis	17 13 23.89	− 0.66	− 0.22	+ 0.30	17 13 23.31	17 08 26.03	57.28
W.	44 Ophiuchi	23 39.13	+ 0.64	− 0.05	+ 0.13	23 39.85	18 42.63	57.22
W.	β Draconis	32 33.74	− 0.20	− 0.18	+ 0.20	32 33.56	27 36.24	57.32
W.	α Ophiuchi	34 03.62	+ 0.32	− 0.11	+ 0.12	34 03.95	29 06.83	57.12
W.	ι Herculis	40 53.00	− 0.08	− 0.18	+ 0.17	40 52.91	35 56.10	56.81
W.	ω Draconis	42 40.08	− 0.83	− 0.32	+ 0.33	42 39.26	37 42.07	57.19
W.	μ Herculis	46 30.15	+ 0.17	− 0.15	+ 0.14	46 30.31	41 33.22	57.09
W.	γ Draconis	58 39.58	− 0.18	− 0.42	+ 0.19	58 39.17	53 42.25	56.92
W.	22 Camelop., L. C.	18 09 55.55	+ 1.57	+ 0.23	− 0.35	18 09 57.00	18 04 59.81	− 4 57.19

NORMAL EQUATIONS.

$$0 = +1.23 + 14.00\,\delta t + 4.04\,a - 4.85\,c \qquad a = +0^s.643$$
$$0 = -4.71 + 4.04\,\delta t + 12.27\,a + 15.85\,c \qquad c = -0^s.120$$
$$0 = -7.06 - 4.85\,\delta t + 15.85\,a + 38.85\,c$$

OGDEN, UTAH, SEPTEMBER 8, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	κ Ophiuchi	16 56 41.37	+ 0.33	0.00	0.00	16 56 41.70	16 51 43.74	− 4 57.96
W.	a^1 Herculis	17 13 53.34	+ 0.28	− 0.01	+ 0.01	17 13 53.62	17 08 55.69	57.93
W.	π Herculis	15 38.72	+ 0.06	− 0.02	+ 0.01	15 38.77	10 40.85	57.92
W.	β Draconis	32 34.52	− 0.19	− 0.05	+ 0.01	32 34.29	27 36.20	58.09
W.	α Ophiuchi	34 04.41	+ 0.30	− 0.04	0.00	34 04.67	29 06.81	57.86
E.	ι Herculis	40 53.90	− 0.08	− 0.06	− 0.01	40 53.75	35 56.07	57.68
E.	ω Draconis	42 40.97	− 0.80	− 0.09	− 0.01	42 40.07	37 42.00	58.07
E.	μ Herculis	46 31.00	+ 0.16	− 0.03	0.00	46 31.13	41 33.20	57.93
E.	ψ^1 Draconis	49 10.55	− 1.05	− 0.06	− 0.02	49 09.42	44 11.30	58.12
E.	γ Draconis	57 40.43	− 0.17	− 0.02	− 0.01	57 40.23	52 42.22	58.01
E.	22 Camelop., L. C.	18 09 56.53	+ 1.52	0.00	+ 0.01	18 09 58.06	18 04 59.89	− 4 58.17

NORMAL EQUATIONS.

$$0 = +2.69 + 11.00\,\delta t + 0.56\,a + 1.34\,c \qquad a = +0^s.622$$
$$0 = -7.07 + 0.56\,\delta t + 11.47\,a - 17.33\,c \qquad c = -0^s.005$$
$$0 = +11.34 + 1.34\,\delta t - 17.33\,a + 40.18\,c$$

The following tables show the corrections and rates of the chronometers used at Cimarron and Ogden:

CHRONOMETER AT CIMARRON.—NEGUS, No. 1344.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1874.	*h.*	*h. m. s.*	*s.*
Sept. 5	18.63	— 0 05 32.900	+ 0.0594
Sept. 6	23.35	34.606	
Sept. 7	20.40	52.010	+ 0.1036
Sept. 8	21.10	— 0 05 54.570	

CHRONOMETER AT OGDEN.—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1874.	*h.*	*h. m. s.*	*s.*
Sept. 6	19.52	— 0 04 56.45	+ 0.0309
Sept. 7	17.22	57.12	+ 0.0352
Sept. 8	17.64	— 0 04 57.98	

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
September 6, 1874:		*h. m. s.*	*h. m. s.*	*h. m. s.*	*m. s.*	*s.*	*m. s.*
Ogden	Cimarron	10 44 32.50	—0 05 35.28	10 38 57.22			
	Ogden	10 15 34.24	—0 04 56.90	10 10 37.34	28 19.88		
Cimarron	Cimarron	10 48 15.16	—0 05 35.28	10 42 39.88			
	Ogden	10 19 17.24	—0 04 56.90	10 14 20.34	19.54	0.34	28 19.710
September 7, 1874:							
Ogden	Cimarron	20 26 48.62	—0 05 52.00	20 20 56.62			
	Ogden	19 57 34.02	—0 04 57.20	19 52 36.82	19.80		
Cimarron	Cimarron	20 30 30.00	—0 05 52.01	20 24 37.99			
	Ogden	20 01 15.66	—0 04 57.21	19 56 18.45	19.54	0.26	19.670
September 8, 1874:							
Ogden	Cimarron	20 04 49.28	—0 05 54.46	19 58 54.82			
	Ogden	19 35 33.04	—0 04 58.05	19 30 34.99	19.83		
Cimarron	Cimarron	20 11 03.85	—0 05 54.47	20 05 09.38			
	Ogden	19 41 47.78	—0 04 58.05	19 36 49.73	28 19.65	0.18	28 19.740

Cimarron east of Ogden .... $0^h\ 28^m\ 19^s.707 \pm 0^s.014$.

Or, $7^\circ\ 04'\ 55''.60 \pm 0''.21$.

Observations and computations for latitude.

CIMARRON, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 31	6940	5 86.0	20.3	24.6	S. W. wind.	36 29 11.7	+ 0 56.6	+2.9	36 30 11.2
	6943	10 42.9	20.5	24.0		26 17.3	+ 3 52.7	+3.1	13.1
	6962	4 39.2	31.0	14.0					
	6997	0 51.0	29.8	15.0					
	7006	16 52.0	9.0	35.8		40 28.4	−10 17.0	−2.8	08.6
	7065	7 27.0	29.6	15.8					
	7098	9 54.1	27.3	17.8		31 33.0	− 1 27.5	+5.4	10.9
	7137	10 21.0	26.8	18.9					
	7176	6 81.0	32.0	13.3		27 53.7	+ 2 11.1	+6.2	11.0
	7200	13 40.3	20.3	25.2					
	7215	4 09.9	30.0	15.7		24 10.4	+ 5 58.7	+2.2	11.3
	7233	13 42.0	21.2	24.6					
	7256	2 94.0	9.3	37.0		36 59.4	− 6 44.0	−7.2	08.2
	7333	10 87.5	27.0	20.3		34 18.5	− 4 09.3	+2.6	11.8
	7368	4 41.0	25.7	21.3					
	7402	10 41.1	22.8	23.5		34 01.4	− 3 51.4	+0.9	10.9
	7455	13 50.0	31.3	15.0					
	7461	2 74.5	11.8	35.3		37 06.3	− 6 53.6	−1.7	11.0
	7520	7 05.3	27.9	18.3					
	7555	9 54.9	18.0	28.0		31 46.2	− 1 36.2	−0.1	09.9
	7606	15 71.0	18.0	28.0					
	7643	2 52.9	37.0	8.7		21 40.4	+ 8 28.2	+4.2	12.8
	7742	8 33.9	23.2	23.0					
	7749	8 49.8	31.0	15.3		30 13.6	− 0 06.5	+3.7	10.8
	7833	8 67.1	33.9	13.7					
	7837	7 57.5	10.4	36.9		29 27.4	+ 0 42.2	−1.5	08.1
	7857	14 80.9	20.3	26.8					
	7884	2 38.1	17.3	30.7		38 10.5	− 7 59.0	−1.6	09.9
	7902	10 29.9	20.8	26.8					
	7908	5 47.1	17.3	30.7		33 19.3	− 3 06.2	−4.5	08.6
	7958	11 24.3	26.8	21.0					
	7995	11 27.1	28.2	19.0		30 08.2	− 0 01.1	+3.5	10.6
	8020	10 96.5	26.0	21.3					
	8048	4 24.5	29.8	17.8		25 46.1	+ 4 19.2	+3.9	09.2
	8058	12 84.0	21.3	26.0					
	8091	8 42.1	33.0	14.9		32 57.6	− 2 50.3	+3.1	10.4
	8097	0 13.0	33.9	14.0		38 14.5	− 8 10.0	+3.5	08.0
	8128	12 06.1	29.0	18.4					
	8156	1 51.9	9.0	39.0		37 01.1	− 6 46.4	−4.5	10.2
	8159	8 35.3	9.0	39.0		36 32 39.4	− 2 22.9	−4.5	36 30 12.0

Observations and computations—Continued.

CIMARRON, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
August 31	8171	5 13.2	24.0	23.5					
	8206	12 14.8	28.5	19.2		36 25 39.6	+ 4 30.5	+2.3	36 30 12.4
September 4..	6895	8 62.6	15.0	27.0	No wind.				
	6912	8 23.7	28.0	14.5		30 24.2	− 0 15.0	+0.3	09.5
	6940	5 09.8	27.0	14.8		29 12.4	+ 0 57.1	−0.4	09.1
	6943	9 65.0	27.8	14.0		26 18.1	+ 3 52.5	−0.1	10.5
	6962	3 61.7	13.9	28.0					
	7065	6 35.9	21.3	20.8					
	7098	8 56.0	22.3	19.7		31 33.7	− 1 21.8	+0.7	09.6
	7137	9 32.0	21.5	20.1					
	7176	5 87.0	24.0	18.5		27 54.6	+ 2 13.0	+1.8	09.4
	7200	12 00.3	34.4	7.8					
	7215	2 66.3	6.5	35.7		24 11.3	+ 6 00.1	−0.6	10.8
	7233	13 87.2	22.7	19.0					
	7256	3 22.8	17.9	24.0		37 00.3	− 6 50.3	−0.5	09.5
	7333	10 17.9	11.8	31.0		34 19.5	− 4 09.8	+0.1	09.8
	7368	3 70.0	31.7	12.0					
	7402	9 73.2	10.0	34.0		34 02.4	− 3 52.5	−1.0	08.9
	7455	13 18.0	34.2	9.8					
	7461	2 34.2	10.0	34.0		37 07.2	− 6 57.8	+0.1	09.5
	7520	5 64.7	26.2	17.8					
	7555	8 15.9	17.3	27.0		31 47.2	− 1 36.8	−0.3	10.1
	7606	14 23.7	13.8	30.2					
	7643	1 11.0	37.0	7.6		21 41.3	+ 8 26.1	+3.0	10.4
	7676	16 75.1	13.2	31.0					
	7712	− 0 42.8	32.9	11.7		41 11.0	−11 02.2	+0.8	09.6
	7742	7 18.1	16.0	28.3					
	7749	7 37.0	33.6	10.8		30 14.7	− 0 07.3	+2.4	09.8
	7857	14 15.1	26.0	18.9					
	7884	1 69.0	17.0	28.4		38 11.4	− 8 00.3	−1.0	10.1
	7902	9 97.7	33.2	11.8					
	7908	5 01.5	14.8	30.3		33 20.3	− 3 11.2	+1.4	10.5
	7958	10 21.0	33.0	12.3					
	7995	10 23.5	12.9	32.8		30 09.3	− 0 01.0	+0.2	08.5
	8020	10 46.6	17.9	27.3					
	8048	3 73.8	33.3	12.0		25 47.1	+ 4 19.4	+2.8	09.3
	8058	11 97.0	30.3	14.7					
	8091	7 59.2	16.0	29.7		32 58.8	− 2 48.7	+0.4	10.5
	8097	− 0 67.0	16.9	29.0		36 38 15.6	− 8 07.3	+0.8	36 30 09.1

Observations and computations—Continued.

CIMARRON, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1874.		*t.* *d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
September 4..	8128	11 56.0	34.8	10.3					
	8156	0 84.9	11.5	34.3		36 37 02.1	− 6 52.0	+0.4	36 30 10.5
	8159	7 67.0	11.4	34.3		32 40.6	− 2 29.9	+0.4	11.1
	8171	2 71.6	17.1	28.2					
	8206	9 67.0	32.4	13.6		25 40.7	+ 4 28.1	+1.8	10.6
September 5..	6895	8 44.2	22.7	15.0					
	6912	8 09.5	14.0	23.5		30 24.3	− 0 13.4	−0.4	10.5
	6940	5 19.2	39.8	......		29 12.6	+ 1 01.7	−2.9	11.4
	6943	9 69.1	40.0	......		26 18.3	+ 3 55.1	−2.8	10.6
	6962	3 59.1	......	46.0					
	7065	6 82.2	9.8	27.0					
	7098	9 07.3	34.3	2.3		31 34.0	− 1 26.8	+3.4	10.6
	7137	9 56.0	15.9	20.7					
	7176	6 19.6	32.8	4.0		27 54.7	+ 2 09.7	+5.6	10.0
	7200	12 35.8	21.0	15.7					
	7215	3 08.0	17.0	19.5		24 11.4	+ 5 57.7	+0.6	09.7
	7233	12 18.6	27.9	8.2					
	7256	1 53.9	4.0	32.3		37 00.5	− 6 50.4	−2.0	08.1
	7333	10 24.2	......	38.3		34 19.8	− 4 08.2	−2.7	08.9
	7368	3 80.4	32.4	5.4					
	7402	9 82.6	2.5	36.7		34 02.6	− 3 52.2	−1.6	08.8
	7455	13 79.0	9.0	28.7					
	7461	2 97.0	24.0	14.0		37 07.5	− 6 57.1	−2.2	08.2
	7520	5 81.2	11.2	27.0					
	7555	8 40.1	32.0	7.0		31 47.4	− 1 39.8	+2.1	09.7
	7606	12 95.4	3.7	35.7					
	7643	− 0 22.0	38.6	0.7		21 41.6	+ 8 27.8	+1.4	10.8
	7676	17 07.9	18.2	21.0					
	7712	− 0 08.1	18.0	21.2		41 11.2	−11 01.5	−1.4	08.3
	7742	7 04.2	34.3	4.7					
	7749	7 19.4	5.0	34.0		30 14.9	− 0 05.8	+0.1	09.2
	7833	8 73.2	20.3	20.0					
	7837	7 77.1	26.3	14.4		29 28.6	+ 0 37.0	+2.8	08.4
	7857	14 78.8	7.6	32.0					
	7884	2 30.1	32.0	7.8		38 11.6	− 8 01.3	0.0	10.3
	7902	8 98.9	19.0	20.3					
	7908	4 08.0	16.0	24.0		33 20.5	− 3 09.2	−2.1	09.2
	7958	9 65.0	17.9	22.2					
	7995	9 69.9	25.3	15.2		36 30 09.5	− 0 01.9	+1.3	36 30 08.9

Observations and computations—Continued.

CIMARRON, NEW MEXICO.

Date.	No. of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1874.		*t. d.*	*d.*	*d.*		° ′ ″	′ ″	″	° ′ ″
September 5..	8020	10 70.1	18.7	21.2					
	8048	3 94.2	25.3	15.0		36 25 47.4	+ 4 20.6	+1.8	36 30 09.8
	8058	12 88.6	31.0	9.0					
	8091	8 52.2	9.0	32.0		32 59.0	— 2 48.2	—0.2	10.6
	8128	11 61.1	19.6	20.8					
	8156	0 91.2	21.0	20.0		37 02.4	— 6 52.4	0.0	10.0
	8159	7 73.1	28.8	20.0		32 40.9	— 2 29.5	—0.1	11.3
	8171	3 50.3	15.1	24.7					
	8206	10 52.5	21.2	18.9		36 25 41.0	+ 4 30.7	—1.7	36 30 10.0

ASTRONOMICAL CO-ORDINATES OF CIMARRON, NEW MEXICO.

Longitude....$6^h\ 59^m\ 39^s.936 \pm 0^s.014$ or $104° 54' 59''.04 \pm 0''.21$ west from Greenwich.
Longitude....$1^h\ 51^m\ 27^s.815 \pm 0^s.014$ or $27° 51' 57''.24 \pm 0''.20$ west from U. S. Naval Observatory, Washington, D. C.

Latitude ..... $36° 30' 10''.01 \pm 0''.09$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN.
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF SIDNEY BARRACKS, NEBRASKA.

SEASON OF 1874.

COMPUTATIONS BY

Dr. F. KAMPF.

SIDNEY BARRACKS, NEBR.

GEOGRAPHICAL POSITION OF STATION.

Longitude, ... 102° 58′ 13″.32 ± 0″.45 west from Greenwich.
Latitude, ... 41° 08′ 36″.75 ± 0″.05 north.
Barometric altitude of observatory above sea-level (from railroad surveys), 4,073.0 feet.

The astronomical station was located in the parade-ground of the military post. Two thousand feet from the barracks is the railway-station of Sidney, a town of about five hundred inhabitants. It is traversed by the Union Pacific Railroad, and has an east and west extension along that line. The surrounding country is a prairie, very nearly level. Only in the northwest is the plain broken by hills, and these are few in number and inconsiderable in height, not rising above 500 feet. South of the station, two miles away, is the Platte River.

METEOROLOGICAL CONDITIONS.

With the exception of one night, on which a heavy wind made it impossible to accomplish satisfactory work, the weather was very favorable during the entire time of observations at this point. The temperature was low in the night-time, being generally below 40° F. at 2 o'clock a. m.

OBSERVATORY.—INSTRUMENTS.—INSTRUMENTAL VALUES.

These were the same as at Las Vegas, in the report upon which station they are described and discussed in full.

The line of the Western Union Telegraph Company was used. The length of circuit to Ogden, the connected station, was about 600 miles. In the transmission of signals the local battery in the office at Sidney was employed, and this was assisted by a repeater at Cheyenne.

Thanks are due to General Morrow, in command of the post, for his assistance in constructing the tent and station, and for his ready co-operation during the whole time of observations.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

Dr. F. Kampf was the observer at Sidney, and Mr. John H. Clark at Ogden, the connected station. All observations for time and the exchange of signals were made by sound. Transmission of signals took place September 23, 24, 25, 26, and 27; observations for latitude were made September 24, 26, and 27. All computations were made by Dr. Kampf in the office.

Tabulation of stars used for determination of time at Sidney Barracks, Nebraska, and Ogden, Utah, 1874.

Name of star.	SIDNEY BARRACKS.					OGDEN.				
	September 23.	September 24.	September 25.	September 26.	September 27.	September 23.	September 24.	September 25.	September 26.	September 27.
μ Herculis	..	..	..	..	..	×	..	..	..	..
γ Draconis	..	..	..	..	..	×	..	..	..	..
γ^2 Sagittarii	..	..	..	..	..	×	..	..	..	..
μ^1 Sagittarii	..	..	..	..	..	×	..	..	..	..
η Serpentis	..	..	..	..	..	×	..	..	..	..
109 Herculis	..	..	..	..	..	×	..	..	..	..
a Lyræ	..	..	..	..	..	×	..	..	×	..
β Lyræ	..	..	..	..	..	×	×	..	×	..
50 Draconis	..	..	..	..	..	×	×	×	×	×
ε Aquilæ	..	×	..	..	..	..	..	..	..	..
ζ Aquilæ	..	×	..	..	..	×	×	×	×	×
d Sagittarii	..	..	..	..	..	..	×	×	×	×
δ Draconis	×	×	..	×	×	×	×	×	×	×
τ Draconis	×	×	..	×	×	×	×	×	×	×
β Cygni	×	×	×	×	×	..	×	×	×	×
κ Aquilæ	×	..	×	×	×	..	×	×	×	×
θ Cygni	..	..	×	..	×	..	..	..	..	..
γ Aquilæ	×	×	×	..	×	..	×	×	×	×
a Aquilæ	×	×	×	×	×	..	×	×	×	×
ε Draconis	×	×	×	×	×	..	×	×	×	×
γ Sagittarii	..	..	.	..	..	..	..	..	..	×
ψ Cygni	×	..	..	×	..	..	..	..	..	..
τ Aquilæ	..	×	×	×	×	..	..	..	..	×
3 Ursæ Majoris, L. C	..	..	..	..	..	..	..	..	..	×
θ Aquilæ	..	..	×	×	×	..	..	..	..	..
31 o^1 Cygni	..	..	×	×	×	..	..	..	..	..
κ Cephei	..	..	×	×	×	..	..	..	..	..

Name of star.	SIDNEY BARRACKS.					OGDEN.				
	September 23.	September 24.	September 25.	September 26.	September 27.	September 23.	September 24.	September 25.	September 26.	September 27.
γ Cygni	..	..	×	..	..	..	..	..	..	..
Groombr. 3241	..	..	..	..	..	×	..	×	×	×
a Delphini	..	..	..	..	..	..	..	×	×	×
a Cygni	..	..	..	..	..	×	..	×	×	×
ε Aquarii	..	..	..	..	..	..	..	..	×	×
μ Aquarii	..	..	..	..	..	×	..	×	×	×
ν Cygni	..	..	..	..	..	×	..	..	×	×
σ^2 Ursæ Majoris, L. C	..	..	..	..	..	..	..	..	..	×
61 Cygni	..	..	..	..	..	×	..	×	×	×
ζ Cygni	..	..	..	..	..	×	..	×	×	×
τ Cygni	..	..	..	..	..	..	..	×	×	..
a Cephei	..	..	..	..	..	×	..	×	..	..
d Ursæ Majoris, L. C	..	..	..	..	..	..	..	×	..	..
β Aquarii	..	..	..	..	..	×	..	..	..	..
β Cephei	..	..	..	..	..	×	..	..	..	..
ξ Aquarii	..	..	..	..	..	×	..	..	..	..
θ Aquarii	×	..	..	..	..	..	..	..	..	..
γ Aquarii	×	..	..	..	..	..	..	..	..	..
π Aquarii	×	..	..	..	..	..	..	..	..	..
δ Cephei	×	..	..	..	..	..	..	..	..	..
226 Cephei	×	..	..	..	..	..	..	..	..	..
ι Cephei	×	..	..	..	..	..	..	..	..	..
o Andromedæ	×	..	..	..	..	..	..	..	..	..
a Pegasi	×	..	..	..	..	..	..	..	..	..
o Cephei	×	..	..	..	..	..	..	..	..	..
θ Piscium	×	..	..	..	..	..	..	..	..	..

Observations and reductions for time taken at sending station.

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 23, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	δ Draconis	19 11 05.04	+10.91	+ 0.61	− 2.20	19 11 14.36	19 12 31.80	+ 1 17.44
E.	τ Draconis	16 25.38	+17.26	+ 0.87	− 2.90	16 40.61	17 57.92	17.31
E.	β Cygni....	24 25.93	− 2.47	+ 0.30	− 0.95	24 22.81	25 40.19	17.38
E.	κ Aquilæ..........	28 59.60	− 7.11	+ 0.12	− 0.85	28 51.76	30 09.02	17.26
W.	γ Aquilæ..........	39 04.90	− 4.93	+ 0.10	+ 0.86	39 00.93	40 18.24	17.31
W.	α Aquilæ..........	43 27.14	− 5.12	+ 0.06	+ 0.85	43 22.93	44 40.27	17.34
W.	ε Draconis	47 02.94	+13.37	+ 0.05	+ 2.46	47 18.82	48 36.06	17.24
W.	ψ Cygni	19 51 01.86	+ 2.94	− 0.05	+ 1.38	19 51 06.13	19 52 23.75	+ 1 17.62
W.	θ Aquarii	22 09 01.24	− 5.41	+ 0.04	+ 0.94	22 09 56.81	22 11 14.01	+ 1 17.20
W.	γ Aquarii	13 58.38	− 4.77	+ 0.04	+ 0.93	13 54.58	15 11.71	17.13
W.	π Aquarii	17 39.88	− 4.56	+ 0.03	+ 0.92	17 36.27	18 53.36	17.09
W.	δ Cephei	23 09.68	+ 3.79	+ 0.05	+ 1.73	23 15.25	24 32.26	17.01
W.	226 Cephei	28 29.52	+15.94	+ 0.07	+ 3.73	28 49.26	30 06.42	17.16
E.	ι Cephei	43 52.77	+ 7.02	+ 0.18	− 2.23	43 57.74	45 14.73	16.99
E.	ο Andromedæ.....	54 54.10	+ 0.07	0.00	− 1.24	54 52.93	56 10.27	17.34
E.	α Pegasi	57 18.94	− 3.23	− 0.06	− 0.95	57 14.70	58 31.92	17.22
E.	ο Cephei	23 12 08.30	+ 8.07	− 0.28	− 2.41	23 12 13.68	23 13 30.82	17.14
E.	θ Piscium	23 20 25.62	− 4.07	− 0.03	− 0.93	23 20 20.59	23 21 37.49	+ 1 16.90

NORMAL EQUATIONS.

First series.

$$0 = +\ 7.80 + 8.00\,\delta t - 2.62\,a^1 + \ 1.61\,c \qquad a^1 = +\ 0^s.515$$
$$0 = -\ 9.67 - 2.62\,\delta t + 7.91\,a^1 - \ 4.65\,c \qquad c = -\ 0^s.844$$
$$0 = +\ 32.28 + 1.61\,\delta t - 4.65\,a^1 + 34.19\,c \qquad a = -\ 9^s.485$$

Adopted $a = -\ 10^s.00$

Second series.

$$0 = +\ 0.65 + 10.00\,\delta t - 1.83\,a^1 - \ 0.52\,c \qquad a^1 = +\ 0^s.182$$
$$0 = +\ 1.49 - \ 1.83\,\delta t + 9.78\,a^1 + \ 3.67\,c \qquad c = -\ 0^s.927$$
$$0 = +\ 35.67 - \ 0.52\,\delta t + 3.67\,a^1 + 39.11\,c \qquad a = -\ 7^s.018$$

Adopted $a = -\ 7^s.20$

Observations and reductions for time taken at sending station—Continued.

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 24, 1874.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	ε Aquilæ	18 52 47.69	− 7.68	− 0.10	− 0.95	18 52 38.96	18 53 56.02	+ 1 17.06
E.	ζ Aquilæ	58 30.83	− 7.85	− 0.15	− 0.95	58 21.91	59 38.87	16.96
E.	δ Draconis	19 10 58.32	+19.20	− 0.56	− 2.41	19 10 14.55	19 11 31.73	17.18
E.	τ Dracouis	16 14.31	+30.38	− 0.88	− 3.17	16 40.64	17 57.84	17.20
E.	β Cygni	24 28.68	− 4.34	− 0.41	− 1.04	24 22.89	25 40.17	17.28
W.	γ Aquilæ	39 09.20	− 8.68	− 0.36	+ 0.94	39 01.10	40 18.23	17.13
W.	α Aquilæ	43 31.55	− 9.02	− 0.37	+ 0.93	43 23.09	44 40.26	17.17
W.	ε Dracouis	46 53.80	+23.54	− 1.13	+ 2.69	46 18.90	47 36.00	17.10
W.	τ Aquilæ	19 56 52.87	− 9.52	− 0.37	+ 0.93	19 56 43.91	19 58 01.28	+ 1 17.37

NORMAL EQUATIONS.

$$0 = - \ 3.33 + 9.00\,\delta t - 1.56\,a^1 + \ 3.28\,c \qquad a^1 = + \ 0^s.306$$
$$0 = - \ 6\ 38 - 1.56\,\delta t + 8.00\,a^1 - \ 5.55\,c \qquad c = - \ 0^s.922$$
$$0 = + 30.23 + 3.28\,\delta t - 5.55\,a^1 + 33.65\,c \qquad a = - 16^s.694$$

Adopted $a = - 17^s.00$

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 25, 1874.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	β Cygni	19 24 23.80	+ 0.49	− 0.30	− 1.08	19 24 22.91	19 25 40.15	+ 1 17.24
E.	κ Aquilæ	28 51.52	+ 1.42	− 0.20	− 0.96	28 51.78	30 08.99	17.21
E.	θ Cygni	31 50.48	− 0.45	− 0.50	− 1.47	31 48.06	33 15.02	16.96
E.	γ Aquilæ	39 01.04	+ 0.98	− 0.33	− 0.97	39 01.04	40 18.21	17.17
E.	α Aquilæ	43 23.22	+ 1.02	− 0.36	− 0.96	43 22.92	44 40.24	17.32
E.	ε Draconis	47 25.40	− 2.66	− 1.18	− 2.78	47 18.78	48 35.94	17.16
W.	τ Aquilæ	56 42.12	+ 1.08	+ 0.07	+ 0.96	56 44.23	58 01.27	17.04
W.	θ Aquilæ	20 03 31.16	+ 1.26	+ 0.07	+ 0.95	20 03 33.44	20 04 50.55	17.11
W.	31 o^1 Cygni	08 23.26	− 0.24	+ 0.08	+ 1.38	08 24.48	09 41.48	17.00
W.	κ Cephei	11 49.40	− 5.08	+ 0.07	+ 4.34	11 48.73	13 05.91	17.18
W.	γ Cygni	20 16 25.62	+ 0.06	− 0.04	+ 1.24	20 16 26.88	20 17 44.21	+ 1 17.38

NORMAL EQUATIONS.

$$0 = + 10.85 + 11.00\,\delta t - \ 1.13\,a - \ 0.68\,c \qquad a = + 1^s.887$$
$$0 = - 13.86 - \ 1.13\,\delta t + 11.27\,a + \ 8.80\,c \qquad c = - 0^s.952$$
$$0 = + 22.68 - \ 0.68\,\delta t + \ 8.80\,a + 41.89\,c$$

Observations and reductions for time taken at sending station—Continued.

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 26, 1874.

Clamp.	Namo of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	δ Draconis	19 11 12.12	+ 0.13	— 0.14	+ 2.18	19 11 14.29	19 12 31.62	+ 1 17.33
W.	τ Draconis	16 37.53	+ 0.21	— 0.23	+ 2.88	16 40.39	17 57.69	17.30
W.	β Cygni	24 21.80	— 0.03	— 0.11	+ 0.95	24 22.61	25 40.13	17.52
W.	κ Aquilæ	28 51.02	— 0.09	— 0.09	+ 0.84	28 51.68	30 08.97	17.29
W.	α Aquilæ	43 22.08	— 0.06	— 0.13	+ 0.35	43 22.74	44 40.23	17.49
W.	ε Dracouis	47 16.34	+ 0.16	— 0.41	+ 2.44	47 18.53	48 35.88	17.35
E.	ψ Cygni	51 08.14	+ 0.04	— 0.11	— 1.36	51 06.71	52 23.66	16.95
E.	τ Aquilæ	56 45.01	— 0.07	— 0.16	— 0.85	56 43.93	58 01.25	17.32
E.	θ Aquilæ	20 03 34.28	— 0.08	— 0.22	— 0.84	20 03 33.14	20 04 50.54	17.40
E.	31 o¹ Cygni	08 25.98	+ 0.01	— 0.58	— 1.21	08 24.20	09 41.47	17.27
E.	κ Cephei	20 11 53.72	+ 0.31	— 1.88	— 3.82	20 11 48.33	20 13 05.82	+ 1 17.49

NORMAL EQUATIONS.

$$0 = - \ \ 4.05 + 11.00\,\delta t - \ \ 4.72\,a - \ \ 2.47\,c \qquad a = -\,0^s.115$$
$$0 = + \ \ 2.49 - \ \ 4.72\,\delta t + 15.67\,a + \ \ 0.07\,c \qquad c = -\,0^s.837$$
$$0 = + 48.93 - \ \ 2.47\,\delta t + \ \ 0.07\,a + 58.06\,c$$

SIDNEY BARRACKS, NEBRASKA, SEPTEMBER 27, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	δ Draconis	19 11 19.36	— 0.87	— 0.70	— 2.48	19 11 15.31	19 12 31.56	+ 1 16.25
E.	τ Draconis	16 47.00	— 1.37	— 0.89	— 3.27	16 41.47	17 57.61	16.14
E.	β Cygni	24 25.03	+ 0.20	— 0.43	— 1.08	24 23.72	25 40.11	16.39
E.	κ Aquilæ	28 53.36	+ 0.56	— 0.25	— 0.96	28 52.71	30 08.96	16.25
E.	θ Cygni	31 51.06	— 0.18	— 0.52	— 1.47	31 48.89	33 04.96	16.07
E.	γ Aquilæ	39 02.62	+ 0.39	— 0.29	— 0.97	39 01.75	40 18.18	16.43
W.	α Aquilæ	43 22.82	+ 0.41	— 0.21	+ 0.96	43 23.98	44 40.21	16.23
W.	ε Draconis	47 18.52	— 1.06	— 0.64	+ 2.78	47 19.60	48 35.82	16.22
W.	τ Aquilæ	56 43.99	+ 0.43	— 0.22	+ 0.96	56 45.16	58 01.24	16.08
W.	θ Aquilæ	20 03 33.08	+ 0.51	— 0.20	+ 0.95	20 03 34.34	20 04 50.53	16.19
W.	31 o¹ Cygni	08 24.50	— 0.10	— 0.42	+ 1.38	08 25.36	09 41.44	16.08
W.	κ Cephei	20 11 48.23	— 2.03	— 1.14	+ 4.34	20 11 49.40	20 13 05.71	+ 1 16.31

NORMAL EQUATIONS.

$$0 = + 10.13 + 12.00\,\delta t - \ \ 4.13\,a - \ \ 1.19\,c \qquad a = +\,0^s.754$$
$$0 = - \ \ 8.38 - \ \ 4.13\,\delta t + 15.90\,a + \ \ 6.74\,c \qquad c = -\,0^s.952$$
$$0 = + 50.14 - \ \ 1.19\,\delta t + \ \ 6.74\,a + 58.84\,c$$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, SEPTEMBER 23, 1874.

Clamp.		Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
			h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	μ	Herculis	17 46 54.50	+ 0.40	— 0.02	+ 0.03	17 46 54.91	17 41 32.88	— 5 22.03
W.	γ	Draconis	59 04.08	— 0.43	— 0.08	+ 0.04	59 03.61	53 41.70	21.91
W.	γ^2	Sagittarii	18 03 05.28	+ 1.69	— 0.03	+ 0.03	18 03 06.97	57 45.03	21.94
W.	μ^1	Sagittarii	11 36.45	+ 1.46	— 0.06	+ 0.02	11 37.87	18 06 15.75	22.12
W.	η	Serpentis	20 10.37	+ 1.06	— 0.10	+ 0.02	20 11.35	14 49.17	22.18
W.	109	Herculis	23 42.86	+ 0.55	— 0.17	+ 0.03	23 43.27	18 21.25	22.02
E.	α	Lyræ	38 03.92	+ 0.09	— 0.22	— 0.03	38 03.76	32 41.63	22.13
E.	β	Lyræ	50 49.15	+ 0.26	— 0.24	— 0.03	50 49.14	45 27.13	22.01
E.	50	Draconis	55 51.45	— 3.37	— 0.72	— 0.10	55 57.26	50 24.96	22.30
E.	ζ	Aquilæ	19 05 00.49	+ 0.73	— 0.22	— 0.02	19 05 00.98	59 38.89	22.09
E.	δ	Draconis	17 56.27	— 1.76	— 0.59	— 0.07	17 53.85	19 12 31.79	22.06
E.	τ	Draconis	19 23 23.54	— 2.79	— 0.79	— 0.09	19 23 19.87	19 17 57.92	— 5 21.95
E.		Groombr. 3241	20 35 58.78	— 2.66	+ 0.14	— 0.46	20 35 55.80	20 30 33.32	— 5 22.48
E.	α	Cygni	42 32.59	— 0.16	+ 0.07	— 0.20	42 32.30	37 10.09	22.21
E.	μ	Aquarii	51 15.04	+ 1.26	+ 0.02	— 0.14	51 16.18	45 54.07	22.11
E.	ν	Cygni	57 52.95	+ 0.02	+ 0.03	— 0.18	57 52.82	52 30.62	22.20
E.	61	Cygni	21 05 39.58	+ 0.11	+ 0.01	— 0.18	21 06 39.52	21 01 17.42	22.10
W.	ζ	Cygni	12 58.61	+ 0.36	— 0.23	+ 0.16	12 58.90	07 36.68	22.22
W.	α	Cephei	20 59.83	— 1.21	— 0.40	+ 0.30	20 58.52	15 36.25	22.27
W.	β	Aquarii	30 19.66	+ 1.18	— 0.13	+ 0.14	30 20.85	24 58.31	22.54
W.	β	Cephei	32 28.03	— 2.24	— 0.43	+ 0.41	32 25.77	27 03.60	22.17
W.	ξ	Aquarii	21 36 26.69	+ 1.22	— 0.11	+ 0.14	21 36 27.94	21 31 05.45	— 5 22.49

NORMAL EQUATIONS.

First series.

$$0 = + 1.82 + 12.00\,\delta t - 1.38\,a + 6.50\,c \qquad a = +1^s.532$$
$$0 = -20.18 - 1.38\,\delta t + 12.60\,a - 20.34\,c \qquad c = -0^s.027$$
$$0 = +33.00 + 6.50\,\delta t - 20.34\,a + 46.79\,c$$

Second series.

$$0 = + 0.92 + 10.00\,\delta t - 1.33\,a + 0.04\,c \qquad a = +1^s.590$$
$$0 = -11.35 - 1.33\,\delta t + 7.18\,a - 0.73\,c \qquad c = -0^s.140$$
$$0 = + 5.83 + 0.04\,\delta t - 0.73\,a + 33.39\,c$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, SEPTEMBER 24, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	β Lyræ	18 50 50.47	+ 0.27	− 0.09	+ 0.11	18 50 50.76	18 45 27.11	− 5 23.65
W.	50 Draconis	55 52.10	− 3.54	− 0.26	+ 0.35	55 48.65	50 24.87	23.78
W.	ζ Aquilæ	19 05 01.83	+ 0.77	− 0.08	+ 0.09	19 05 02.61	59 38.87	23.74
W.	d Sagittarii	15 40.38	+ 1.48	− 0.05	+ 0.10	15 41.91	19 10 18.12	23.79
W.	δ Draconis	17 57.33	− 1.85	− 0.21	+ 0.24	17 55.51	12 31.74	23.77
W.	τ Draconis	23 24.35	− 2.93	− 0.26	+ 0.31	23 21.47	17 57.85	23.62
E.	β Cygni	31 03.44	+ 0.43	− 0.06	− 0.10	31 03.71	25 40.17	23.54
E.	κ Aquilæ	35 31.77	+ 1.22	− 0.03	− 0.09	35 32.87	30 09.00	23.87
E.	γ Aquilæ	45 41.25	+ 0.84	− 0.05	− 0.09	45 41.95	40 18.23	23.72
E.	α Aquilæ	50 03.18	+ 0.87	− 0.05	− 0.09	50 03.91	44 40.26	23.65
E.	ε Draconis	19 54 02.47	− 2.25	− 0.15	− 0.26	19 54 59.81	19 49 36.01	− 5 23.80

NORMAL EQUATIONS.

$$0 = + 6.55 + 11.00\,\delta t - 2.91\,a - 6.18\,c \qquad a = + 1^s.609$$
$$0 = - 21.50 - 2.91\,\delta t + 13.76\,a + 14.28\,c \qquad c = - 0^s.090$$
$$0 = - 19.79 - 6.18\,\delta t + 14.28\,a + 50.73\,c$$

OGDEN, UTAH, SEPTEMBER 25, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	50 Draconis	18 55 53.19	− 3.20	− 0.13	+ 0.30	18 55 50.16	18 50 24.77	− 5 25.39
W.	ζ Aquilæ	19 05 03.33	+ 0.70	− 0.06	+ 0.08	19 05 04.05	59 38.86	25.19
W.	d Sagittarii	15 42.01	+ 1.34	− 0.05	+ 0.08	15 43.38	19 10 18.10	25.28
W.	δ Draconis	17 58.53	− 1.67	− 0.33	+ 0.19	17 56.72	12 31.68	25.04
W.	τ Draconis	23 25.52	− 2.64	− 0.52	+ 0.26	23 22.62	17 57.77	24.85
E.	β Cygni	31 04.90	+ 0.39	− 0.05	− 0.08	31 05.16	25 40.15	25.01
E.	κ Aquilæ	35 33.13	+ 1.10	− 0.04	− 0.07	35 34.12	30 08.99	25.13
E.	γ Aquilæ	45 42.70	+ 0.76	− 0.07	− 0.08	45 43.31	40 18.21	25.10
E.	α Aquilæ	50 04.68	+ 0.78	− 0.07	− 0.07	50 05.32	44 40.24	25.08
E.	ε Draconis	19 54 03.68	− 2.03	− 0.26	− 0.22	19 54 01.17	19 48 35.94	− 5 25.23
E.	Groombr. 3241	20 36 01.35	− 2.49	− 0.08	− 0.83	20 36 57.95	21 31 33.19	− 5 24.76
E.	α Delphini	39 14.11	+ 0.67	− 0.04	− 0.27	39 14.47	33 49.42	25.05
E.	α Cygni	42 35.51	− 0.15	− 0.06	− 0.36	42 34.94	37 10.05	24.89
E.	μ Aquarii	51 18.39	+ 1.18	− 0.03	− 0.26	51 19.28	45 54.04	25.24
W.	61 Cygni	21 06 42.51	+ 0.10	− 0.26	+ 0.32	21 06 42.67	21 01 17.39	25.28
W.	ζ Cygni	13 01.62	+ 0.34	− 0.24	+ 0.29	13 02.01	07 36.65	25.36
W.	τ Cygni	15 13.01	+ 0.10	− 0.26	+ 0.32	15 13.17	09 47.87	25.30
W.	α Cephei	21 02.73	− 1.13	− 0.44	+ 0.54	21 01.70	15 36.18	25.52
W.	d Ursæ Maj. L. C	21 28 41.27	+ 4.13	+ 0.24	− 0.75	21 28 44.89	21 23 19.89	− 5 25.00

NORMAL EQUATIONS.

First series.

$$0 = + 5.38 + 10.00\,\delta t - 3.08\,a - 4.98\,c \qquad a = + 1^s.453$$
$$0 = - 19.25 - 3.08\,\delta t + 13.73\,a + 14.52\,c \qquad c = - 0^s.075$$
$$0 = - 18.03 - 4.98\,\delta t + 14.52\,a + 49.29\,c$$

Second series.

$$0 = - 2.15 + 9.00\,\delta t + 1.85\,a + 3.89\,c \qquad a = + 1^s.491$$
$$0 = - 16.54 + 1.85\,\delta t + 11.92\,a + 5.13\,c \qquad c = - 0^s.255$$
$$0 = + 0.51 + 3.89\,\delta t + 51.13\,a + 32.61\,c$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, SEPTEMBER 26, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Lyræ	18 38 08.45	+ 0.10	— 0.09	+ 0.13	18 38 08.59	18 32 41.55	— 5 27.04
W.	β Lyræ	50 53.93	+ 0.29	— 0.09	+ 0.12	50 54.25	45 27.06	27.19
W.	50 Draconis	54 55.42	— 3.69	— 0.29	+ 0.39	54 51.83	49 24.68	27.15
W.	ζ Aquilæ	19 05 05.27	+ 0.81	— 0.08	+ 0.10	19 05 06.10	59 38.84	27.26
E.	d Sagittarii	15 43.81	+ 1.54	+ 0.01	— 0.11	15 45.25	19 10 18.09	27.16
E.	δ Draconis	18 00.91	— 1.93	+ 0.02	— 0.26	18 58.74	13 31.62	27.12
E.	τ Draconis	23 28.31	— 3.05	0.00	— 0.34	23 24.92	17 57.69	27.23
E.	β Cygni	31 06.82	+ 0.45	— 0.02	— 0.11	31 07.14	25 40.13	27.01
E.	κ Aquilæ	35 35.04	+ 1.28	— 0.03	— 0.10	35 36.19	30 08.98	27.21
E.	γ Aquilæ	45 44 63	+ 0.87	— 0.05	— 0.11	45 45.34	40 18.20	27.14
E.	α Aquilæ	50 06.61	+ 0.90	— 0.06	— 0.10	50 07.35	44 40.22	27.13
E.	ε Draconis	19 54 05.92	— 2.35	— 0.28	— 0.29	19 54 03.00	19 48 35.88	— 5 27.12
E.	Groombr. 3241	20 36 02.75	— 1.74	— 0.31	— 0.30	20 36 00.40	20 30 33.13	— 5 27.27
E.	α Delphini	39 16.23	+ 0.47	— 0.15	— 0.09	39 16.46	33 49.40	27.06
E.	α Cygni	42 37.46	— 0.10	— 0.21	— 0.13	42 37.02	37 10.02	27.00
E.	ε Aquarii	46 20.53	+ 0.82	— 0.10	— 0.09	46 21.16	40 53.91	27.25
E.	μ Aquarii	51 20.72	+ 0.82	— 0.10	— 0.09	51 21.35	45 54.03	27.32
W.	ν Cygni	57 57.79	+ 0.01	— 0.12	+ 0.12	57 57.80	52 30.53	27.27
W.	61 Cygni	21 06 44.57	+ 0.07	— 0.18	+ 0.12	21 06 44.58	21 01 17.38	27.20
W.	ζ Cygni	13 03.72	+ 0.24	— 0.19	+ 0.10	13 03.87	07 36.63	27.24
W.	τ Cygni	21 15 14.95	+ 0.07	— 0.21	+ 0.11	21 15 14.92	21 09 47.85	— 5 27.07

NORMAL EQUATIONS.

First series.

$$0 = +\ 7.22 + 12.00\,\delta t - 2.85\,a + 6.75\,c \qquad a = +1^s.678$$
$$0 = -23.74 - 2.85\,\delta t + 13.76\,a - 2.32\,c \qquad c = -0^s.100$$
$$0 = +10.12 + 6.75\,\delta t - 2.32\,a + 52.39\,c$$

Second series.

$$0 = -0.53 + 9.00\,\delta t + 0.64\,a + 2.74\,c \qquad a = +1^s.050$$
$$0 = -4.87 + 0.64\,\delta t + 4.29\,a - 3.94\,c \qquad c = -0^s.091$$
$$0 = +6.10 + 2.74\,\delta t - 3.94\,a + 21.97\,c$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, SEPTEMBER 27, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	50 Draconis	18 55 56.02	− 2.84	0.00	+ 0.41	18 55 53.59	18 50 24.58	− 5 29.01
W.	ζ Aquilæ	19 05 07.02	+ 0.62	0.00	+ 0.11	19 05 07.75	59 38.82	28.93
W.	d Sagittarii	15 45.71	+ 1.19	− 0.01	+ 0.11	15 47.00	19 10 18.07	28.93
W.	δ Draconis	18 01.49	− 1.49	− 0.04	+ 0.27	18 00.23	12 31.56	28.67
W.	τ Draconis	23 28.39	− 2.35	− 0.08	+ 0.36	23 26.32	17 57.60	28.72
E.	β Cygni	31 08.52	+ 0.35	+ 0.08	− 0.12	31 08.83	25 40.11	28.72
E.	κ Aquilæ	35 36.99	+ 0.98	+ 0.04	− 0.11	35 37.90	30 08.96	28.94
E.	γ Aquilæ	45 46.40	+ 0.67	+ 0.06	− 0.11	45 47.02	40 18.18	28.84
E.	α Aquilæ	50 08.36	+ 0.70	+ 0.06	− 0.10	50 09.02	44 40.21	28.81
E.	ε Draconis	54 06.72	− 1.81	+ 0.20	− 0.31	54 04.80	48 35.82	28.98
E.	γ Sagittarii	58 39.44	+ 0.52	+ 0.08	− 0.11	58 39.93	53 11.21	28.72
E.	τ Aquilæ	20 03 29.36	+ 0.73	+ 0.07	− 0.10	20 03 30.06	58 01.24	28.82
E.	3 Ursæ Maj. L. C ..	20 05 43.00	+ 3.36	− 0.09	+ 0.29	20 05 46.56	20 00 17.70	− 5 28.86
E.	Groombr. 3241 ...	20 37 04.27	− 1.98	+ 0.11	− 0.38	20 37 02.02	20 31 33.06	− 5 28.96
E.	α Delphini	39 17.62	+ 0.53	+ 0.04	− 0.12	39 18 07	33 49.39	28.68
E.	α Cygni	42 38.98	− 0.12	+ 0.06	− 0.16	42 38 76	37 10.00	28.76
E.	ε Aquarii	46 21.80	+ 0.94	+ 0.02	− 0.12	46 22.64	40 53.90	28.74
E.	μ Aquarii	51 22.12	+ 0.94	+ 0.02	− 0.12	51 22.96	45 54.02	28.94
W.	ν Cygni	57 59.13	+ 0.01	+ 0.09	+ 0.15	57 59.38	52 30.51	28.87
W.	σ² Ursæ Maj. L. C ..	21 04 45.06	+ 2.96	− 0.06	− 0.31	21 04 47.65	59 18.67	28.98
W.	61 Cygni	06 45.98	+ 0.08	+ 0.09	+ 0.15	06 46.30	21 01 17.36	28.94
W.	ζ Cygni	21 13 05.08	+ 0.27	+ 0.08	+ 0.13	21 13 05.56	21 07 36.62	− 5 28.94

NORMAL EQUATIONS.

First series.

$$0 = + 1.93 + 13.00\,\delta t + 0.49\,a - 5.68\,c \qquad a = + 1^s.292$$
$$0 = - 26.12 + 0.49\,\delta t + 20.97\,a + 8.32\,c \qquad c = - 0^s.105$$
$$0 = - 5.79 - 5.68\,\delta t + 8.32\,a + 59.10\,c$$

Second series.

$$0 = - 2.24 + 9.00\,\delta t + 3.06\,a + 6.63\,c \qquad a = + 1^s.188$$
$$0 = - 11.93 + 3.06\,\delta t + 10.49\,a + 2.70\,c \qquad c = - 0^s.116$$
$$0 = + 0.42 + 6.63\,\delta t + 2.70\,a + 27.30\,c$$

The following tables show the corrections and rates of the chronometers used at Sidney Barracks and Ogden:

CHRONOMETER AT SIDNEY BARRACKS.—NEGUS, No. 1344.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1874.	*h.*	*h. m. s.*	*s.*
Sept. 23	21.15	+ 0 01 17.240	0.000
Sept. 24	19.43	17.160	0.000
Sept. 25	19.70	17.160	0.000
Sept. 26	19.70	17.340	+ 0.040
Sept. 27	19.70	+ 0 01 16.220	

CHRONOMETER AT OGDEN.—NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1874.	*h.*	*h.* *m.* *s.*	*s.*
Sept. 23	19.75	— 0 05 22.168	+ 0.065
Sept. 24	19.30	23.720	+ 0.059
Sept. 25	20.12	25.145	+ 0.084
Sept. 26	20.00	27.110	+ 0.070
Sept. 27	20.10	— 0 05 28.855	

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*	*m.* *s.*	*s.*	*m.* *s.*
September 23, 1874:							
Ogden	Sidney Barracks .	20 26 51.56	+0 01 17.25	20 28 08.81			
	Ogden	19 57 24.14	—0 05 22.17	19 52 01.97	36 06.84		
Sidney Barracks	Sidney Barracks .	20 30 50.11	+0 01 17.25	20 32 07.36			
	Ogden	20 01 22.72	—0 05 22.18	19 56 00.54	06.82	0.02	36 06.830
September 24, 1874:							
Ogden	Sidney Barracks	20 31 49.22	+0 01 17.16	20 33 06.38			
	Ogden	20 02 23.35	—0 05 23.76	19 56 59.59	06.79		
Sidney Barracks	Sidney Barracks .	20 35 30.03	+0 01 17.16	20 36 47.19			
	Ogden	20 06 04.21	—0 05 23.76	20 00 40.45	06.74	0.05	06.765
September 25, 1874:							
Ogden	Sidney Barracks .	20 46 16.97	+0 01 17.16	20 47 34.13			
	Ogden	20 16 52.36	—0 05 25.15	20 11 27.21	06.92		
Sidney Barracks	Sidney Barracks .	20 49 50.10	+0 01 17.16	20 51 07.26			
	Ogden	20 20 25.58	—0 05 25.15	20 15 00.43	06.83	0.09	06.875
September 26, 1874:							
Ogden	Sidney Barracks .	20 52 06.19	+0 01 17.34	20 53 23.53			
	Ogden	20 22 44.04	—0 05 27.19	20 17 16.85	06.68		
Sidney Barracks	Sidney Barracks .	20 56 00.21	+0 01 17.34	20 57 17.55			
	Ogden	20 26 38.14	—0 05 27.19	20 21 10.95	06.60	0.08	06.640
September 27, 1874:							
Ogden	Sidney Barracks .	20 41 41.03	+0 01 16.18	20 42 57.21			
	Ogden	20 12 19.36	—0 05 28.85	20 06 50.51	06.70		
Sidney Barracks	Sidney Barracks .	20 45 20.11	+0 01 16.18	20 46 36.29			
	Ogden	20 15 58.52	—0 05 28.86	20 10 29.66	36 06.63	0.07	36 06.665

Sidney Barracks east of Ogden.............................. $0^h\ 36^m\ 06^s.755 \pm 0^s.030$

Or, $9° 01' 41''.32 \pm 0''.45$

Observations and computations.

SIDNEY BARRACKS, NEBRASKA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
Sept. 24	7706	7 55.9	30.0	8.0	Heavy wind					
	7749	9 09.0	3.7	34.5	from south-west; cloudy.	41 09 37.6	− 0 59.0	−2.0	......	41 08 36.6
	7824	15 49.8	28.3	8.7	25ᵍ p.m.					
	7843	3 01.0	6.4	31.2		16 37.6	− 8 01.4	−1.2	+0.1	35.1
	7856	3 61.5	16.0	21.3						
	7902	14 52.0	18.0	20.0		15 38.0	− 7 00.4	−1.7	......	35.9
	7917	14 94.0	10.2	27.9						
	7932	4 21.0	24.0	14.0		01 43.5	+ 6 53.7	−1.8	......	35.4
	7962	10 23.6	25.0	12.3		05 34.2	+ 3 01.4	−1.1	......	34.5
	7972	8 69.8	16.0	22.0						
	7984	5 35.6	18.3	20.0		10 45.9	− 2 08.8	−1.8	......	35.3
	7994	−1 60.7	20.0	18.0						
	8023	12 55.1	9.0	29.0		17 44.2	− 9 05.8	−4.2	.....	34.2
	8106	12 65.0	21.5	17.0		08 16.3	+ 0 22.2	−4.3	......	34.2
	8173	2 84.9	21.3	17.8		02 00.2	+ 6 40.1	−4.5	......	35.6
	8182	13 22.5	8.0	31.0						
	8195	12 16.7	22.7	15.9						
	8223	12 03.9	6.6	32.3		08 36.5	+ 0 04.9	−4.4	......	37.0
	8237	7 54.1	6.0	33.1		05 43.8	+ 2 58.3	−4.7	......	37.4
	8268	6 95.9	15.8	23.5		12 02.6	− 3 22.3	−2.5	......	37.8
	8282	21 57.8	15.5	23.8		21 25.4	−12 45.8	−2.6	......	37.0
	8324	1 71.3	18.3	21.3						
	16	18 19.9	17.3	22.9	No wind now.					
	67	1 26.1	16.3	24.7	Clear.	19 32.5	−10 53.0	−3.2	......	36.3
	100	11 05.1	25.1	14.9		14 13.4	− 5 33.1	−4.2	......	36.1
	152	15 52.0	24.0	17.0		17 05.2	− 8 25.4	−5.0	......	34.8
	173	2 41.0	6.3	34.8						
	215	13 70.0	17.7	23.0						
	254	4 44.9	17.0	24.0		02 43.6	+ 5 56.7	−2.9	......	37.4
	283	13 46.9	22.4	18.8						
	337	3 99.0	7.3	34.0		02 37.3	+ 6 05.4	−5.4	......	37.3
	368	4 38.0	27.0	13.9						
	387	13 89.0	0.0	41.0		14 50.9	− 6 05.6	−6.5	......	37.8
	412	3 25.0	13.7	26.9		05 16.0	+ 3 28.3	−4.9	......	39.4
	444	16 76.0	12.2	28.0		13 55.4	− 5 12.3	−5.4	......	37.7
	453	8 65.5	16.0	24.0						
	487	17 67.5	33.0	6.9						
	516	2 86.6	1.0	39.0		18 11.8	− 9 30.9	−2.8	......	38.1
	540	6 61.1	21.0	19.2						
	576	14 64.2	9.3	31.8		41 03 31.8	+ 5 09.6	−4.8	......	41 08 36.6

Observations and computations—Continued.

SIDNEY BARRACKS, NEBRASKA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1874.		*t.* *d.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
Sept. 24	600	7 83.1	27.0	13.7						
	629	10 67.0	4.0	36.8		41 06 44.8	+ 1 49.4	—4.5	......	41 08(29.7)
	647	17 26.7	22.7	18.0		04 49.0	+ 3 55.0	—4.7	......	39.3
	658	11 17.1	7.9	33.0						
	666	6 06.0	25.5	15.5		11 59.1	— 3 17.0	—3.5	......	38.6
	691	9 00.0	13.5	27.3						
	715	11 92.6	16.0	24.8		10 33.5	— 1 52.8	—5.2	......	35.5
	731	5 38.9	14.5	26.3		06 24.2	+ 2 19.2	—5.9	......	37.5
Sept. 26	7706	7 00.0	27.0	7.6	Wind moderate.					
	7749	8 62.4	8.4	26.2		09 37.9	— 1 02.6	+0.4	......	35.7
	7789	12 43.9	11.5	23.0						
	7807	7 37.0	26.3	9.0		11 52.0	— 3 15.4	+1.3	......	37.9
	7824	15 57.2	0.0	34.8						
	7843	3 03.0	36.0	......		16 38.0	— 8 03.5	+0.6	......	35.1
	7856	3 34.9	29.7	5.0						
	7902	14 30.0	7.1	28.7		15 38.4	— 7 02.2	+0.7	.....	36.9
	7917	14 91.2	16.9	18.7						
	7932	4 21.8	19.3	16.5		01 44.0	+ 5 52.2	+0.2	......	36.4
	7962	10 21.2	20.0	16.6		05 34.7	+ 3 01.2	+0.4	......	36.3
	7972	8 70.9	11.8	24.6						
	7978	14 98.7	23.7	12.6		04 34.1	+ 4 02.1	—0.4	......	35.8
	7984	5 26.9	26.5	9.8		10 46.4	— 2 12.6	+0.9	......	34.7
	7994	— 1 59.0	16.4	19.8						
	8023	12 65.4	20.0	17.0		17 44.7	— 9 09.1	—0.1	......	35.5
	8106	12 32.8	14.6	22.9		08 16.7	+ 0 18.5	+1.6	......	36.8
	8173	2 52.2	13.0	24.9		02 00.7	+ 6 36.5	+0.7	......	37.9
	8182	12 80.7	26.5	11.4						
	8195	11 87.8	28.7	9.0						
	8223	11 89.5	10.5	27.4		08 37.0	— 0 00.7	+0.6	......	36.9
	8237	7 41.0	9.0	29.0		05 44.4	+ 2 52.2	—0.1	......	36.5
	8268	7 00.0	17.3	20.5		12 03.1	— 3 26.4	+1.0	......	37.3
	8282	21 62.5	17.2	20.8		21 26.1	—12 50.2	+0.9	......	36.8
	8324	1 64.6	22.8	15.5						
	16	17 92.9	15.9	22.9						
	67	0 86.6	25.6	13.4		19 33.4	—10 57.8	+1.2	......	36.8
	100	11 81.6	12.0	26.3		14 13.8	— 5 37.4	+1.0	......	37.4
	152	16 28.0	11.6	27.2		17 05.8	— 8 29.4	+0.7	......	37.1
	173	3 06.5	28.8	10.0						
	215	13 42.0	23.2	15.7						
	254	4 24.9	18.0	20.9		41 02 44.1	+ 5 53.5	+1.1	......	41 08 38.7

Observations and computations—Continued.

SIDNEY BARRACKS, NEBRASKA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1874.		*t.* *d.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
Sept. 26	283	13 18.0	20.0	18.4						
	337	3 86.5	19.8	19.0		41 02 37.8	+ 5 59.1	+0.6	......	41 08 37.5
	368	4 44.0	29.5	8.9						
	387	14 12.4	8.1	30.5		14 51.3	− 6 13.3	−0.4	......	37.6
	412	4 03.0	10.0	28.0		05 16.4	+ 3 20.7	+0.4	......	37.5
	444	17 52.5	10.3	28.6		13 55.9	− 5 19.5	+0.3	......	36.7
	453	9 23.7	29.4	9.8						
	487	16 73.0	17.1	21.5						
	513	1 81.9	23.7	15.5		18 12.3	− 9 34.8	+0.9	......	38.4
	540	6 79.2	23.4	15.7						
	576	14 64.3	19.7	20.0		03 32.3	+ 5 02.6	+1.7	......	36.6
	600	7 11.9	......	41.9						
	629	9 83.0	43.9	......		06 45.2	+ 1 44.5	+0.9	......	(30.6)
	647	16 89.2	19.9	19.7		04 49.5	+ 3 49.8	−0.9	......	38.4
	658	10 93.0	18.0	21.9						
	666	5 71.0	22.0	17.9		11 59.5	− 3 21.2	0.0	......	38.3
	691	7 77.0	26.8	13.0						
	715	10 81.2	14.0	26.2		10 34.0	− 1 57.3	+0.4	......	37.1
	731	4 31.1	13.8	26.8		06 24.6	+ 2 13.3	+0.2	......	38.1
Sept. 27	7706	7 90.4	15.0	21.5						
	7749	9 45.0	17.2	19.8		09 38.1	− 0 59.6	−2.1	......	36.4
	7789	12 62.0	10.8	26.4						
	7807	7 61.9	21.3	16.1		11 52.2	− 3 12.8	−2.4	......	37.0
	7824	15 59.3	−0.2	37.0						
	7843	3 10.0	35.5	1.7		16 38.3	− 8 01.6	−0.8	......	35.9
	7856	3 66.9	13.8	22.9						
	7902	14 55.1	17.8	20.0		15 38.6	− 6 59.5	−2.6	......	36.5
	7917	15 05.6	19.7	17.8						
	7932	4 26.5	12.0	25.3		01 44.2	+ 6 56.0	−2.6	......	37.6
	7962	10 26.3	12.0	26.6		05 34.9	+ 3 04.8	−2.9	......	36.8
	7972	8 23.8	14.0	23.8						
	7984	4 91.7	15.9	22.0		10 46.6	− 2 08.0	−3.7	......	34.9
	7994	−0 91.2	21.0	17.2	30^s p. m.					
	8023	13 24.0	10.7	28.0		17 44.9	− 9 05.7	−3.1	+0.1	36.2
					Changed inclination.					
	8106	11 97.0	26.2	12.5		08 17.0	+ 0 17.0	+1.3	......	35.3
	8173	2 15.6	24.6	14.0		02 01.0	+ 6 35.3	+0.5	......	36.8
	8182	12 41.0	15.0	23.3						
	8195	11 76.1	17.7	19.9						
	8223	11 83.2	20.0	17.7		08 37.3	− 0 02.7	0.0	......	34.6
	8237	7 31.0	17.9	20.0		41 05 44.6	+ 2 51.6	−1.0	......	41 08 35.2

Observations and computations—Continued.

SIDNEY BARRACKS, NEBRASKA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1874.		*t.* *d.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
Sept. 27	8268	7 03.2	13.8	23.7		41 12 03.4	— 3 28.2	+2.1	......	41 08 37.3
	8282	21 64.8	11.3	26.4		21 26.3	—12 51.7	+0.9	......	35.5
	8324	1 63.1	28.6	9.7						
	16	16 88.0	11.1	27.3						
	67	—0 21.6	31.0	7.9		19 33.1	—10 59.1	+1.6	......	35.6
	100	12 08.0	22.9	15.9		14 14.2	— 5 39.2	+2.1	......	37.1
	152	16 54.0	20.2	18.5		17 06.1	— 8 31.1	+0.9	......	35.9
	173	3 28.2	20.5	18.3						
	215	13 41.1	23.3	14.9						
	254	4 24.1	15.0	23.6		02 44.3	+ 5 53.5	0.0	......	37.8
	283	13 44.4	15.7	22.9						
	337	4 12.2	20.8	18.0		02 38.1	+ 5 59.4	—1.0	......	36.5
	368	4 36.9	18.2	19.8						
	387	14 10.3	19.9	19.0		14 51.5	— 6 15.3	—0.2	......	36.0
	412	3 53.0	15.1	22.4		05 16.6	+ 3 19.3	+2.0	......	37.9
	444	17 04.6	13.4	24.5		13 56.1	— 5 21.7	+1.1	......	35.5
	453	8 70.0	27.0	11.2						
	487	16 23.9	20.1	17.8						
	516	1 26.2	20.0	18.1		18 12.5	— 9 37.4	+1.0	......	36.1
	540	4 98.0	12.1	25.6						
	576	12 85.3	28.8	9.0		41 03 32.5	+ 5 03.5	+1.5	......	41 08 37.5

NOTE.—The observations on pairs 600 and 629 were excluded in obtaining the mean.

ASTRONOMICAL CO-ORDINATES OF STATION AT SIDNEY BARRACKS, NEBRASKA.

Longitude.. $6^h\ 51^m\ 52^s.888 \pm 0^s.030$ or $102°\ 58'\ 13''.32 \pm 0''.45$ west from Greenwich.
Longitude.. $1^h\ 43^m\ 40^s.768$ or $25°\ 55'\ 11''.52$ west from U. S. Naval Observatory, Washington, D. C.
Latitude....... .... $41°\ 08'\ 36''.75 \pm 0''.05$ north.

The latitude was obtained by taking the separate results given by each pair, and thus securing twenty-eight individual results. *Cf.* report on Colorado Springs, p. 78.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1ST LIEUT. GEO. M. WHEELER, CORPS OF ENGINEERS, U. S. ARMY, IN CHARGE.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF JULESBURG, COLORADO.

SEASON OF 1874.

COMPUTATIONS BY

DR. F. KAMPF.

JULESBURG, COLORADO.

GEOGRAPHICAL POSITION OF STATION.

Longitude, ... $102° 21' 32''.30 \pm 0''.43$ west from Greenwich
Latitude, ... $40° 59' 07''.63 \pm 0''.04$ north.
Altitude of observatory above sea-level (from railroad surveys), 3,500.0 feet.

The astronomical station was established at a distance of about 45 feet from the side-track of the Union Pacific Railroad, and 27 feet from the southwest corner of the warehouse belonging to the same.

About twenty-five years ago the settlement of Julesburg was of considerable size, but, the town being attacked and destroyed by the Indians in 1852, the greater part of its population removed to Sidney and North Platte. At the time of the occupation of this station there were but five houses in the place, and three of these were the property of the railroad company.

The surrounding country is level, except in the southeast, where, four miles away, the plains are broken by hills. At a distance of two miles the Platte River flows by in an easterly direction. On its banks some efforts at agriculture have been made, but with very little success.

METEOROLOGICAL CONDITIONS.

During the time of occupation the weather was fair, with the exception of two days, when it rained. In general the air was calm until 10 o'clock in the evening, when the atmosphere began to grow undulatory, and after 12 o'clock, midnight, it became so hazy that stars of the sixth magnitude were invisible.

For description of observatory and instruments, *personnel* of party, name of computer, and other information omitted here, the reader may consult the report on the Las Vegas station, which possessed many circumstances of observation in common with this.

The use of the Atlantic and Pacific Telegraph line was kindly granted by the superintendent at Omaha, and over this route exchanges for time were made with Ogden on October 7, 8, 9, 10, and 11. The latitude was determined by observations on the nights of October 9, 10, and 11.

The length of circuit was 650 miles. For the transmission of signals the local battery in the office at Julesburg was employed, and this was assisted by a repeater at Cheyenne.

Tabulation of stars used for determination of time at Julesburg, Colorado, and Ogden, Utah, 1874.

Name of star.		JULESBURG.					OGDEN.				
		October 7.	October 8.	October 9.	October 10.	October 11.	October 7.	October 8.	October 9.	October 10.	October 11.
α	Lyræ	..	..	..	..	..	×	×	×	×	×
42	Lyræ	..	..	..	..	..	×	..	..	..	..
β	Lyræ	..	..	..	..	..	×	×	×	×	×
50	Draconis	..	..	..	..	..	×	×	×	×	×
γ	Lyræ	..	..	..	..	..	×	×	×	×	×
ζ	Aquilæ	..	..	..	..	..	×	×	×	×	×
ι	Lyræ	..	..	..	..	..	..	×	×	×	×
d	Sagittarii	..	..	..	..	..	×	..	×	×	×
δ	Draconis	..	..	..	..	..	×	×	×	×	×
τ	Draconis	..	..	..	..	..	×	×	×	×	×
δ	Aquilæ	×	..	..	..	..	..	..	..	..	..
ι	Cygni	×	..	..	..	..	..	..	..	..	..
β	Cygni	..	..	..	×	..	×	×	×	×	×
κ	Aquilæ	×	..	..	×	×	×	×	×	×	×
θ	Cygni	..	..	..	×	×	..	..	..	..	..
γ	Aquilæ	×	..	×	×	×	×	×	×	×	×
α	Aquilæ	×	..	×	×	×	×	×	×	×	×
ε	Draconis	×	..	×	×	×	×	×	×	×	×
ψ	Cygni	×	..	×	×	×	..	..	..	..	..
τ	Aquilæ	..	..	×	..	×	..	..	..	..	..
θ	Aquilæ	×	..	×	×	×	..	..	..	..	..
31 o^1	Cygni	×		×	×	×	..	..	..	..	..
κ	Cephei	×	..	..	×	×	..	..	..	..	..
γ	Cygni	×	..	×	×	×	..	..	..	..	..
π	Capricorni	×	..	×	×	×	..	..	..	..	..
θ	Cephei	×	..	×	×	×	..	..	..	..	..

Name of star.		JULESBURG.					OGDEN.				
		October 7.	October 8.	October 9.	October 10.	October 11.	October 7.	October 8.	October 9.	October 10.	October 11.
β	Delphini	×	..	..	×	×	..	..	..	..	..
α	Delphini	..	..	×	..	..	..	..	..	..	..
α	Cygni	..	..	×	..	..	..	..	..	..	..
β	Aquarii	..	..	..	..	..	×	..	..	..	..
β	Cephei	..	×	..	..	..	×	..	×	..	×
ξ	Aquarii	..	×	..	..	..	×	..	×	..	×
ε	Pegasi	..	×	..	..	..	×	..	×	..	×
11	Cephei	..	×	..	..	..	×	..	×	..	×
μ	Capricorni	..	×	..	..	..	×	..	×	..	×
79	Draconis	..	..	..	..	..	×	..	×	..	×
α	Aquarii	..	..	..	..	..	×	..	×	..	×
ζ	Cephei	..	..	..	..	..	×	..	×	..	×
32	Ursæ Majoris, L. C	..	..	..	..	..	×	..	..	×	..
θ	Aquarii	..	..	..	..	..	..	..	×	..	×
γ	Aquarii	..	..	..	..	..	×	..	×	×	×
π	Aquarii	..	..	..	..	..	×	..	×	×	×
9	Draconis, L. C	..	..	..	..	..	×	..	..	..	..
226	Cephei	..	..	..	..	..	..	..	×	×	×
ζ	Pegasi	..	..	..	..	..	..	..	×	×	×
η	Pegasi	..	..	..	..	..	..	..	×	×	..
λ	Pegasi	..	..	..	..	..	..	..	×	×	..
ι	Cephei	..	..	..	..	..	..	..	×	×	..
o	Andromedæ	..	..	..	..	..	..	..	..	×	..
γ	Pegasi	..	..	..	..	..	..	..	..	×	..
π	Cephei	..	..	..	..	..	..	..	..	×	..
υ	Pegasi	..	..	..	..	..	..	..	..	×	..

Observations and reductions for time taken at sending station.

JULESBURG, COLORADO, OCTOBER 7, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	δ Aquilæ	19 15 20.58	+ 3.32	0.00	+ 0.20	19 15 24.10	19 19 10.55	+ 3 46.45
E.	ι Cygni	22 47.58	— 1.55	— 0.03	+ 0.32	22 46.32	26 32.55	46.23
E.	κ Aquilæ	26 18.06	+ 4.01	— 0.03	+ 0.20	26 22.24	30 08.81	46.57
E.	γ Aquilæ	36 28.50	+ 2.78	— 0.05	+ 0.20	36 31.43	40 18.02	46.59
E.	α Aquilæ	40 50.42	+ 2.89	— 0.03	+ 0.20	40 53.48	44 40.05	46.57
E.	ε Draconis	44 55.52	— 7.54	— 0 05	+ 0.58	44 48.51	48 35.16	46.65
E.	ψ Cygni	48 38.30	— 1.66	0.00	+ 0.33	48 36.97	52 23.32	46.35
W.	θ Aquilæ	20 01 00.60	+ 3.58	— 0.11	— 0.20	20 01 03.87	20 04 50.37	46.50
W.	$31o^1$ Cygni	05 55.92	— 0.75	— 0.22	— 0.29	05 54.66	09 41.17	46.51
W.	κ Cephei	09 34.12	—14.45	— 0.55	— 0.91	09 18.21	13 04.70	46.49
W.	γ Cygni	13 57.64	+ 0.16	— 0.19	— 0.26	13 57.35	17 43.94	46.59
W.	π Capricorni	16 18.06	+ 4.87	— 0.08	— 0.21	16 22.64	20 09.03	46.39
W.	θ Cephei	23 47.38	— 4.28	— 0.34	— 0.43	23 42.33	27 28.76	46.43
W.	β Delphini	20 27 51.84	+ 2.51	— 0.18	— 0.21	20 27 53.96	20 31 40.46	+ 3 46.50

NORMAL EQUATIONS.

$$0 = +13.77 + 14.00\,\delta t - 1.14\,a - 2.38\,c \qquad a = +5^s.350$$
$$0 = -72.68 - 1.14\,\delta t + 13.12\,a + 9.48\,c \qquad c = +0^s.200$$
$$0 = -62.02 - 2.38\,\delta t + 9.48\,a + 50.30\,c$$

JULESBURG, COLORADO, OCTOBER 8, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	β Cephei	21 23 18.20	— 0.84	— 0.43	— 0.48	21 23 16.45	21 27 02.90	+ 3 46.45
W.	ξ Aquarii	27 18.59	+ 0.46	— 0.11	— 0.16	27 18.78	31 05.30	46.52
W.	ε Pegasi	34 15.74	+ 0.31	— 0.15	— 0.16	34 15.74	38 02.37	46.63
W.	11 Cephei	36 21.08	— 0.89	— 0.45	— 0.49	36 19.25	40 05.73	46.48
E.	μ Capricorni	21 42 41.42	+ 0.50	— 0.10	+ 0.17	21 42 41.99	21 46 28.42	+ 3 46.43

NORMAL EQUATIONS.

$$0 = +0.95 + 5.00\,\delta t - 0.77\,a \qquad a = +0^s.591$$
$$0 = -3.54 - 0.77\,\delta t + 5.86\,a$$

Adopted $c + 0^s.163$

Observations and reductions for time taken at sending station—Continued.

JULESBURG, COLORADO, OCTOBER 9, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	γ Aquilæ	19 36 31.56	+ 0.27	— 0.10	+ 0.12	19 36 31.85	19 40 17.99	+ 3 46.14
E.	α Aquilæ	40 53.56	+ 0.28	— 0.13	+ 0.12	40 53.83	44 40.02	46.19
E.	ϵ Draconis	44 49.82	— 8.74	— 0.49	+ 0.35	44 48.94	48 35.04	46.10
E.	ψ Cygni	48 37.44	— 0.16	— 0.35	+ 0.20	48 37.13	52 23.25	46.12
E.	τ Aquilæ	54 14.70	+ 0.29	— 0.21	+ 0.12	54 14.90	58 01.06	46.16
E.	θ Aquilæ	20 01 03.90	+ 0.35	— 0.19	+ 0.12	20 01 04.18	20 04 50.34	46.16
W.	31 o^1 Cygni	05 55.38	— 0.07	— 0.13	— 0.18	05 55.00	09 41.11	46.11
W.	γ Cygni	13 58.12	+ 0.01	— 0.16	— 0.16	13 57.81	17 43.89	46.08
W.	π Capricorni	16 22.66	+ 0.47	— 0.07	— 0.13	16 22.93	20 09.00	46.07
W.	θ Cephei	23 43.52	— 0.42	— 0.34	— 0.26	23 42.50	27 28.67	46.17
W.	α Delphini	30 03.16	+ 0.24	— 0.18	— 0.12	30 03.10	33 49.21	46.11
W.	α Cygni	20 33 24.04	— 0.05	— 0.30	— 0.17	20 33 23.52	20 37 09.71	+ 3 46.19

NORMAL EQUATIONS.

$$0 = +0.32 + 12.00\,\delta t + 0.93\,a + 0.16\,c \qquad a = +0^s.525$$
$$0 = -2.41 + 0.93\,\delta t + 5.10\,a - 1.70\,c \qquad c = +0^s.121$$
$$0 = -2.48 + 0.16\,\delta t - 1.70\,a + 27.96\,c$$

JULESBURG, COLORADO, OCTOBER 10, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
E.	β Cygni	19 21 53.36	+ 0.28	— 0.11	+ 0.18	19 21 53.71	19 25 39.84	+ 3 46.13
E.	κ Aquilæ	26 22.02	+ 0.81	— 0.12	+ 0.16	26 22.87	30 08.76	45.89
E.	θ Cygni	29 18.90	— 0.26	— 0.38	+ 0.25	29 18.51	33 04.56	46.05
E.	γ Aquilæ	36 31.56	+ 0.56	— 0.26	+ 0.16	36 32.02	40 17.97	45.95
E.	α Aquilæ	40 53.56	+ 0.59	— 0.29	+ 0.16	40 54.02	44 40.00	45.98
E.	ϵ Draconis	44 50.84	— 1.53	— 0.97	+ 0.47	44 48.81	48 34.97	46.16
E.	ψ Cygni	48 37.92	— 0.34	— 0.67	+ 0.26	48 37.17	52 23.22	46.05
W.	θ Aquilæ	20 01 03.92	+ 0.73	— 0.11	— 0.16	20 01 04.38	20 04 50.32	45.94
W.	31 o^1 Cygni	05 55.68	— 0.15	— 0.22	— 0.23	05 55.08	09 41.09	46.01
W.	κ Cephei	09 22.74	— 2.93	— 0.51	— 0.73	09 18.57	13 04.40	45.83
W.	γ Cygni	13 58.16	+ 0.03	— 0.17	— 0.21	13 57.81	17 43.87	46.06
W.	π Capricorni	16 22.16	+ 0.99	— 0.06	— 0.17	16 22.92	20 08.98	46.06
W.	θ Cephei	23 43.90	— 0.87	— 0.12	— 0.35	23 42.56	27 28.62	46.06
W.	β Delphini	20 27 54.22	+ 0.51	0.00	— 0.16	20 27 54.57	20 31 40.41	+ 3 45.84

NORMAL EQUATIONS.

$$0 = +3.34 + 14.00\,\delta t - 1.45\,a - 2.30\,c \qquad a = +1^s.085$$
$$0 = -15.50 - 1.45\,\delta t + 12.79\,a + 9.24\,c \qquad c = +0^s.160$$
$$0 = -18.31 - 2.30\,\delta t + 9.24\,a + 50.42\,c$$

Observations and reductions for time taken at sending station—Continued.

JULESBURG, COLORADO, OCTOBER 11, 1874.

Clamp.	Name of star.	T.	*Aa.*	*Bb.*	*Cc.*	T'.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	κ Aquilæ	19 26 22.08	+ 0.53	0.00	+ 0.17	19 26 22.78	19 30 08.75	+ 3 45.97
E.	θ Cygni	29 18.58	− 0.17	− 0.15	+ 0.26	29 18.52	33 14.52	46.00
E.	γ Aquilæ	36 31.58	+ 0.37	− 0.09	+ 0.17	36 32.03	40 17.95	45.92
E.	α Aquilæ	40 53.70	+ 0.39	− 0.08	+ 0.17	40 54.18	44 39.99	45.81
E.	ε Draconis	44 49.74	− 1.01	− 0.26	+ 0.50	44 48.97	48 34.90	45.93
E.	ψ Cygni	48 37.20	− 0.22	− 0.16	+ 0.28	48 37.10	52 23.18	46.08
E.	τ Aquilæ	54 14.70	+ 0.40	− 0.08	+ 0.17	54 15.19	58 01.03	45.84
W.	θ Aquilæ	20 01 04.18	+ 0.48	− 0.14	− 0.17	20 01 04.35	20 04 50.31	45.96
W.	31 o¹ Cygni	05 55.78	− 0.10	− 0.28	− 0.25	05 55.15	09 41.06	45.91
W.	κ Cephei	09 21.86	− 1.93	− 0.73	− 0.78	09 18.42	13 04.29	45.87
W.	γ Cygni	13 58.32	+ 0.02	− 0.27	− 0.22	13 57.85	17 43.85	46.00
W.	π Capricorni	16 22.66	+ 0.65	− 0.11	− 0.18	16 23.02	20 08.97	45.95
W.	θ Cephei	23 43.86	− 0.57	− 0.46	− 0.37	23 42.46	27 28.57	46.11
W.	β Delphini	20 27 54.46	+ 0.34	− 0.20	− 0.17	20 27 54.43	20 31 40.39	+ 3 45.96

NORMAL EQUATIONS.

$$0 = +\ 4.73 + 14.00\,\delta t - 1.15\,a - 2.42\,c \qquad a = +\,0^s.713$$
$$0 = -\,11.18 - 1.15\,\delta t + 13.03\,a + 9.52\,c \qquad c = +\,0^s.170$$
$$0 = -\,15.88 - 2.42\,\delta t + 9.52\,a + 50.16\,c$$

Observations and reductions for time taken at receiving station.

OGDEN, UTAH, OCTOBER 7, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Lyræ	18 38 41.09	− 0.10	+ 0.08	− 0.06	18 38 41.01	18 32 41.28	− 5 59.73
W.	42 Lyræ	46 10.64	− 0.08	+ 0.09	− 0.06	46 10.59	40 10.79	59.80
W.	β Lyræ	51 26.78	− 0.27	+ 0.08	− 0.06	51 26.53	45 26.81	59.72
W.	50 Draconis	55 19.94	+ 3.50	+ 0.19	− 0.19	55 23.44	49 23.62	59.82
W.	γ Lyræ	19 00 15.02	− 0.29	+ 0.07	− 0.06	19 00 14.74	54 15.06	59.68
W.	ζ Aquilæ	05 39.34	− 0.76	+ 0.06	− 0.05	05 38.59	59 38.64	59.95
E.	d Sagittarii	16 19.08	− 1.46	+ 0.09	+ 0.05	16 17.76	19 10 17.90	59.86
E.	δ Draconis	18 28.28	+ 1.83	+ 0.42	+ 0.13	18 30.66	12 30.97	59.69
E.	τ Draconis	23 52.97	+ 2.89	+ 0.46	+ 0.17	23 56.49	17 56.79	59.70
E.	β Cygni	31 39.88	− 0.43	+ 0.15	+ 0.06	31 39.66	25 39.90	59.76
E.	κ Aquilæ	36 09.56	− 1.21	+ 0.09	+ 0.05	36 08.49	30 08.81	59.68
E.	γ Aquilæ	46 18.51	− 0.82	+ 0.10	+ 0.05	46 17.84	40 18.02	59.82
E.	α Aquilæ	50 40.61	− 0.86	+ 0.08	+ 0.05	50 39.88	44 40.05	59.83
E.	ε Draconis	19 54 32.55	+ 2.23	+ 0.23	+ 0.14	19 54 35.15	19 48 35.17	− 5 59.98
E.	β Aquarii	21 30 58.93	− 1.26	− 0.16	+ 0.08	21 30 57.59	21 24 58.17	− 5 59.42
E.	β Cephei	33 00.96	+ 2.40	− 0.62	+ 0.22	33 02.96	27 02.95	60.01
E.	ξ Aquarii	37 06.11	− 1.31	− 0.16	+ 0.08	37 04.72	31 05.31	59.41
E.	ε Pegasi	44 02.80	− 0.92	− 0.22	+ 0.08	44 01.74	38 02.36	59.38
E.	11 Cephei	46 03.30	+ 2.53	− 0.71	+ 0.23	46 05.35	40 05.78	59.57
E.	μ Capricorni	51 29.54	− 1.45	− 0.17	+ 0.08	51 28.00	45 28.43	59.57
W.	79 Draconis	57 17.42	+ 3.10	− 0.93	− 0.26	57 19.33	51 19.64	59.69
W.	α Aquarii	22 05 22.69	− 1.14	− 0.23	− 0.07	22 05 21.25	59 21.42	59.83
W.	ζ Cephei	12 30.58	+ 0.88	− 0.54	− 0.14	12 30.78	22 06 31.15	59.63
W.	32 Ursæ Maj., L. C.	14 56.49	− 3.96	+ 0.22	+ 0.18	14 52.93	08 53.15	59.78
W.	γ Aquarii	21 12.91	− 1.16	− 0.23	− 0.07	21 11.45	15 11.64	59.81
W.	π Aquarii	24 54.59	− 1.10	− 0.24	− 0.08	24 53.17	18 53.28	59.89
W.	9 Draconis, L. C.	22 30 26.18	− 6.40	+ 0.65	+ 0.32	22 30 20.75	22 24 20.98	− 5 59.77

NORMAL EQUATIONS.

First series.

$$0 = +\ 6.63 + 14.00\,\delta t - 2.62\,a + 4.25\,c \qquad a = -1^s.590$$
$$0 = +\ 19.99 - 2.62\,\delta t + 13.79\,a - 2.60\,c \qquad c = +0^s.049$$
$$0 = -\ 3.50 + 4.25\,\delta t - 2.60\,a + 55.09\,c$$

Second series.

$$0 = +\ 4.89 + 13.00\,\delta t + 5.75\,a + 8.40\,c \qquad a = -1^s.701$$
$$0 = +\ 48.96 + 5.75\,\delta t + 30.84\,a + 21.17\,c \qquad c = +0^s.076$$
$$0 = +\ 28.37 + 8.40\,\delta t + 21.17\,a + 64.10\,c$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, OCTOBER 8, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Lyræ	18 38 42.23	+ 0.02	— 0.06	— 0.09	18 38 42.10	18 32 41.25	— 6 00.85
W.	β Lyræ	51 27.67	+ 0.07	— 0.09	— 0.08	51 27.57	45 26.79	00.78
W.	50 Draconis	56 25.79	— 0.85	— 0.33	— 0.27	56 24.34	50 23.53	00.81
W.	γ Lyræ	19 00 15.84	+ 0.07	— 0.13	— 0.08	19 00 15.70	54 15.04	00.66
W.	ζ Aquilæ	05 39.38	+ 0.18	— 0.12	— 0.07	05 39.37	59 38.62	00.75
W.	ι Lyræ	08 50.31	+ 0.04	— 0.16	— 0.08	08 50.21	19 02 49.52	00.59
E.	δ Draconis	18 31.89	— 0.44	— 0.07	+ 0.18	18 31.56	12 30.91	00.65
E.	τ Draconis	23 57.84	— 0.70	— 0.09	+ 0.23	23 57.28	17 56.72	00.56
E.	β Cygni	31 40.37	+ 0.10	— 0.04	+ 0.08	31 40.51	25 39.88	00.63
E.	κ Aquilæ	36 09.31	+ 0.29	— 0.03	+ 0.07	36 09.64	30 08.79	00.85
E.	γ Aquilæ	46 18.52	+ 0.20	— 0.03	+ 0.07	46 18.76	40 18.00	00.76
E.	α Aquilæ	50 40.60	+ 0.21	— 0.02	+ 0.06	50 40.85	44 40.03	00.82
E.	ε Draconis	19 54 36.55	— 0.54	— 0.08	+ 0.20	19 54 36.13	19 48 35.10	— 6 01.03

NORMAL EQUATIONS.

$$0 = -2.13 + 13.00\,\delta t - 3.48\,a + 3.26\,c \qquad a = +0^s.385$$
$$0 = -3.86 - 3.48\,\delta t + 12.95\,a - 3.65\,c \qquad c = +0^s.068$$
$$0 = -3.26 + 3.26\,\delta t - 3.65\,a + 54.15\,c$$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, OCTOBER 9, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α Lyræ	18 38 43.87	+ 0.02	− 0.10	− 0.12	18 38 43.67	18 32 41.23	− 6 02.44
W.	β Lyræ	51 29.44	+ 0.06	− 0.10	− 0.12	51 29.28	45 26.76	02.52
W.	50 Draconis	56 27.43	− 0.73	− 0.29	− 0.38	56 26.03	50 23.43	02.60
W.	γ Lyræ	19 00 17.59	+ 0.06	− 0.10	− 0.11	19 00 17.44	54 15.02	02.42
W.	ζ Aquilæ	05 41.22	+ 0.16	− 0.09	− 0.10	05 41.19	59 38.60	02.59
W.	ι Lyræ	08 52.17	+ 0.04	− 0.12	− 0.12	08 51.97	19 02 49.49	02.48
E.	d Sagittarii	16 20.22	+ 0.30	− 0.09	+ 0.10	16 20.53	10 17.87	02.66
E.	δ Draconis	18 33.81	− 0.38	− 0.42	+ 0.25	18 33.26	12 30.85	02.41
E.	τ Draconis	23 59.91	− 0.60	− 0.52	+ 0.33	23 59.12	17 56.63	02.49
E.	β Cygni	31 42.22	+ 0.09	− 0.19	+ 0.11	31 42.23	25 39.86	02.37
E.	κ Aquilæ	36 11.22	+ 0.25	− 0.11	+ 0.10	36 11.46	30 08.78	02.68
E.	γ Aquilæ	46 20.31	+ 0.17	− 0.13	+ 0.10	46 20.45	40 17.99	02.46
E.	α Aquilæ	50 42.39	+ 0.18	− 0.13	+ 0.10	50 42.54	44 40.02	02.52
E.	ε Draconis	19 54 38.31	− 0.46	− 0.40	+ 0.28	19 54 37.73	19 48 35.04	− 6 02.69
E.	β Cephei	21 33 05.40	− 0.40	+ 0.17	+ 0.22	21 33 05.39	21 27 02.85	− 6 02.54
E.	ξ Aquarii	37 07.38	+ 0.22	+ 0.03	+ 0.07	37 07.70	31 05.29	02.41
E.	ε Pegasi	44 04.42	+ 0.16	+ 0.02	+ 0.08	44 04.68	38 02.34	02.34
E.	11 Cephei	46 08.13	− 0.43	0.00	+ 0.22	46 07.92	40 05.68	02.24
E.	μ Capricorni	52 30.50	+ 0.24	− 0.01	+ 0.08	52 30.81	46 28.41	02.40
E.	79 Draconis	57 22.37	− 0.52	− 0.09	+ 0.25	57 22.01	51 19.54	02.47
E.	α Aquarii	22 05 23.53	+ 0.19	− 0.02	+ 0.08	22 05 23.78	59 21.40	02.38
W.	ζ Cephei	12 34.78	− 0.77	− 0.23	− 0.14	12 33.64	22 06 31.09	02.55
W.	θ Aquarii	16 15.52	+ 1.15	− 0.09	− 0.08	16 16.50	10 13.90	02.60
W.	γ Aquarii	21 13.40	+ 1.01	− 0.09	− 0.07	21 14.25	15 11.62	02.63
W.	π Aquarii	24 55.05	+ 0.96	− 0.10	− 0.07	24 55.84	18 53.26	02.58
W.	226 Cephei	36 12.34	− 3.27	− 0.46	− 0.30	36 08.31	30 05.70	02.61
W.	ζ Pegasi	41 15.34	+ 0.77	− 0.13	− 0.08	41 15.90	35 13.33	02.57
W.	η Pegasi	43 10.66	+ 0.34	− 0.17	− 0.09	43 10.74	37 08.39	02.35
W.	λ Pegasi	46 32.61	+ 0.49	− 0.15	− 0.08	46 32.87	40 30.36	02.51
W.	ι Cephei	22 51 18.85	− 1.47	− 0.33	− 0.18	22 51 16.87	22 45 14.40	− 6 02.47

NORMAL EQUATIONS.

First series.

$0 = -0.65 + 14.00\,\delta t - 2.56\,a + 4.32\,c$ $a = +0^s.331$

$0 = -4.12 - 2.56\,\delta t + 13.80\,a - 2.67\,c$ $c = +0^s.096$

$0 = -4.74 + 4.32\,\delta t - 2.67\,a + 55.27\,c$

Second series.

For E.: $0 = +0.42 + 7.00\,\delta t - 1.89\,a$ $a = +0^s.287$

$0 = -2.71 - 1.89\,\delta t + 9.57\,a$

For W.: $0 = +2.96 + 9.00\,\delta t - 0.53\,a$ $a = +1^s.480$

$0 = -12.04 - 0.53\,\delta t + 8.05\,a$

Adopted $c = +0^s.074$.

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, OCTOBER 10, 1874.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
W.	α Lyræ	18 38 45.65	+ 0.09	— 0.13	— 0.12	18 38 45.49	18 32 41.20	— 6 04.29
W.	β Lyræ	51 31.02	+ 0.24	— 0.16	— 0.12	51 30.98	45 26.74	04.24
W.	50 Draconis	56 31.92	— 3.16	— 0.39	— 0.38	56 27.99	50 23.33	04.66
W.	γ Lyræ	19 00 19.29	+ 0.26	— 0.14	— 0.11	19 00 19.30	54 15.00	04.30
W.	ζ Aquilæ	05 42.58	+ 0.69	— 0.13	— 6.10	05 43.04	59 38.59	04.45
E.	ι Lyræ	08 53.90	+ 0.16	— 0.18	— 0.12	08 53.76	19 02 49.47	04.29
E.	d Sagittarii	16 21.06	+ 1.32	— 0.03	— 0.10	16 22.25	10 17.85	04.40
E.	δ Draconis	18 36.53	— 1.65	0.00	+ 0.25	18 35.13	12 30.79	04.34
E.	τ Draconis	24 03.08	— 2.62	+ 0.09	+ 0.33	24 00.88	17 56.55	04.33
E.	β Cygni	31 43.74	+ 0.39	+ 0.03	+ 0.11	31 44.27	25 39.84	04.43
E.	κ Aquilæ	36 12.22	+ 1.09	0.00	+ 0.10	36 13.41	30 08.76	04.65
E.	γ Aquilæ	46 21.78	+ 0.75	— 0.02	+ 0.10	46 22.61	40 17.97	04.64
E.	α Aquilæ	50 43.74	+ 0.78	— 0.03	+ 0.09	50 44.58	44 40.00	04.58
E.	ε Draconis	19 54 41.26	— 2.01	— 0.10	+ 0.28	19 54 39.43	19 48 34.97	— 6 04.46
E.	32 Ursæ Maj., L. C.	22 14 55.16	+ 2.97	— 0.07	— 0.18	22 14 57.88	22 08 53.30	— 6 04.58
E.	γ Aquarii	21 15.30	+ 0.87	+ 0.05	+ 0.07	21 16.29	15 11.61	04.63
E.	π Aquarii	24 56.97	+ 0.83	+ 0.03	+ 0.07	24 57.90	18 53.26	04.64
E.	226 Cephei	36 12.63	— 2.82	+ 0.07	+ 0.30	36 10.18	30 05.64	04.54
E.	ζ Pegasi	41 17.14	+ 0.66	0.00	+ 0.08	41 17.88	35 13.32	04.56
E.	η Pegasi	43 12.49	+ 0.29	— 0.01	+ 0.09	43 12.86	37 08.38	04.48
E.	λ Pegasi	46 34.46	+ 0.42	— 0.02	+ 0.08	46 34.94	40 30.35	04.59
E.	ι Cephei	51 20.19	— 1.26	— 0.04	+ 0.18	51 19.07	45 14.37	04.70
W.	o Andromedæ	23 02 14.84	0.00	— 0.19	— 0.10	23 02 14.55	56 10.16	04.39
W.	γ Pegasi	04 36.35	+ 0.28	— 0.13	— 0.08	04 36.42	58 31.85	04.57
W.	π Cephei	10 13.33	— 1.24	— 0.43	— 0.28	10 01.38	23 03 56.79	04.59
W.	υ Pegasi	23 25 13.02	+ 0.20	— 0.14	— 0.08	23 25 13.00	23 19 08.31	— 6 04.69

NORMAL EQUATIONS.

First series.

$$0 = +\ 5.32 + 14.00\,\delta t - 2.56\,a + 2.20\,c \qquad a = +\,1^{s}.438$$
$$0 = -19.72 - 2.56\,\delta t + 13.80\,a - 4.63\,c \qquad c = +\,0^{s}.097$$
$$0 = +\ 1.50 + 2.20\,\delta t - 4.63\,a + 55.27\,c$$

Second series.

For E.: $0 = -\ 1.19 + 8.00\,\delta t + 1.54\,a$
$0 = -15.91 + 1.54\,\delta t + 12.60\,a \qquad a = +\,1^{s}.274$

For W.: $0 = +\ 0.20 + 4.00\,\delta t - 1.29\,a$
$0 = -\ 2.62 - 1.29\,\delta t + 4.71\,a \qquad a = +\,0^{s}.595$

Adopted $c = +\,0^{s}.074$

Observations and reductions for time taken at receiving station—Continued.

OGDEN, UTAH, OCTOBER 11, 1874.

Clamp.	Name of star.		T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
			h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	m. s.
W.	α	Lyræ	18 38 48.03	+ 0.03	— 0.24	— 0.08	18 38 47.74	18 32 41.18	— 6 06.56
W.	β	Lyræ	51 33.60	+ 0.08	— 0.23	— 0.07	51 33.38	45 26.71	06.67
W.	50	Draconis	56 32.19	— 1.02	— 0.58	— 0.23	56 30.39	50 23.24	07.15
W.	γ	Lyræ	19 00 21.81	+ 0.08	— 0.18	— 0.07	19 00 21.64	54 14.97	06.67
W.	ζ	Aquilæ	05 45.42	+ 0.22	— 0.14	— 0.06	05 45.44	59 38.57	06.87
W.	ι	Lyræ	08 56.43	+ 0.05	— 0.18	— 0.07	08 56.23	19 02 49.44	06.79
E.	d	Sagittarii	16 24.39	+ 0.43	— 0.01	+ 0.06	16 24.87	10 17.83	07.04
E.	δ	Draconis	18 37.81	— 0.53	— 0.05	+ 0.16	18 37.39	12 30.73	06.66
E.	τ	Draconis	24 03.88	— 0.85	— 0.06	+ 0.20	24 03.17	17 56.46	06.71
E.	β	Cygni	31 46.54	+ 0.13	— 0.01	+ 0.07	31 46.73	25 39.82	06.91
E.	κ	Aquilæ	36 15.38	+ 0.35	0.00	+ 0.06	36 15.79	30 08.75	07.04
E.	γ	Aquilæ	46 24.63	+ 0.24	0.00	+ 0.06	46 24.93	40 17.96	06.97
E.	α	Aquilæ	50 46.75	+ 0.25	0.00	+ 0.06	50 47.06	44 39.99	07.07
E.	ε	Draconis	19 54 42.43	— 0.65	0.00	+ 0.18	19 54 41.96	19 48 34.90	— 6 07.06
E.	β	Cephei	21 33 09.78	— 0.45	+ 0.28	+ 0.22	21 33 09.83	21 27 02.74	— 6 07.09
E.	ξ	Aquarii	37 11.86	+ 0.25	+ 0.06	+ 0.08	37 12.25	31 05.27	06.98
E.	ε	Pegasi	44 08.88	+ 0.17	+ 0.06	+ 0.07	44 09.18	38 02.32	06.86
E.	11	Cephei	46 12.36	— 0.48	+ 0.18	+ 0.22	46 12.28	40 05.57	06.71
E.	μ	Capricorni	52 34.96	+ 0.27	+ 0.03	+ 0.08	52 35.34	46 28.39	06.95
E.	79	Draconis	57 26.66	— 0.58	+ 0.12	+ 0.25	57 26.45	51 19.43	07.02
E.	α	Aquarii	22 05 28.01	+ 0.22	+ 0.03	+ 0.07	22 05 28.33	59 21.38	06.95
W.	ζ	Cephei	12 37.73	+ 0.47	— 0.16	— 0.14	12 37.90	22 06 31.02	06.88
W.	θ	Aquarii	16 21.65	— 0.70	— 0.06	— 0.08	16 20.81	10 13.89	06.92
W.	γ	Aquarii	21 19.22	— 0.61	— 0.07	— 0.07	21 18.47	15 11.60	06.87
W.	π	Aquarii	25 00.80	— 0.58	— 0.08	— 0.07	25 00.07	18 53.25	06.82
W.	226	Cephei	36 11.16	+ 1.98	— 0.40	— 0.30	36 12.44	30 05.59	06.85
W.	ζ	Pegasi	22 41 20.75	— 0.47	— 0.10	— 0.08	22 41 20.10	22 35 13.31	— 6 06.79

NORMAL EQUATIONS.

First series.

$$0 = +1.79 + 14.00\,\delta t - 2.56\,a + 4.32\,c$$
$$0 = -6.41 - 2.56\,\delta t + 13.80\,a - 2.67\,c \qquad a = -0^s.465$$
$$0 = -1.79 + 4.32\,\delta t - 2.67\,a + 55.27\,c \qquad c = +0^s.060$$

Second series.

For E.: $0 = +0.86 + 7.00\,\delta t - 1.89\,a$
$0 = -3.14 - 1.89\,\delta t + 9.57\,a \qquad a = +0^s.321$

For W.: $0 = -0.36 + 6.00\,\delta t - 0.10\,a$
$0 = +6.21 - 0.10\,\delta t + 6.91\,a \qquad a = -0^s.898$

Adopted $c = +0^s.074$

The following tables show the corrections and rates of the chronometers used at Julesburg and Ogden:

CHRONOMETER AT JULESBURG.—NEGUS, No. 1344.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1874.	*h.*	*h. m. s.*	*s.*
Oct. 7	19.9	+ 0 03 46.49	0.00
Oct. 8	21.6	46.50	0.00
Oct. 9	20.1	46.13	0.00
Oct. 10	20.0	46.00	0.00
Oct. 11	20.0	+ 0 03 45.95	0.00

CHRONOMETER AT OGDEN.—NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Adopted hourly rate.
1874.	*h.*	*h. m. s.*	*s.*
Oct. 7	20.6	— 0 05 05.730	+ 0.042
Oct. 8	19.3	06 00.750	+ 0.057
Oct. 9	20.7	02.491	+ 0.073
Oct. 10	21.0	04.503	+ 0.084
Oct. 11	20.7	— 0 06 06.878	+ 0.099

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
October 7, 1874:		*h. m. s.*	*h. m. s.*	*h. m. s.*	*m. s.*	*s.*	*m. s.*
Ogden	Julesburg	21 05 33.12	+0 03 46.49	21 09 19.61			
	Ogden	20 36 45.73	—0 05 59.73	20 30 46.00	38 33.61		
Julesburg	Julesburg	21 09 04.88	+0 03 46.49	21 12 51.37			
	Ogden	20 40 17.56	—0 05 59.73	20 34 17.83	33.54	0.07	38 33.575
October 8, 1874:							
Ogden	Julesburg	21 12 12.57	+0 03 46.50	21 15 59.07			
	Ogden	20 43 26.24	—0 06 00.82	20 37 25.42	33.65		
Julesburg	Julesburg	21 15 34.84	+0 03 46.50	21 19 21.34			
	Ogden	20 46 48.62	—0 06 00.82	20 40 47.80	33.54	0.11	33.595
October 9, 1874:							
Ogden	Julesburg	21 16 43.09	+0 03 46.13	21 20 29.22			
	Ogden	20 47 58.26	—0 06 02.49	20 41 55.77	33.45		
Julesburg	Julesburg	21 20 04.85	+0 03 46.13	21 23 50.98			
	Ogden	20 51 20.07	—0 06 02.49	20 45 17.58	33.40	0.05	33.425
October 10, 1874:							
Ogden	Julesburg	21 01 54.81	+0 03 46.00	21 05 40.81			
	Ogden	20 33 11.74	—0 06 04.46	20 27 07.28	33.53		
Julesburg	Julesburg	21 05 14.89	+0 03 46.00	21 09 00.89			
	Ogden	20 36 31.93	—0 06 04.46	20 30 27.47	33.42	0.11	33.475
October 11, 1874:							
Ogden	Julesburg	21 04 30.42	+0 03 45.95	21 08 16.37			
	Ogden	20 35 49.78	—0 06 06.86	20 29 42.92	33.45		
Julesburg	Julesburg	21 07 49.85	+0 03 45.95	21 11 35.80			
	Ogden	20 39 09.36	—0 06 06.86	20 33 02.50	38 33.30	0.15	38 33.375

Julesburg east of Ogden .... $0^h\ 38^m\ 33^s.489 \pm 0^s.029$
Or, $9^\circ\ 38'\ 22''.34 \pm 0''.43$

Observations and computations for latitude.

JULESBURG, COLORADO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 9 ...	8146	14 40.0	26.5	9.3					
	8162	3 67.6	9.0	27.0		40 52 14.5	+ 6 53.4	−0.2	40 59 07.7
	8195	0 38.2	8.0	27.6					
	8223	15 30.0	33.7	2.4		68 40.2	− 9 35.1	+2.7	07.8
	8237	10 80.9	31.3	5.0		65 47.6	− 6 42.0	+1.6	07.2
	8247	4 36.0	9.5	26.0					
	8277	13 08.4	29.0	7.0		64 43.2	− 5 36.3	+1.3	08.2
	8293	0 47.1	26.9	8.5					
	8314	17 50.6	7.0	28.8		70 04.4	−10 56.7	−0.8	06.9
	8324	1 82.0	14.0	21.5					
	8364	16 46.0	24.0	12.5		68 30.1	− 9 24.3	+0.9	06.7
	8372	11 94.0	23.0	13.8		65 36.8	− 6 30.1	+0.4	07.1
	Gr. 4237	6 23.0	18.5	17.8		53 34.6	+ 5 32.3	+1.5	08.4
	13	6 34.0	18.5	17.8		53 39.5	+ 5 28.0	+1.5	09.0
	58	14 85.0	21.2	15.5					
	102	12 80.0	15.0	22.0					
	131	5 50.9	21.3	16.0		54 27.1	+ 4 41.0	−0.4	07.7
	Gr. 96	12 77.7	17.0	19.8		64 25.4	− 5 17.2	−0.4	07.8
	146	11 16.2	17.0	19.8		63 23.0	− 4 15.0	−0.4	07.6
	164	4 54.8	19.0	18.0					
	178	7 86.1	18.8	18.0					
	182	9 76.6	17.3	19.8		60 21.5	− 1 13.4	−0.4	07.7
	215	9 25.5	9.3	28.0					
	244	5 16.1	30.0	7.5		56 27.9	+ 2 37.8	+0.9	06.6
	254	14 95.4	29.8	8.0		62 47.3	− 3 39.7	+0.7	08.3
	283	4 90.7	38.3	......					
	337	10 43.2	......	39.4		62 41.1	− 3 33.0	−0.5	07.6
	351	11 87.2	19.4	17.8					
	376	6 01.6	17.5	19.5		55 22.6	+ 3 45.7	−0.1	08.2
	393	12 93.9	23.0	13.8					
	408	4 38.0	13.0	24.3		64 37.7	− 5 30.0	−0.5	07.2
	444	5 11.3	17.3	20.2					
	476	13 68.1	20.9	17.2		53 36.1	+ 5 30.4	+0.2	06.7
	502	1 60.7	13.9	23.3					
	510	− 0 33.0	23.0	14.5		57 52.3	+ 1 14.7	−0.2	06.8
	535	10 72.2	7.0	29.8		57 28.2	+ 1 40.9	−0.8	08.3
	564	2 26.1	6.0	31.4		52 00.5	+ 7 07.1	−1.4	06.2
	572	13 33.9	28.3	9.1	Dpl. med.				
	610	5 62.2	18.0	19.5		58 27.7	+ 0 41.9	−0.9	08.7
	620	15 20.2	18.0	19.6		40 64 35.8	− 5 27.4	−0.9	40 59 07.2
	632	6 71.0	17.7	20.0					

Observations and computations—Continued.

JULESBURG, COLORADO.

Date.	Number of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 10 ..	8071	4 78.9	18.5	21.1					
	8122	13 16.2	18.0	21.5		40 64 32.7	— 5 22.8	—1.4	40 59 08.5
	8146	14 02.0	26.7	13.0					
	8162	3 24.2	8.7	31.0		52 14.7	+ 6 55.4	—2.0	08.1
	8173	10 96.5	28.4	11.2					
	8182	6 42.8	5.0	34.7		62 03.7	— 2 54.9	—2.9	05.9
	8195	0 97.0	25.0	14.3					
	8223	15 78.1	11.0	29.3		68 40.4	— 9 31.0	—1.8	07.6
	8237	11 29.9	11.0	29.8		65 47.8	— 6 38.2	—1.9	07.7
	8247	3 71.2	37.3	3.0					
	8277	12 38.0	0.0	41.0		64 43.4	— 5 34.1	—1.6	07.7
	8293	0 19.0	22.0	18.5					
	8314	17 15.3	11.2	29.7		70 04.6	—10 53.9	—3.5	07.2
	8324	0 93.0	31.3	9.0					
	8364	15 55.0	7.0	34.0		68 30.3	— 9 23.6	—1.1	05.6
	8372	11 04.0	5.8	35.4		65 37.0	— 6 29.7	—1.7	05.6
	Gr. 4237	6 41.9	25.6	15.0		53 34.9	+ 5 34.8	—2.4	07.3
	13	6 52.2	25.0	15.7		53 39.7	+ 5 30.8	—2.7	07.8
	58	15 10.5	10.2	31.3					
	102	11 95.5	43.0	......					
	131	4 58.5	......	47.2		54 27.3	+ 4 44.1	—2.0	09.4
	Gr. 96	12 73.1	12.5	29.3		64 25.7	— 5 17.8	—1.1	06.8
	146	11 12.0	12.5	29.3		63 23.2	— 4 15.7	—1.1	06.4
	164	4 48.8	27.0	15.1					
	178	8 07.2	25.7	16.0					
	182	9 96.0	15.6	26.3		60 21.7	— 1 12.8	—0.2	08.7
	215	8 77.0	28.6	13.3					
	244	4 61.0	9.7	33.0		56 28.1	+ 2 40.4	—1.9	06.6
	254	14 38.1	7.9	35.0		62 47.5	— 3 36.3	—2.7	08.5
	283	5 30.8	30.4	12.0					
	337	10 75.3	5.0	38.0		62 41.4	— 3 29.9	—3.4	08.1
	351	11 58.5	24.3	18.0					
	376	5 59.4	10.2	32.2		55 22.8	+ 3 50.9	—3.6	10.1
	393	12 47.1	24.2	18.0					
	408	3 99.1	8.8	34.0		64 38.0	— 5 27.0	—4.4	06.6
	444	4 00.4	19.1	23.0					
	476	12 64.7	19.0	23.3		53 36.4	+ 3 33.3	—1.9	07.8
	502	1 64.1	28.5	13.5					
	510	— 0 36.2	8.8	33.0		40 57 52.5	+ 1 17.2	—2.1	40 59 07.6

Observations and computations—Continued.

JULESBURG, COLORADO.

Date.	Number of star.	Microm. readings.	Level.		Remarks.	Half-sum of declination.	Corrections.		Latitude.
			N.	S.			Microm. and refr.	Level.	
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	° ′ ″
October 10 ..	535	13 36.7	31.3	10.2		40 57 28.5	+ 1 42.9	—3.3	40 59 08.1
	564	4 94.0	32.0	9.8		52 00.7	+ 7 07.8	—3.1	05.4
	572	16 03.7	3.3	38.7					
	610	6 11.4	25.2	16.9		58 27.9	+ 0 44.8	—4.8	07.9
	620	15 69.2	27.0	15.0		64 36.0	— 5 24.3	—3.9	07.8
	632	7 27.7	6.5	35.3					
October 11 ..	8146	14 52.2	22.4	17.0	Cloudy.				
	8162	3 73.1	9.6	30.0		52 14.9	+ 6 56.0	—3.5	07.4
	8293	0 07.9	21.0	18.6					
	8314	17 01.6	9.3	29.8		70 04.8	—10 52.9	—4.2	07.7
	146	11 75.0	18.0	22.0					
	164	5 01.9	28.0	12.2		63 23.4	— 4 19.5	+2.7	06.6
	178	8 05.4	22.6	17.3					
	182	10 01.8	23.5	16.6		60 21.9	— 1 15.7	+2.8	09.0
	215	9 03.2	33.0	7.0					
	244	4 99.0	12.2	28.5		56 28.3	+ 2 35.8	+2.3	06.4
	254	14 78.5	12.0	29.0		62 47.7	— 3 41.7	+2.1	08.1
	283	5 06.9	16.0	24.6					
	337	10 67.5	29.5	12.0		62 41.6	— 3 36.1	+2.1	07.6
	351	11 22.1	26.5	14.0					
	376	5 39.5	16.0	25.0		55 23.0	+ 3 44.6	+0.8	08.4
	444	4 55.8	23.2	17.7	Hazy.				
	476	13 23.0	13.9	27.7		53 36.6	+ 5 34.2	—2.0	08.8
	502	1 66.0	26.8	14.0					
	510	— 0 25.0	15.7	25.8		57 52.8	+ 1 13.6	+0.6	07.0
	535	10 95.2	20.0	21.0					
	572	13 52.8	20.3	21.3		57 28.7	+ 1 39.3	—0.5	07.5
	610	6 35.5	21.3	20.2		58 28.1	+ 0 41.1	0.0	09.2
	620	15 94.8	20.2	21.6		40 64 36.3	— 5 28.7	—0.6	40 59 07.0
	632	7 42.1	20.4	21.6					

For the final result of latitude, the pairs 8173 and 8182 and 564 and 572 are excluded, on account of the star positions. The probable error is derived from the single observations belonging to one pair and the mean taken from 23 individual results.

ASTRONOMICAL CO-ORDINATES OF ASTRONOMICAL STATION AT JULESBURG, COLORADO.

Longitude.....$6^h\ 49^m\ 26^s.15 \pm 0^s.029$ or $102° 21′ 32″.30 \pm 0″.43$ west foom Greenwich.
Longitude.....$1^h\ 41^m\ 14^s.03$ or $25° 18′ 30″.50$ west from U. S. Naval Observatory, Washington, D. C.

Latitude ...... $40° 59′ 07″.63 \pm 0″.04$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,

1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

RESULTS

OF

OBSERVATIONS MADE BY DR. F. KAMPF AND JOHN H. CLARK IN THE DETERMINATION OF THE ASTRONOMICAL CO-ORDINATES OF NORTH PLATTE, NEBRASKA.

SEASON OF 1874

COMPUTATIONS BY

Dr. F. KAMPF.

NORTH PLATTE, NEBRASKA.

GEOGRAPHICAL POSITION OF STATION.

Longitude, . . . 100° 45′ 53″.14 ± 0″.95 west from Greenwich.
Latitude, . . . 41° 08′ 18″.33 ± 0″.06 north.
Altitude of observatory above sea-level from railroad surveys, 2789.0 feet.

North Platte is one of the principal stations of the Union Pacific Railroad, and possesses a population of three or four thousand. On the west side of the town, in the center of the military reservation, the astronomical station was fixed.

The adjacent country is level and better fitted for agriculture than the western part of the State. North of the town, distant two miles, is the Platte River, flowing from west to east.

METEOROLOGICAL CONDITIONS.

The weather was fair until the night of October 17. Then the rainy season commenced, compelling the relinquishment of all observations. The ensuing storm continued for three weeks without intermission.

The observatory, instruments, and instrumental values were the same as at Las Vegas. For transmission of signals to Ogden the use of the wire of the Atlantic and Pacific Telegraph Company was kindly granted by the superintendent at Omaha. The local battery at North Platte and a repeater at Cheyenne were employed. The length of circuit, from North Platte to Ogden, was 738 miles.

The astronomer at this station would express his obligations to Captain Mills, in command of the military post, for the assistance rendered by him in erecting the tent and building the monument.

CONNECTIONS.—OBSERVERS.—COMPUTERS.

The longitude was determined by three exchanges with Ogden on October 15, 16, and 17. Observations for latitude were taken on the nights of October 15, 16, and 17. Mr. John H. Clark was observer at Ogden, and Dr. F. Kampf at North Platte. All computations were made by the latter.

Tabulation of stars used for determination of time at Ogden, Utah, and North Platte, Nebraska, 1874.

Name of star.	OGDEN.			NORTH PLATTE.			
	October 15.	October 16.	October 17.	October 15.	October 16.	October 17.	October 18.
α Lyræ	×	×	×	..	..	..	..
β Lyræ	×	×	×	..	..	..	..
σ Sagittarii	..	×	×	..	..	..	..
50 Dracouis	×	..	..	..	..	..	..
γ Lyræ	×	×	×	..	..	..	..
ζ Aquilæ	×	×	×	..	..	..	..
ι Lyræ	×	×	×	..	..	..	..
d Sagittarii	×	×	×	..	..	..	..
τ Draconis	×	×	×	..	..	..	..
β Cygui	×	×	×	..	..	..	..
κ Aquilæ	×	×	×	..	..	..	..
γ Aquilæ	×	×	×	..	..	×	..
α Aquilæ	×	×	×	..	..	×	..
ε Draconis	×	×	×	..	..	×	..
ψ Cygni	..	..	..	..	..	×	..
γ Sagittarii	×	×	×	..	..	..	..
τ Aquilæ	..	..	..	×	×	×	..
3 Ursæ Miuoris, L. C	×	×	..	..	..	..	..
θ Aquilæ	..	..	..	×	×	×	×
31 *o* Cygni	..	..	..	×	×	×	×
α^2 Capricorni	..	..	..	×	..	..	..
κ Cephei	..	..	..	×	×	..	×
γ Cygui	..	..	..	×	×	×	×
θ Cephci	..	..	..	×	×	×	×
β Delphini	..	..	..	×	×	×	×
α Cygni	..	..	..	..	×	×	..
ε Aquarii	..	..	..	×	×	×	×
μ Aquarii	..	..	..	×	×	×	×
12-Year Catalogue, 1879	..	..	..	×	×	×	×
61 Cygni	..	..	..	×	×	..	×
ζ Cygni	..	..	..	..	×	..	×
τ Cygni	..	..	..	×	..	..	..
α Cephei	..	..	..	×	×	..	..
1 Pegasi	..	×	..	..	..	..	..
β Aquarii	..	×	..	..	..	..	..
β Cephei	×	×	..	..	..	..	..
ξ Aquarii	×	×	..	..	..	..	..
ε Pegasi	×	×	..	..	..	..	..
11 Cephei	×	×	..	..	..	..	..
μ Capricorni	×	×	..	..	..	..	..
79 Draconis	×	×	..	..	..	.	..
α Aquarii	×	×	..	..	..	..	..
ζ Cephei	×	×	..	..	..	..	..
θ Aquarii	×	×	..	..	..	..	..
γ Aquarii	×	×	..	..	..	..	..
π Aquarii	×	×	..	.	..	..	..
9 Draconis, L. C	×	×	..	..	..	..	..
226 Cephei	×	×	..	..	..	..	..
ζ Pegasi	×	..	..	..	..	..	..

Observations and reductions for time taken at sending station.

NORTH PLATTE, NEBRASKA, OCTOBER 15, 1874.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	τ Aquilæ	19 47 51.66	— 0.80	0.00	— 0.31	19 47 50.55	19 58 00.96	+ 10 10.41
E.	θ Aquilæ	54 41.14	— 0.94	— 9.05	— 0.31	54 39.84	20 04 50.25	10.41
E.	31*o* Cygni	95 31.00	+ 0.18	— 0.14	— 0.45	59 30.59	09 40.94	10.35
E.	*a*² Capricorni	20 00 57.18	— 1.17	— 0.08	— 0.32	20 00 55.61	11 06.03	10.42
E.	κ Cephei	02 51.66	+ 3.79	— 0.70	— 1.40	02 53.35	13 03.87	10.52
E.	γ Cygni	07 33.92	— 0.04	— 0.30	— 0.40	07 33.18	17 43.74	10.56
E.	ε Cephei	17 18.10	+ 1.11	— 0.53	— 0.67	17 18.01	27 28.40	10.39
E.	β Delphini	21 31.08	— 0.66	— 0.25	— 0.32	21 29.85	31 40.33	10.48
W.	*a* Aquarii	30 44.14	— 1.11	— 0,16	+ 0.31	30 43.18	40 53.66	10.48
W.	μ Aquarii	35 44.26	— 1.10	— 0.16	+ 0.31	35 43.31	45 53.78	10.47
W.	12-Yr. Cat., 1879	42 56.30	+ 5.14	— 0.99	+ 1.79	42 02.24	52 12.66	10.42
W.	61 Cygni	51 06.42	— 0.10	— 0.25	+ 0.39	51 06.46	21 01 17.03	10.57
W.	τ Cygni	59 36.92	— 0.11	— 0.25	+ 0.39	59 36.95	09 47.49	10.54
W.	*a* Cephei	21 05 23.66	+ 1.07	— 0.36	+ 0.66	21 05 25.03	21 15 35.47	+ 10 10.44

NORMAL EQUATIONS.

$$0 = - \;4.39 + 14.00\,\delta t - \;3.73\,a + \;1.06\,c$$
$$0 = + 37.56 - \;3.73\,\delta t + 24.70\,a + \;9.45\,c \qquad a = - 1^s.408$$
$$0 = + 37.07 + \;1.06\,\delta t + \;9.45\,a + 76.87\,c \qquad c = - 0^s.308$$

NORTH PLATTE, NEBRASKA, OCTOBER 16, 1874.

Clamp.	Name of star.	T.	A*a*.	B*b*.	C*c*.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
E.	τ Aquilæ	19 47 51.16	— 0.66	— 0.16	— 0.32	19 47 50.02	19 58 00.95	+ 10 10.93
E.	θ Aquilæ	54 40.64	— 0.78	— 0.20	— 0.32	54 39.34	20 04 50.23	10.89
E.	31*o* Cygni	59 30.54	+ 0.15	— 0.39	— 0.46	59 29.84	09 40.91	11.07
E.	κ Cephei	20 02 51.94	+ 3.13	— 0.96	— 1.45	20 02 52.66	13 03.76	11.10
E.	γ Cygni	07 33.48	— 0.03	— 0.34	— 0.41	07 32.70	17 43.72	11.02
W.	θ Cephei	17 16.28	+ 0.92	— 0.57	+ 0.69	17 17.32	27 28.35	11.03
W.	β Delphini	21 29.74	— 0.55	— 0.27	+ 0.33	21 29.25	31 10.32	11.07
W.	*a* Cygni	26 58.20	+ 0.10	— 0.36	+ 0.45	26 58.39	37 09.53	11.14
W.	ε Aquarii	30 43.40	— 0.92	— 0.15	+ 0.33	30 42.66	40 53.64	10.98
W.	μ Aquarii	30 43.62	— 0.91	— 0.13	+ 0.32	30 42.90	40 53.76	10.86
W.	12-Yr. Cat., 1879.	42 56.24	+ 4.25	— 0.72	+ 1.85	42 01.62	52 12.53	10.91
W.	61 Cygni	51 05.68	— 0.08	— 0.16	+ 0.41	51 05.85	21 01 17.01	11.16
E.	ζ Cygni	57 26.16	— 0.27	— 0.14	— 0.37	57 25.38	07 36.31	10.93
E.	*a* Cephei	21 05 24.86	+ 0.89	— 0.40	— 0.68	21 05 24.67	21 15 35.43	+ 10 10.76

NORMAL EQUATIONS.

$$0 = - \;5.46 + 14.00\,\delta t - \;4.50\,a - \;1.11\,c$$
$$0 = + 30.65 - \;4.50\,\delta t + 24.06\,a + \;8.31\,c \qquad a = - 1^s.165$$
$$0 = + 34.43 - \;1.11\,\delta t + \;8.31\,a + 77.53\,c \qquad c = - 0^s.319$$

Observations and reductions for time taken at sending station—Continued.

NORTH PLATTE, NEBRASKA, OCTOBER 17, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	γ Aquilæ	19 30 07.48	+ 0.32	— 0.10	— 0.25	19 30 07.45	19 40 17.85	+ 10 10.40
E.	α Aquilæ	34 29.46	+ 0.33	— 0.17	— 0.25	34 29.37	44 39.89	10.52
E.	ε Draconis	38 26.16	— 0.89	— 0.56	— 0.71	38 24.00	48 34.49	10.49
E.	ψ Cygni	42 13.28	— 0.19	— 0.40	— 0.40	42 12.29	52 22.98	10.69
E.	τ Aquilæ	47 50.36	+ 0.35	— 0.22	— 0.25	47 50.24	58 00.93	10.69
E.	θ Aquilæ	54 39.54	+ 0.41	— 0.22	— 0.24	54 39.49	20 04 50.22	10.73
E.	31 o Cygni	59 30.92	— 0.08	— 0.47	— 0.35	59 30.02	09 40.89	10.87
W.	γ Cygni	20 07 32.98	+ 0.02	— 0.42	+ 0.32	20 07 32.90	17 43.70	10.80
W.	θ Cephei	17 18.22	— 0.48	— 0.63	+ 0.53	17 17.64	27 28.31	10.67
W.	β Delphini	21 29.48	+ 0.29	— 0.28	+ 0.25	21 29.74	31 40.30	10.56
W.	α Cygni	26 59.04	— 0.06	— 0.40	+ 0.34	26 58.92	37 09.50	10.58
W.	ε Aquarii	30 42.46	+ 0.48	— 0.16	+ 0.25	30 43.03	40 53.63	10.60
W.	μ Aquarii	35 42.70	+ 0.48	— 0.16	+ 0.25	35 43.27	45 53.75	10.48
W.	12-Yr. Cat., 1879	20 43 03.98	— 2.23	— 1.35	+ 1.41	20 43 01.81	20 53 12.40	+ 10 10.59

NORMAL EQUATIONS.

$$0 = -2.72 + 14.00\,\delta t - 2.05\,a - 3.70\,c$$
$$0 = -6.70 - 2.05\,\delta t + 18.95\,a + 18.29\,c \qquad a = +0^{s}.612$$
$$0 = +4.82 - 3.70\,\delta t + 18.29\,a + 62.52\,c \qquad c = -0^{s}.243$$

NORTH PLATTE, NEBRASKA, OCTOBER 18, 1874.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	θ Aquilæ	19 54 38.86	+ 0.51	— 0.08	— 0.40	19 54 38.89	20 04 50.20	+ 10 11.31
E.	31 o Cygni	59 30.50	— 0.10	— 0.17	— 0.58	59 29.65	09 40.86	11.21
E.	κ Cephei	20 02 56.59	— 2.03	— 0.44	— 1.84	20 02 52.28	13 03.54	11.26
E.	γ Cygni	07 33.04	+ 0.02	— 0.17	— 0.52	07 32.37	17 43.68	11.31
E.	θ Cephei	17 18.96	— 0.60	— 0.30	— 0.87	17 17.19	27 28.26	11.07
E.	β Delphini	21 29.22	+ 0.35	— 0.15	— 0.42	21 29.00	31 40.28	11.28
W.	ε Aquarii	30 41.60	+ 0.60	— 0.13	+ 0.41	30 42.48	40 53.62	11.14
W.	μ Aquarii	35 41.64	+ 0.59	— 0.10	+ 0.41	35 42.54	45 53.74	11.20
W.	12-Yr. Cat., 1879	43 01.74	— 2.76	— 0.30	+ 2.34	43 01.02	53 12.27	11.25
W.	61 Cygni	51 05.18	+ 0.05	— 0.05	+ 0.51	51 05.69	21 01 16.97	11.28
W.	ζ Cygni	20 57 24.46	+ 0.17	— 0.03	+ 0.46	20 57 25.06	21 07 36.27	+ 10 11.21

NORMAL EQUATIONS.

$$0 = +0.08 + 11.00\,\delta t - 4.22\,a + 1.26\,c$$
$$0 = -13.57 - 4.22\,\delta t + 23.15\,a + 6.24\,c \qquad a = +0^{s}.755$$
$$0 = +23.09 + 1.26\,\delta t + 6.24\,a + 69.98\,c \qquad c = -0^{s}.403$$

The corresponding observations taken at Ogden, Utah, will be found in the report on determination of longitude of that station, season of 1874.

The following tables show the corrections and rates of the chronometers used at North Platte and Ogden:—

CHRONOMETER AT NORTH PLATTE—NEGUS, No. 1344.

Date.	Local sidereal time.	Correction of chronometer.	Hourly rate.
1874.	*h.*	*h. m. s.*	*s.*
October 15	20.6	+ 0 10 10.46	— 0.022 + 0.015 — 0.025
October 16	20.1	10.99	
October 17	20.3	10.62	
October 18	20.6	+ 0 10 11.23	

CHRONOMETERS AT OGDEN.

NEGUS, No. 1511.

Date.	Local sidereal time.	Correction of chronometer.	Hourly rate.
1874.	*h.*	*h. m. s.*	*s.*
October 15	20.63	— 0 06 16.972	+ 0.0533

NEGUS, No. 1491.

Date.	Local sidereal time.	Correction of chronometer.	Hourly rate.
1874.	*h.*	*h. m. s.*	*s.*
October 16	20.59	— 0 06 2.49	+ 0.0801
October 17	19.20	— 0 06 4.26	+ 0.0917

Final results of longitude.

Signals sent from—	Recorded at—	Mean of signals sent and received.	Time-corrections.	Corrected time.	Difference of longitude.	Double-wave time.	Means.
		h. m. s.	*h. m. s.*	*h. m. s.*	*m. s.*	*s.*	*s.*
October 15, 1874:							
Ogden	North Platte	21 43 04.07	+ 0 10 10.49	21 53 14.56			
	Ogden	21 14 35.21	— 0 06 17.00	21 08 18.21	44 56.35		
North Platte	North Platte	21 46 45.14	+ 0 10 10.49	21 56 55.63			
	Ogden	21 18 16.47	— 0 06 17.00	21 11 59.47	56.16	0.19	56.255
October 16, 1874:							
Ogden	North Platte	21 34 51.45	+ 0 10 10.97	21 45 02.42			
	Ogden	21 06 08.74	— 0 06 02.52	21 00 06.22	56.20		
North Platte	North Platte	21 38 20.47	+ 0 10 10.97	21 48 31.44			
	Ogden	21 09 37.93	— 0 06 02.52	21 03 35.41	56.03	0.17	56.115
October 17, 1874:							
Ogden	North Platte	21 31 23.99	+ 0 10 10.65	21 41 34.64	56.00		
	Ogden	21 02 43.07	— 0 06 04.43	20 56 38.64			
North Platte	North Platte	21 34 55.58	+ 0 10 10.65	21 45 06.23			
	Ogden	21 06 14.81	— 0 06 04.44	21 00 10.37	44 55.86	0.14	55.930

North Platte east of Ogden .... $0^h\ 44^m\ 56^s.100 \pm 0^s.063$

Or, $11^\circ\ 14'\ 01''.50 \pm 0^s.95$

Observations and computations for latitude.

NORTH PLATTE, NEBRASKA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
October 15..	7994	— 2 54.0	35.8	5.0						
	8023	12 25.0	4.0	37.5		41 17 49.0	— 9 30.1	— 0.6	....	41 08 18.3
	8106	12 66.7	17.9	24.7		08 20.8	— 0 04.5	+ 1.5	....	17.8
	8173	2 88.1	17.3	25.8		02 04.7	+ 6 12.7	+ 1.1	....	18.5
	8182	12 55.0	28.2	15.0						
	8195	8 82.6	25.8	17.0						
	8223	9 47.5	22.0	21.4		08 41.5	— 0 25.0	+ 2.2	....	18.7
	8237	4 94.5	20.0	23.5		05 48.8	+ 2 29.6	+ 1.2	......	19.6
	8268	3 36.0	37.3	6.2		12 07.5	— 3 49.7	+ 1.6	....	19.4
	8282	17 97.8	36.7	7.0		21 30.5	—13 13.2	+ 1.3	....	18.6
	8324	— 2 59.8	10.0	34.0						
	16	18 31.0	34.2	10.1						
	67	0 68.8	10.5	33.8		19 37.4	—11 19.4	+ 0.2	....	18.2
	100	8 84.0	21.3	23.0		14 18.6	— 6 01.0	+ 2.2	....	19.8
	152	13 31.2	21.3	23.6		17 10.6	— 8 53.3	+ 2.0	....	19.3
	173	— 0 52.2	28.0	17.0						
	215	13 68.1	16.0	28.3						
	254	5 11.1	28.0	16.8		02 48.7	+ 5 30.4	— 0.3	....	18.8
	412	4 20.2	32.3	12.2		05 20.5	+ 2 59.9	— 0.2	....	20.2
	444	17 68.5	31.0	14.3		14 00.2	— 5 39.8	— 0.9	....	19.5
	453	8 87.0	12.3	33.0						
	487	16 92.0	35.9	9.8						
	516	1 42.0	12.3	33.4		18 16.8	— 9 57.5	+ 1.1	....	20.4
	540	3 78.5	40.3	5.3						
	576	11 08.9	7.2	38.7		03 36.8	+ 4 41.5	+ 0.8	....	19.1
	658	9 49.0	31.7	13.9						
	666	3 70.4	11.3	34.0		12 03.8	— 3 43.1	— 1.1	....	19.6
	691	7 93.3	34.0	11.0						
	715	11 62.1	16.0	29.6		10 38.2	— 2 22.1	+ 2.2	....	18.3
	731	5 10.7	14.0	31.3		06 28.9	+ 1 48.9	+ 1.3	....	19.1
October 16..	7856	3 13.0	17.7	19.0						
	7902	14 67.0	19.7	17.5		15 42.4	— 7 24.9	+ 0.2	....	17.7
	7917	15 02.4	37.7	......		01 48.2	+ 6 33.8	— 3.3	....	18.7
	7932	4 80.8	......	44.7		05 38.9	+ 2 42.4	— 4.1	....	17.2
	7962	10 81.0	......	46.4						
	7972	8 66.7	19.0	18.0						
	7976	14 43.0	6.5	30.0		04 38.4	+ 3 42.2	— 5.1	....	15.5
	7984	4 72.6	9.6	27.0		10 50.7	— 2 31.9	— 3.9	....	14.9
	7994	— 1 20.4	31.2	5.0						
	8023	13 51.2	1.1	36.0		41 17 49.1	— 9 27.3	— 2.0	....	41 08 19.8

Observations and computations—Continued.

NORTH PLATTE, NEBRASKA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude
1874.		*t.* *d.*	*d.*	*d.*		° ′ ″	′ ″	″	″	° ′ ″
October 16..	8106	12 28.6	9.0	28.2		41 08 21.0	− 0 06.2	+ 1.8	....	41 08 16.6
	8173	2 47.4	5.9	31.6		02 04.9	+ 6 12.1	+ 0.3	....	17.3
	8182	12 12.5	32.0	5.0						
	8195	8 52.1	34.0	2.3						
	8223	9 11.0	2.5	34.0		08 41.7	− 0 22.7	0.0	....	19.0
	8237	4 58.7	2.0	34.7		05 47.1	+ 2 31.6	− 0.2	....	18.5
	8268	7 26.1	11.8	24.8		12 07.8	− 3 52.0	+ 2.1	....	17.9
	8282	21 81.7	5.0	31.7		21 30.6	−13 13.2	− 0.9	....	16.5
	8324	1 24.1	29.8	7.8						
	16	17 01.6	23.2	14.3						
	67	− 0 66.0	13.6	24.0		19 37.6	−11 21.4	− 0.3	....	15.9
	100	12 01.5	14.3	23.0		14 18.8	− 6 02.0	+ 1.4	....	18.2
	152	16 47.0	13.8	24.0		17 10.9	− 8 53.7	+ 1.0	....	18.2
	173	2 62.5	26.4	11.8						
	215	13 86.6	20.1	18.0						
	254	5 30.1	17.9	20.5		02 48.9	+ 5 30.2	− 0.1	....	19.0
	283	12 47.2	14.7	24.0						
	337	3 82.0	31.0	8.3		02 42.8	+ 5 33.5	+ 3.1	....	19.4
	412	3 95.7	11.9	26.8		05 20.7	+ 2 53.6	+ 4.8	....	19.1
	444	17 43.6	9.0	29.8		14 10.4	− 5 46.0	+ 3.5	....	17.9
	453	8 46.1	37.3	1.6						
	487	17 37.2	21.2	17.6						
	516	1 79.2	21.3	18.0		18 17.0	−10 00.6	+ 1.6	....	18.0
	540	3 20.7	17.3	22.0						
	576	10 57.0	19.7	20.0		03 37.0	+ 4 43.8	− 1.2	....	19.6
	647	14 14.1	24.6	15.0		04 53.9	+ 3 24.1	+ 1.7	....	19.7
	658	8 84.5	18.8	21.0						
	666	2 96.9	26.5	13.3		12 04.0	− 3 46.6	+ 2.6	....	20.0
	691	8 04.0	21.3	18.7						
	715	11 77.6	25.3	14.6		10 38.4	− 2 24.0	+ 3.1	....	17.5
	731	5 27.0	24.4	15.9		06 29.2	+ 1 46.8	+ 2.6	....	18.6
October 17..	7856	3 35.7	17.3	17.9						
	7902	14 91.0	18.0	17.9		15 42.5	− 7 25.3	− 0.1	....	17.1
	7917	15 03.1	17.4	18.2						
	7932	4 90.4	19.6	16.0		01 48.2	+ 6 30.3	+ 0.6	....	19.1
	7962	10 92.1	18.0	18.0		05 39.1	+ 2 38.4	− 0.2	....	17.3
	7972	6 33.7	16.2	19.6						
	7978	12 05.7	18.0	17.7		04 38.6	+ 3 40.5	− 0.7	....	18.4
	7984	2 33.0	20.5	15.0		10 50.9	− 2 34.4	+ 0.5	....	17.0
	7994	− 0 52.1	6.0	29.0						
	8023	14 32.9	32.0	4.3		41 17 49.4	− 9 32.4	+ 1.1	....	41 08 18.1

Observations and computations—Continued.

NORTH PLATTE, NEBRASKA.

Date.	No. of star.	Microm. readings.	Level. N.	Level. S.	Remarks.	Half-sum of declination.	Corrections. Microm. and refr.	Corrections. Level.	Corrections. Merid.	Latitude.
1874.		t. d.	d.	d.		° ′ ″	′ ″	″	″	° ′ ″
October 17..	8106	12 64.0	12.8	24.8		41 08 21.2	− 0 04.7	+ 0.5	....	41 08 17.0
	8173	2 85.6	13.8	23.9		02 05.0	+ 6 12.4	+ 0.9	....	18.3
	8182	12 51.7	25.8	11.7						
	8195	9 02.1	17.8	19.3						
	8223	9 68.3	24.0	13.5		08 41.9	− 0 25.5	+ 2.1	....	18.5
	8237	5 19.0	23.0	15.0		05 49.2	+ 2 27.6	+ 1.7	....	18.5
	8268	5 21.1	24.0	14.0		12 08.0	− 3 49.7	+ 0.5	....	18.8
	8282	19 89.4	24.6	14.0	25^s p. m.	21 30.8	−13 15.7	+ 0.7	+ 0.1	15.9
	8324	− 0 74.7	15.8	23.4						
	16	17 87.0	21.2	18.3						
	67	0 19.8	19.7	20.0		19 37.8	−11 21.3	+ 0.6	....	17.1
	100	8 90.0	21.0	18.0		14 19.1	− 6 05.3	+ 4.3	....	18.1
	152	13 38.5	21.2	18.2		17 11.1	− 8 58.1	+ 4.3	....	17.3
	173	− 0 57.4	27.3	11.8						
	283	13 42.2	4.8	33.2						
	337	4 75.1	38.7	−0.4		02 43.0	+ 5 34.3	+ 2.5	....	19.8
	368	3 91.2	17.4	20.0						
	387	13 27.0	23.0	15.2		14 55.7	− 6 39.3	+ 1.2	....	17.6
	412	4 45.6	18.1	20.5		05 20.9	+ 2 55.5	+ 1.9	....	18.3
	444	17 93.3	18.8	20.6		14 00.7	− 5 44.1	+ 2.0	....	18.6
	453	9 00.9	24.9	14.5						
	487	16 18.8	23.2	15.8						
	516	0 54.1	27.0	12.7		18 17.3	−10 03.2	+ 5.0	....	19.1
	540	4 49.2	19.6	20.2						
	576	11 75.0	22.3	17.9		03 37.3	+ 4 39.8	+ 0.9	....	18.0
	647	13 46.1	17.2	22.3		04 54.1	+ 3 22.1	+ 3.5	....	19.7
	658	8 21.8	30.0	9.7						
	666	2 25.7	20.0	19.5		12 04.2	− 3 49.7	+ 4.8	....	19.3
	691	8 28.8	16.6	23.0						
	715	12 03.7	30.5	9.2		10 38.6	− 2 24.5	+ 3.5	....	17.6
	731	5 52.2	30.6	9.5		41 06 29.4	+ 1 46.6	+ 3.4	......	41 08 19.4

For the method used in deriving the result for latitude, see the report on Julesburg station.

ASTRONOMICAL CO-ORDINATES OF ASTRONOMICAL STATION AT NORTH PLATTE, NEBRASKA.

Longitude.. $6^h\ 43^m\ 03^s.54 \pm 0^s.063$ or $100°\ 45'\ 53''.14 \pm 0''.95$ west from Greenwich.
Longitude.. $1^h\ 34^m\ 51^s.42$ or $23°\ 42'\ 51''.34$ west from U. S. Naval Observatory, Washington, D. C.
Latitude... $41°\ 08'\ 18''.33 \pm 0''.06$ north.

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

APPENDIX TO PART I, VOLUME II,

COMPRISING

UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., March 1, 1874.

SIR: I submit herewith a report of astronomical observations made during the season of 1873, at the main or receiving station, Salt Lake City, Utah.

GEOGRAPHICAL POSITION OF STATION.

The Salt Lake City observatory, belonging to the Mormon Church, was occupied as the main or receiving station, and with it all the primary astronomical points, except Bozeman, Montana, were connected telegraphically for difference of longitude.

It is situated in Temple Square, about one hundred feet from the south-east corner, than which no position more objectionable could have been selected for such a purpose.

PHYSICAL SURROUNDINGS.

By its location the observatory is subject to the dust and smoke of the city, the noise of travel in the adjacent streets, and, worst of all, to the heavy concussions to which, from its construction, the Temple is subject. It is so hemmed in that from the position of the instrument nothing terrestrial can be seen but the top of a distant mountain, by which the city is bounded to the northward. In the south there is no horizontal view possible in consequence of the interposition of the wall of the Temple yard. Eastward this wall again shuts off the prospect, but to the west there is an open view past the Tabernacle and over the trees and house-tops to the Great Salt Lake and the adjacent mountains.

Among the first settlers of the Salt Lake Valley there is a common opinion that the rains are now more abundant than in former times, and the cause is attributed to the growing of trees, and the introduction of the telegraph wires and railroad track. There are probably no sufficient data for such a conclusion, especially as regards the telegraph and railway. However, the meteorological record taken at my astronomical stations for the years 1872 and 1873 favors the popular notion, and shows a cumulative amount of moisture, cloudy weather, storm, and rain.

On several occasions during this season it was not possible to accomplish a complete set of observations on any one night for a week at a time, in consequence of the clouds and rain, and there was one feature about this weather which was especially unfavorable for astronomical work. This was that atmospheric condition in which the sky would become cloudy and remain so during the night, while through the day the sun would dispel the mist and shine with its wonted power. The heaviest rains occurred in the afternoon, accompanied in most instances with many electrical phenomena, and showers in full sunshine were quite frequent. These storms, unlike those of the previous season, came from every quarter, and not alone from the south and west, which are believed to be their prevailing direction during the summer months.

There were seven cloudy nights in June, of which four only were of such a character as to prevent all observations. July 10 and 11 were slightly cloudy; July 20, 21, and 22, quite so; for the rest of the month there was no obscuration of the heavens whatever, the nights being all that the most ardent observer could desire. August 3, 8, 9, 10, 11, 12, 21, 22, 23, 29, 30, and 31, twelve days in all, were more or less cloudy. On September 1, 2, 3, 15, 18, and 27, six days only, observations were impossible. The first week in October was clear; in that time the difference of longitude between Salt Lake City and Ogden observatory was determined, and then the latter place was occupied as the base for astronomical observations.

DESCRIPTION OF OBSERVATORY.

The observatory consists of a double house, one enveloping the other. The inner one of these is of frame-work, and was built by the United

States Coast Survey; the outer is of adobe material, and was constructed by the Mormons. The observing-room presents a space of about ten by fifteen feet and is supplied with two stone pillars, on the western one of which the transit was mounted, and the observations in connection with the various stations of the season were made. The openings in the roof over the eastern pillar are sufficient for latitude work only, and over the western block they extend no farther than the eaves. This arrangement is enough for the purposes of the owners, as they make no other use of their transit than to get the time by the sun, but it is insufficient for complete astronomical work. The pillars are solid blocks of sandstone, pretty well dressed, particularly the western one. They are firmly planted, and, considering the surroundings, stand remarkably steady.

Two soldiers of the Engineer Battalion, Looram and Kirkpatrick, were detailed to assist me and keep a meteorological record. I found them intelligent and attentive to their duty. After a few weeks Kirkpatrick was put in service with Mr. W. D. Wheeler at the Ogden observatory and elsewhere, while Looram remained and rendered all the assistance required.

All connections were made over the Western Union lines of telegraph, except with Green River, which was by way of the Deseret of Utah and the Atlantic and Pacific, and with the secondary stations at Provo and Richfield, which were also connected by the Deseret wires. Mr. Dougall, of the Deseret office, directed or personally performed all the operating done with these and the Atlantic and Pacific wires, while Mr. W. P. Baker, a very efficient operator of the Western Union office, did the telegraphing necessary over this line. At times, when the regular incumbent could not be present, Mr. Oscar G. Sawyer, one of the oldest and most expert operators in the country, gratuitously supplied his place. It is but a small tribute to the many gentlemen of the telegraph lines with whom I have been brought in contact while on duty with your expedition, to say that without exception they always afforded me every facility in their power, although many times it caused them annoyance and interruption, especially when they were pressed with overland business, which was often the case.

Transit.—The transit used was the Würdemann, No. 19, which belongs to the Ogden observatory. Its focal length is 31 inches and its aperture

$2\frac{1}{2}$ inches. Originally it had nine wires, but four were broken or were so indistinct that they could not be used in observations. The remaining five were fortunately adjacent, but, since they were on one side of the diaphragm, they had to be adjusted to the central positions. Making observations with this instrument by means of electro-magnetism is unnecessarily tedious, as its equatorial intervals are 23 seconds. The bearings of its axes are a little worn and the illumination is somewhat imperfect; otherwise, it and its appurtenances are in good order.

Chronograph.—The observations were made and recorded by the instrumentality of a local battery and chronograph. A description of this machine is given in the report upon the determination at Cheyenne.* It was run with much less trouble than during the previous season, owing partly to a better knowledge of the workings of the instrument and partly to the improvement which it had undergone. For field-work it should be further improved by covering the axes of the wheels so as to exclude the dirt. On this account I found it necessary on several occasions to take it to pieces, which is a troublesome job in itself, besides necessitating a readjustment of the spring balances for the proper movement, an operation that requires no little time, patience, and skill. A weight of 150 pounds was used, although it is quite probable that the spring would vibrate with more regularity and would altogether act better under a greater driving power. Still I was afraid to apply it, even though the cord was iron, having a vivid recollection of the perplexities that befell me in this line during the previous season. The ordinary glass pen, so universally used in connection with the chronograph, is a great nuisance, failing very often at a critical moment. Dr. Kampf has substituted a simple but very effective contrivance by which an ordinary writing-pen is made to do this work with great certainty and perfection.

Chronometer.—The chronometer that fell to my lot was the Negus, break-circuit, No. 1511. It was received, corked for transportation, from the hands of Mr. Negus, in New York, and placed in motion only after arrival in Salt Lake City. For the month of June and up to July 4 it had a mean gaining rate of one and three-tenths seconds for every 24

* Published in 1874.

hours. Then, to July 19, its average rate was four-tenths of a second, still gaining, and from about July 24 till August 28 it had a mean rate of zero, seldom showing in that time a variation in clock-error of as much as one-tenth of a second from sidereal time in 24 hours. From August 20 to August 25 it gained two seconds, whether gradually or by a jump I had no observations to show. Up to about August 31 it again ran with sidereal time. For September and till October 5, when the observations at Salt Lake City were finished, its average gaining rate per day of 24 hours was two-tenths of a second. The electrical current was kept on only while observing, and, so far as I could perceive, did not affect its rate.

It went the season through without repair, though occasionally making faint half-second breaks, but not so as to interfere with the reading. The meteorological record will show the temperature to which the chronometer was exposed, but only approximately, for the thermometer was necessarily kept on the outside of the observatory, while the chronometer, being within, was in a much cooler and more equable atmosphere.

Battery.—At first I used one of the carbon batteries with which the astronomical parties were furnished. It is very compact, not liable to be broken, and has the great advantage of evolving electrical power almost instantaneously, but exhausts its force in about twenty hours when worked with acids, as was necessary, thus requiring a renewal at every set of observations. Having burnt out the zincs in a few weeks, I resorted to the form used the previous season, known as the Hill battery. With the fluid that belongs with the carbon battery, it would probably work a season through with but few renewals, and for field purposes possibly be superior to any other form.

CONNECTIONS.—OBSERVER.—COMPUTER.

The places with which corresponding observations were made for the determination of the differences of longitude were Green River, Wyoming, and Winnemucca and Virginia City, Nevada, occupied by Mr. Maryatt; Georgetown, Hughes, Colorado Springs, Labran, and Trinidad, Colorado, and Ogden, Utah, occupied by Dr. Kampf; and Santa Fé and Fort Union, New Mexico, occupied by Professor Safford. Besides the stations recounted above, two connections for longitude were made in conjunction with Lieutenant Hoxie at Provo, Utah, June 1, 2, and 3, and at Richfield, Utah, July 16. The determination of time by Lieutenant Hoxie was with the sextant.

With the assistance of Mr. William Looram, I read off during the season all the observations from the chronographic sheets, duplicated them, and made some progress in their reduction. Since that time they have been entirely and finally computed by myself in the office. These reductions, with the circumstances of communication with the connected stations, will be found in the accompanying special reports on those stations.

INSTRUMENTAL VALUES.

The value of each division of the striding-level used was $1''.60$, according to Mr. Austin's measurement, a very satisfactory one, made in 1871. The thread of the micrometer-screw was broken, but there was no occasion to use it, even if it had been intact. The collimation, as developed by the computations, remained quite constant, showing a mean value during the season of $0^s.13$ plus, clamp east. In its variation it depended much upon the number and positions of the stars grouped in eliminating its value by the method of least squares. The azimuth gave me some trouble, not because of any unsteadiness of the instrument, but by reason of the unskillful handling it received from its owners when they came to regulate their time from observations on the sun.

Both chronometric and arbitrary breaks were made use of in the interchange of signals whenever the wires were working well enough to admit of it. In general there was no trouble in this respect, except at side-stations, like Trinidad, or over a long and poor line, as that to Santa Fé. In such cases we resorted to arbitrary signals recorded by sound. Sometimes it was difficult to get chronometric breaks over the main lines, especially where there was much of what the operators called sympathetic escapement, or when a storm, charged with atmospheric electricity, was bursting somewhere on the circuit. Although the observatory was situated between the city office and all the stations with which exchanges were made, the circuit was nevertheless closed through it. This was a fortunate circumstance, for my operator always required its assistance to make the necessary switches to enable him to call up the various offices, particularly Corinne, Ogden, and Cheyenne, to know if the line could be got, and, if so, to have them "straighten the wire" and be on hand to adjust the repeaters for the signals.

The work of the season at Salt Lake City extended from May 31 to October 5, 1873, and embraced exchanges with four different parties, as already stated. Having so many to respond to, with weather-reports oftentimes failing, I was necessarily forced, in order to be prepared with clock-error, to observe almost every available night, Sundays included; yet in all this time, though I did not once fail to make the effort, I succeeded in making exchanges but one Sunday night, and those were with the neighboring station, Ogden. The difficulty lay in the fact that the operators could not be kept at hand to see that the circuit was closed and the "wire straightened." I do not mention this as a matter of fault-finding, but simply to assign the reason for failing to utilize the night which would naturally be supposed to be the best opportunity for astronomical work, it being for business a *dies non.*

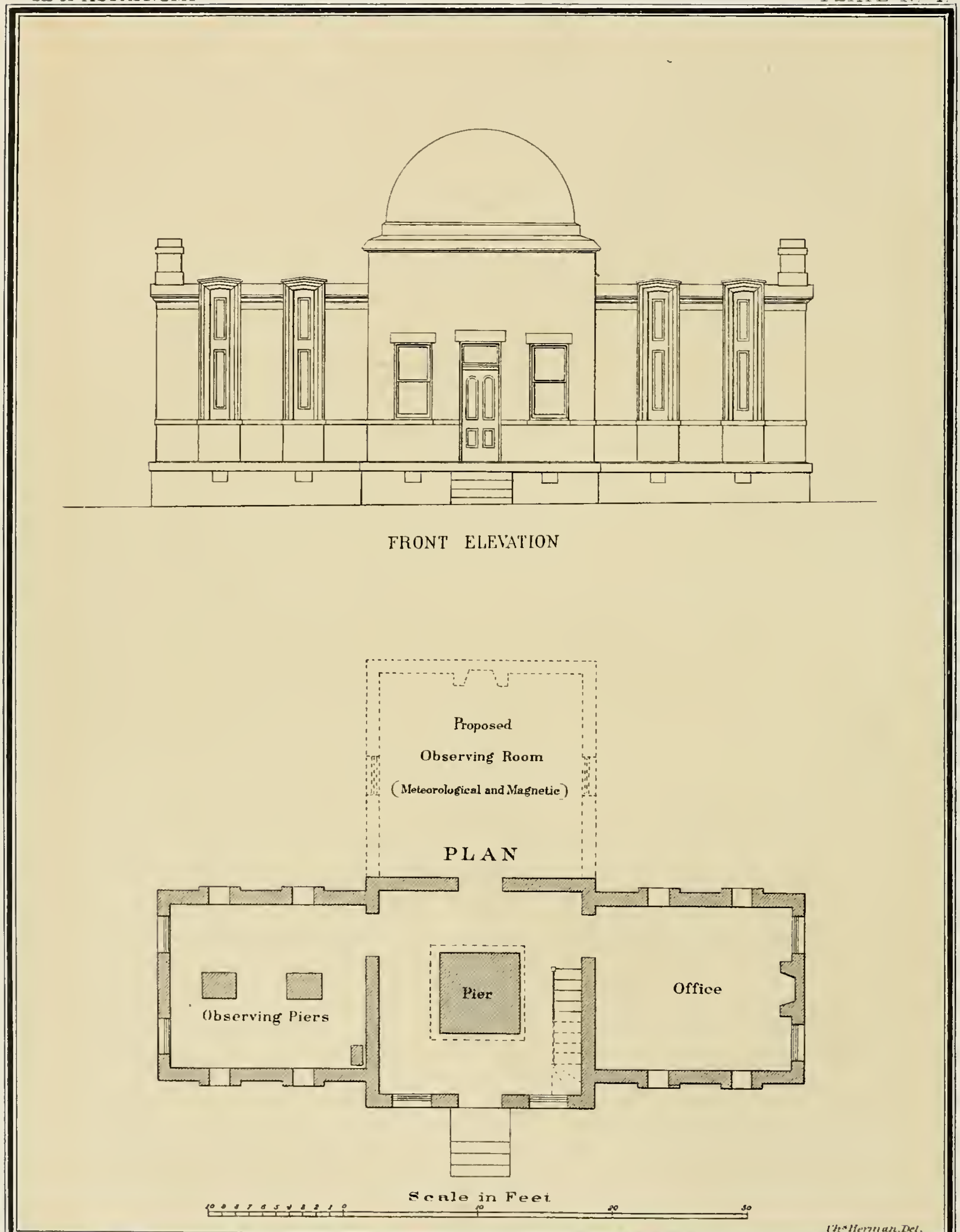
I have made a complete and final reduction of all the observations by the method of least squares. They show a very small probable error, and I can say of them that I believe that the longitudes deduced from them will compare favorably with any field-determinations heretofore made under your direction.

Very respectfully, your obedient servant,

JOHN H. CLARK.

First Lieut. GEORGE M. WHEELER,

Corps of Engineers, United States Army, in charge.



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PLAN AND ELEVATION of the ASTRONOMICAL OBSERVATORY at OGDEN, UTAH.
ERECTED 1873.

ASTRONOMICAL OBSERVATORY AT OGDEN, UTAH.

The observatory built at Ogden, Weber County, Utah, has been mentioned briefly in the report upon the determination of the astronomical co-ordinates of that station.

The plan and front elevation of the structure as now completed are shown in Plate I, and also the plan of an additional room intended for meteorological and magnetic observations. The topographical sketch (Plate II) of Ogden and vicinity has located upon it the position of the observatory. The wire of the Western Union Telegraph Company has been conducted to the site, and connection may be readily made also with the wires of the Atlantic and Pacific and Deseret lines. Magnetic observations may also be made in the central room, beneath the dome-room, and also in the basement beneath this same space. An additional room, leading to or adjoining a long hall or gallery for photographic purposes, may be constructed in a position similar to that one shown for the north extension, and thus add, with little expense, to the value of the building as a permanent field-observatory.

It had been the intention to recommend its occupation for a complete series of observations throughout the year by an engineer officer, an assistant observer, and a detail of non-commissioned officers and enlisted men, not exceeding fifteen, from the Engineer Battalion.

The reduction of the Engineer Battalion occurred at or about the date of establishing this observatory, and request for such authority has consequently been delayed. Any or all of the force stationed at this point could take service during the spring, summer, and fall months with the expedition parties regularly dispatched to regions north and south of the Pacific Railroads.

It will be noticed from the sketch that four railroads leading toward the cardinal points center at Ogden, *i. e.*, (1) Union Pacific Railroad, (2) Central Pacific Railroad, (3) Utah Central Railroad, and (4) Utah Northern Railroad; and hence *sending*-stations embracing a large field in longitude can be reached from this point, while by the establishment of additional receiving-stations, one near the Sierras and another at the east base of the Rocky Mountains, near the fortieth parallel, telegraphic signals may be interchanged with most of the points at which it will prove necessary to determine astronomically longitudes and latitudes in the prosecution to completion of the topographical surveys covering the entire region west of the one hundredth meridian.

The Wahsatch range limits the horizon to the east, and crests of mountains to the westward of the Great Salt Lake on the west. The northwest arm of the Wahsatch and the Promontory ranges lie to the north and east and north and westward, and the Oquirrh range to the southward.

It is to be noticed that, independently of the facilities for telegraphic communication over main lines, a typical point in the Great Salt Lake Basin has been selected at and from which the meteorological conditions of this section of the great interior basin can be studied, and from which surveys of a topographical and hydrographical character may be made to define the conditions of moisture in this part of the extended interior plateaux without ocean drainage, and its other physical peculiarities.

The point named Observatory Peak is believed to be as favorably situated for an observatory at a high altitude as any of the number of mountain-peaks exceeding ten thousand feet in the entire Western mountain region lying in the vicinity of the fortieth parallel. Its accessibility is an element of convenience, and the comparably small number of storms noted about its summit by inhabitants of this section has a practical significance to the observer.

The relative humidity, as shown by the comparison of differences of wet and dry bulb, is less than at peaks ordinarily of elevations of ten thousand feet. The consequent variety and brilliance of the atmosphere lend

Prepared Under the Direction of 1st Lt. Geo. M. Wheeler, Corps of Eng^{rs} U.S. Army.

Scale in Feet.

1000 0 1000 2000 3000 4000 5000

TOPOGRAPHICAL SKETCH Showing OBSERVATORY SITE And Surroundings AT OGDEN, UTAH.

SURVEYED 1877.

Geographical Position of Centre of East Pier in West Room

Long. 111° 59′ 54″.64 Lat. 41° 13′ 08″.56.

Altitude 4374.0 ft. Above Sea

Surveyed by Thompson & Wrigo Weyss & Lang Del.

The Graphic Co. N.Y.

BY ORDER OF THE HONORABLE THE SECRETARY OF WAR, UNDER THE DIRECTION OF BRIG. GEN. A. A. HUMPHREYS, CHIEF OF ENGINEERS U.S. ARMY accuracy to all observations made. It is intended that a series of meteorological observations shall be taken at this point as soon as the force at disposal permits.

The record at the observatory from August 4 to October 30, 1874, and from July 1 to September 11, 1877, shows that from among one hundred and fifty-five nights, ninety-six were clear and favorable for observing purposes.

UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., May 5, 1877.

SIR: I have the honor to submit herewith a few brief remarks on the determination for personal equations made by members of the expedition; also a description and representation of the new personal-equation apparatus, together with some of the results obtained by its use.

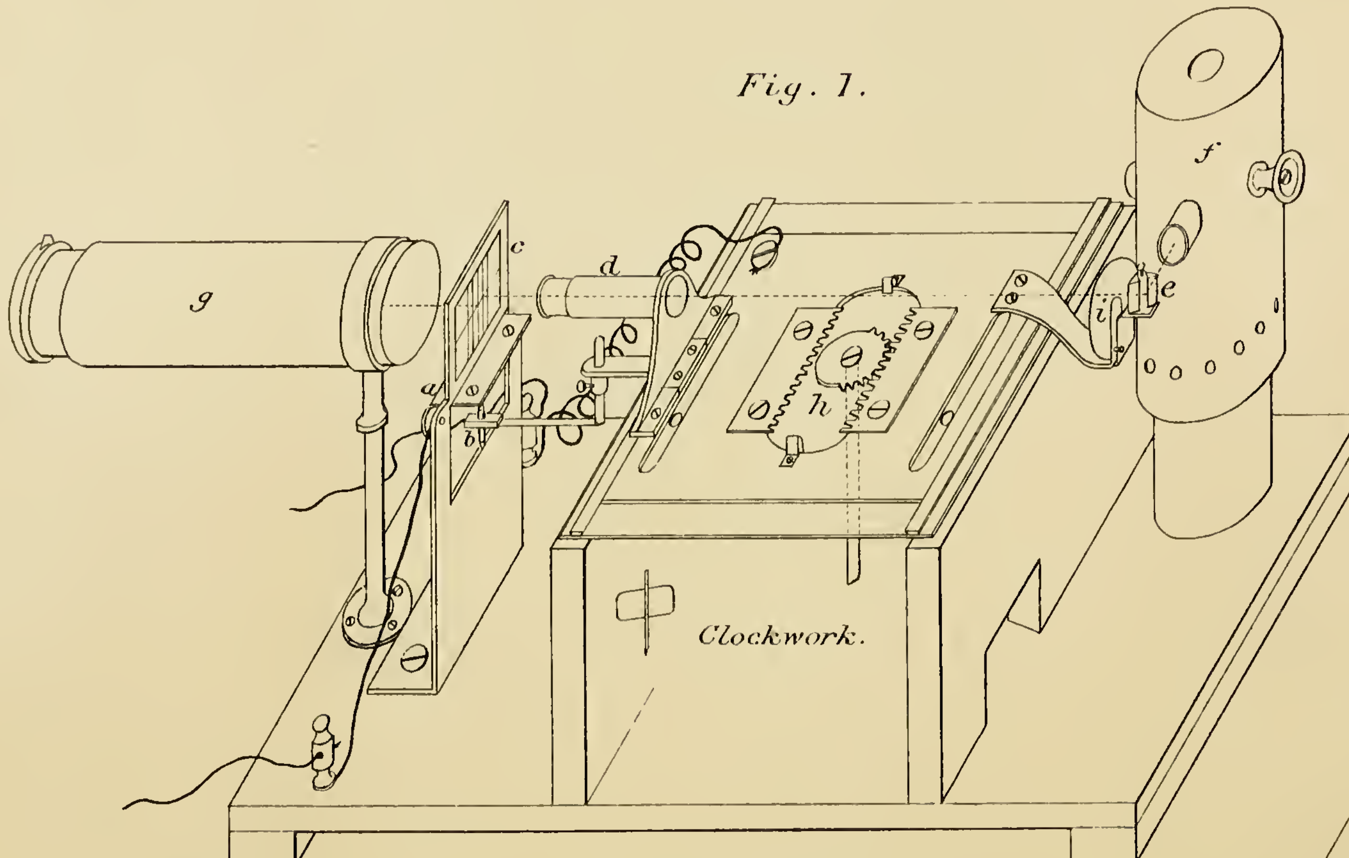
I am, very respectfully, your obedient servant,

DR. F. KAMPF.

To First Lieut. GEO. M. WHEELER,
Corps of Engineers, in charge of Geographical Survey.

APPARATUS for Determining Absolute PERSONAL EQUATION.

Fig. 1.



One-third natural size.
1/3

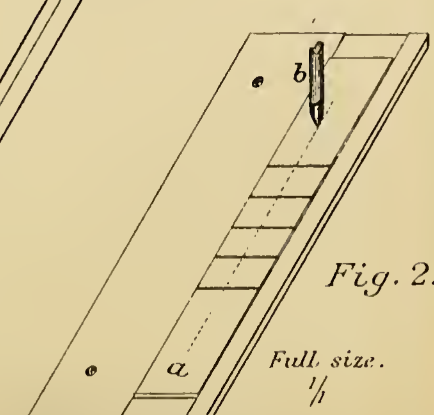


Fig. 2.

Full size.
1/1

a Platina Plate.
b Transit Point.
c Diaphragm.
d Telescope.
e Prism.
f Lantern.
g Observing Telescope.
h Movement for converting motion.

G. Thompson, Del.

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ON THE DETERMINATION OF PERSONAL EQUATIONS.

A knowledge of the personal equation of observers is of the first importance when observations for longitude are to be made. The method of determining this equation before and after a complete set of observations for longitude is unsatisfactory, since it is well established that the personal equation may change even in one night. This fact induced efforts to determine the equation after every observation taken, but all the instruments so far invented for the purpose, several of which I have employed, have proven almost a failure on account of difficulty in adjustment, or have been found objectionable in other respects.

A continuous study of this subject has brought into existence a machine which is recommended for use in all future determinations of longitude from this office, and it is to be regretted that its availability comes so late. The determinations of longitude considered in this report require correction for personal equation, but after reducing the observations for this purpose I find the result of little value. Each observer was always desirous of finishing a station and proceeding to the next as soon as possible, to avoid the probabilities of bad weather. The distance between the stations, and the delay and expense attending a journey to the sending-station, explains why observations for personal equation were not made after each determination of longitude. I recommend, therefore, that no personal equation be applied to any of the observations, and that after the circle is closed, which will be done when Santa Fé is connected with San Diego, an investigation be made to obtain the most probable result for each determination.

The annexed table gives the observations taken by the different observers for determination of personal equation. It will be seen that John H.

Clark and E. P. Austin used different instruments in the same meridian. In other cases, both observers used the same transit and observed alternate stars. The method of reduction of Professor Safford and J. H. Clark's observations can be found in the report on the determination of longitude between Salt Lake City and Santa Fé, page 11.

SALT LAKE CITY, SEPTEMBER 13, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	κ Cephei	20 15 49.80	— 0.19	— 0.04	+ 0.21	20 15 49.78	20 13 11.80	— 0 02 37.98
E.	ε Delphini	28 46.26	+ 0.04	0.00	+ 0.05	28 46.35	26 07.84	38.51
E.	α Cygni...........	38 44.14	— 0.01	+ 0.03	+ 0.07	38 44.23	36 06.06	38.17
E.	ν Cygni...........	54 04.14	0.00	+ 0.05	+ 0.06	54 04.25	51 26.12	38.13
W.	ζ Cygni...........	21 09 09.54	+ 0.01	— 0.03	— 0.05	21 09 09.47	21 06 31.45	38.02
W.	1 Pegasi	17 50.40	+ 0.03	— 0.03	— 0.05	17 50.35	15 12.17	38.18
W.	β Cephei	21 28 41.30	— 0.10	— 0.10	— 0.14	21 28 40.96	21 26 02.91	— 0 02 38.05
E.	κ Cephei	20 15 03.86	— 7.01	— 0.15	— 6.97	20 15 49.73	20 13 11.80	— 0 02 37.93
E.	ε Delphini	28 46.20	+ 1.32	— 0.04	— 1.55	28 45.93	26 07.84	38.09
E.	α Cygni...........	38 46.52	— 0.26	— 0.06	— 2.15	38 44.05	36 06.06	37.99
E.	ν Cygni...........	54 06.76	0.00	— 0.05	— 2.01	54 04.70	51 26.12	38.58
W.	ζ Cygni...........	21 09 06.74	+ 0.57	+ 0.15	+ 1.75	21 09 09.21	21 06 31.45	37.76
W.	1 Pegasi	17 47.26	+ 1.01	+ 0.20	+ 1.62	17 50.09	15 12.17	37.92
W.	β Cephei	21 28 39.80	— 3.69	+ 0.59	+ 4.45	21 28 41.15	21 26 02.91	— 0 02 38.24
	Correction by E. P. Austin							— 0 02 38.149
	Correction by John H. Clark							— 0 02 38.073

NORMAL EQUATIONS OF AUSTIN'S OBSERVATIONS.

$$0 = +0.41 + 7.00\,\delta t - 3.13\,a + 3.19\,c \qquad \delta t = -0^s.049$$
$$0 = -0.46 - 3.13\,\delta t + 9.91\,a - 8.52\,c \qquad a = +0^s.071$$
$$0 = -0.95 + 3.19\,\delta t - 8.52\,a + 36.62\,c \qquad c = +0^s.047$$

NORMAL EQUATIONS OF CLARK'S OBSERVATIONS.

$$0 = +1.000 + 7.00\,\delta t - 3.13\,a^1 + 3.19\,c^1 \qquad \delta t = +0^s.127$$
$$0 = -5.535 - 3.13\,\delta t + 9.91\,a^1 - 8.52\,c^1 \qquad a^1 = +0^s.578$$
$$0 = +5.391 + 3.19\,\delta t - 8.52\,a^1 + 36.62\,c^1 \qquad c^1 = -0^s.024$$

Adopted azimuth $= +2.00$ Therefore $a = +2^s.578$
Adopted error of collim. $= -1.50$ $c = -1^s.524$

SALT LAKE CITY, SEPTEMBER 16, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
W.	δ Draconis	19 14 15.20	+ 0.12	— 0.37	+ 0.10	19 14 15.05	19 11 32.34	— 0 02 42.71
W.	γ Aquilæ	41 55.04	— 0.05	— 0.12	+ 0.04	41 54.91	39 12.24	42.67
W.	α Aquilæ	46 16.80	— 0.06	— 0.10	+ 0.04	46 16.68	43 34.10	42.58
W.	ε Draconis	50 19.92	+ 0.14	— 0.25	+ 0.11	50 19.92	47 37.32	42.60
E.	κ Cephei	20 14 54.20	+ 0.28	— 0.11	— 0.17	20 14 54.20	20 12 11.54	42.66
E.	ε Delphini	28 50.66	— 0.05	0.00	— 0.04	28 50.57	26 07.81	42.76
E.	α Cygni	38 48.66	+ 0.01	+ 0.04	— 0.05	38 48.66	36 06.01	42.65
E.	ν Cygni	54 08.50	0.00	+ 0.04	— 0.05	54 08.49	51 26.08	42.41
E.	61 Cygni	21 02 54.69	— 0.01	+ 0.05	— 0.05	21 02 54.68	21 00 11.92	— 0 02 42.76
E.	γ Aquilæ	19 41 53.72	+ 2.74	0.00	— 1.79	19 41 54.67	19 39 12.24	— 0 02 42.43
E.	α Aquilæ	46 15.38	+ 2.85	0.00	— 1.77	46 16.46	43 34.10	42.36
E.	ε Draconis	50 32.48	— 7.49	0.00	— 5.12	50 19.87	47 37.32	42.55
W.	κ Cephei	20 14 59.76	—14.29	+ 0.55	+ 7.98	20 14 54.00	20 12 11.54	42.46
W.	ε Delphini	28 45.82	+ 2.69	+ 0.20	+ 1.79	28 50.50	26 07.81	42.69
W.	α Cygni	38 45.98	— 0.53	+ 0.41	+ 2.48	38 48.34	36 06.01	42.33
W.	ν Cygni	54 06.14	0.00	+ 0.33	+ 2.31	54 08.78	51 26.08	42.70
W.	61 Cygni	21 02 51.51	+ 0.32	+ 0.27	+ 2.22	21 02 54.32	21 00 11.92	— 0 02 42.40
	Correction by E. P. Austin							— 0 02 42.644
	Correction by John H. Clark							— 0 02 42.490

NORMAL EQUATIONS OF AUSTIN'S OBSERVATIONS.

$$0 = +0.990 + 9.000\,\delta t - 3.770\,a + 2.010\,c \qquad \delta t = -0^s.144$$
$$0 = +0.416 - 3.770\,\delta t + 11.565\,a - 5.750\,c \qquad a = -0^s.102$$
$$0 = +1\,384 + 2.010\,\delta t - 5.750\,a + 44.484\,c \qquad c = -0^s.038$$

NORMAL EQUATIONS OF CLARK'S OBSERVATIONS.

$$0 = +1.860 + 8.000\,\delta t - 2.600\,a^1 - 4.620\,c^1 \qquad \delta t = -0^s.290$$
$$0 = -1.316 - 2.600\,\delta t + 10.196\,a^1 + 8.804\,c^1 \qquad a^1 = +0^s.273$$
$$0 = +5.768 - 4.620\,\delta t + 8.804\,a^1 + 37.672\,c^1 \qquad c^1 = -0^s.253$$

Adopted azimuth $+5^s.00$ Therefore $a = +5^s.273$
Adopted error of collim. $-1^s.50$ $c = -1^s.753$

SALT LAKE CITY, SEPTEMBER 17, 1872.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	β Lyræ	18 47 06.70	— 0.01	0.00	— 0.04	18 47 06.65	18 44 22.54	— 0 02 44.11
E.	50 Draconis	53 14.42	+ 0.12	0.00	— 0.13	53 14.41	50 30.05	44.36
E.	ζ Aquilæ	19 01 17.40	— 0.02	— 0.01	— 0.04	19 01 17.33	58 33.12	44.21
E.	δ Draconis	14 16.06	+ 0.06	— 0.04	— 0.09	14 15.99	19 11 32.28	43.71
E.	δ Aquilæ	20 48.62	— 0.03	— 0.03	— 0.04	20 48.52	18 04.41	44.11
E.	γ Aquilæ	41 56.42	— 0.03	— 0.04	— 0.03	41 56.32	39 12.23	44.09
W.	ε Draconis	50 21.35	+ 0.08	— 0.07	+ 0.10	50 21.46	47 37.25	44.21
W.	τ Aquilæ	59 39.08	— 0.03	— 0.02	+ 0.03	59 39.06	56 55.09	43.97
W.	κ Cephei	20 14 55.22	+ 0.15	— 0.04	+ 0.15	20 14 55.48	20 12 11.44	44.04
W.	ε Delphini	20 28 52.06	— 0.03	0.00	+ 0.04	20 28 52.07	20 26 07.80	— 0 02 44.27
W.	δ Draconis	19 14 17.41	— 5.46	— 0.05	+ 4.33	19 14 16.26	19 11 32.28	— 0 02 43.98
W.	γ Aquilæ	41 51.98	+ 2.43	— 0.01	+ 1.69	41 56.09	39 12.23	43.86
W.	α Aquilæ	46 13.52	+ 2.52	0.00	+ 1.67	46 17.71	43 34.09	43.62
E.	κ Cephei	20 15 15.64	—12.65	— 0.18	— 7.54	20 14 55.27	20 12 11.44	43.83
E.	ε Delphini	20 28 51.26	+ 2.38	— 0.04	— 1.69	20 28 51.91	20 26 07.80	— 0 02 44.11
	Correction by E. P. Austin							— 0 02 44.078
	Correction by John H. Clark							— 0 02 43.880

NORMAL EQUATIONS OF AUSTIN'S OBSERVATIONS.

$$0 = -1.130 + 10.000\,\delta t - 4.690\,a + 1.300\,c \qquad \delta t = +0^s.092$$
$$0 = +1.540 - 4.690\,\delta t + 17.129\,a + 5.430\,c \qquad a = -0^s.054$$
$$0 = +2.181 + 1.300\,\delta t + 5.430\,a + 58.108\,c \qquad c = -0^s.035$$

NORMAL EQUATIONS OF CLARK'S OBSERVATIONS.

$$0 = +0.860 + 5.000\,\delta t - 2.310\,a^1 + 0.930\,c^1 \qquad \delta t = +0^s.120$$
$$0 = -5.193 - 2.310\,\delta t + 9.535\,a^1 - 9.831\,c^1 \qquad a^1 = +0^s.668$$
$$0 = +3.648 + 0.930\,\delta t - 9.831\,a^1 + 30.615\,c^1 \qquad c^1 = +0^s.092$$

Adopted azimuth $= +4^s.00$ Therefore $a = +4^s.668$
Adopted error of collim. $= -1^s.750$ $c = -1^s.658$

SALT LAKE CITY, JULY 2, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	μ Herculis	9 34 17.16	− 0.49	− 0.14	+ 0.18	9 34 16.61	17 41 31.39	+ 8 07 14.78
E	72 Ophiuchi......	54 08.04	− 1.04	− 0.10	+ 0.16	54 07.06	18 01 21.79	14.73
E.	η Serpentis	10 07 33.06	− 1.35	− 0.08	+ 0.16	10 07 31.79	14 46.35	14.56
W.	a Lyræ	25 26.18	− 0.10	− 0.20	− 0.21	25 25.67	32 40.52	14.85
W.	50 Draconis	43 14.17	+ 4.36	− 0.26	− 0.64	43 17.63	50 31.99	14.36
W.	d Sagittarii	11 02 02.03	− 1.80	− 0.03	− 0.17	11 02 00.03	19 09 14.51	+ 8 07 14.48
	Correction by J. H. Clark							+ 8 07 14.626
E.	γ Draconis	9 46 26.81	+ 0.59	− 0.21	+ 0.26	9 46 27.45	17 53 42.07	+ 8 07 14.62
E.	μ Sagittarii	58 59.71	− 1.86	− 0.06	+ 0.17	58 57.96	18 06 12.43	14.47
E.	1 Aquilæ	10 21 06.73	− 1.49	− 0.08	+ 0.16	10 21 05.32	28 19.88	14.56
W.	β Lyræ	38 11.54	− 0.31	− 0.14	− 0.19	38 10.90	45 25.58	14.68
W.	ζ Aquilæ	52 22.68	− 0.92	− 0.05	− 0.17	52 21.54	59 36.34	14.80
W.	τ Draconis	11 10 45.17	+ 3.60	− 0.15	− 0.56	11 10 48.06	19 18 02.87	+ 8 07 14.81
	Correction by W. W. Marryatt							+ 8 07 14.657

NORMAL EQUATIONS.

$$0 = +\ 6.96 + 12.00\,\delta t + 0.41\,a - 5.11\,c + 6.00\,x \qquad \delta t = -\,0^s.373$$
$$0 = +\,20.65 + 0.41\,\delta t + 11.83\,a + 16.25\,c + 0.20\,x \qquad a = -\,1^s.956$$
$$0 = +\,23.33 - 5.11\,\delta t + 16.25\,a + 40.68\,c - 1.98\,x \qquad c = +\,0^s.162$$
$$0 = +\ 2.78 + 6.00\,\delta t + 0.20\,a - 1.98\,c + 6.00\,x \qquad x = +\,0^s.031$$

SALT LAKE CITY, JULY 3, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	s.	s.	s.	h. m. s.	h. m. s.	h. m. s.
E.	ζ Ophiuchi.....	8 22 59.89	− 1.38	− 0.08	+ 0.13	8 22 58.56	16 30 11.98	+ 8 07 13.42
E.	κ Ophiuchi......	44 28.83	− 0.92	− 0.10	+ 0.13	44 27.94	51 41.34	13.40
E.	a_1 Herculis	9 01 40.71	− 0.80	− 0.06	+ 0.13	9 01 39.98	17 08 53.40	13.42
E.	Gr. 966, S. P.	15 35.58	− 6.05	+ 0.05	− 0.52	15 29.06	22 42.56	13.50
W.	Gr. 966, S. P.	15 34.48	− 6.06	+ 0.05	+ 0.52	15 28.99	22 42.56	13.57
W.	ω Draconis	30 29.90	+ 2.27	0.00	− 0.37	30 31.80	37 45.42	13.62
W.	72 Ophiuchi......	54 09.34	− 0.92	+ 0.04	− 0.14	54 08.32	18 01 21.80	13.48
W.	η Serpentis	10 07 34.25	− 1.20	+ 0.06	− 0.14	10 07 32.97	18 14 46.36	+ 8 07 13.39
	Correction by J. H. Clark							+ 8 07 13.475
E.	η Herculis	8 31 21.11	− 0.07	− 0.16	+ 0.17	8 31 21.05	16 38 34.66	+ 8 07 13.61
E.	d Herculis	49 43.94	− 0.26	− 0.10	+ 0.16	49 43.74	56 56.97	13.23
E.	ν Serpentis	9 06 31.23	− 1.43	+ 0.03	+ 0.14	9 06 29.97	17 13 43.21	13.24
W.	a Ophiuchi......	21 51.92	− 0.79	0.00	− 0.14	21 50.99	29 04.38	13.39
W.	γ Draconis	46 28.21	+ 0.52	+ 0.03	− 0.22	46 28.54	53 41.70	13.16
W.	μ_1 Sagittarii	9 58 00.88	− 1.66	+ 0.03	− 0.14	9 58 59.11	18 06 12.43	+ 8 07 13.32
	Correction by W. W. Marryatt							+ 8 07 13.325

NORMAL EQUATIONS.

$$0 = +\,13.25 + 14.00\,\delta t + 10.75\,a - 1.92\,c + 6.00\,x \qquad \delta t = +\,0^s.475$$
$$0 = +\,46.13 + 10.75\,\delta t + 29.51\,a + 4.25\,c + 2.11\,x \qquad a = -\,1^s.745$$
$$0 = +\ 1.34 - 1.92\,\delta t + 4.25\,a + 51.42\,c - 0.19\,x \qquad c = +\,0^s.135$$
$$0 = +\ 1.77 + 6.00\,\delta t + 2.11\,a - 0.19\,c + 6.00\,x \qquad x = -\,0^s.150$$

SALT LAKE CITY, JULY 4, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	β Ursæ Minoris..	6 43 53.74	+ 3.62	+ 0.50	— 0.33	6 43 57.53	14 51 09.37	+ 8 07 11.84
W.	β Libræ.........	7 03 01.55	— 1.32	+ 0.10	— 0.09	7 03 00.24	15 10 12.07	11.83
W.	ζ^3 Libræ.........	16 22.04	— 1.49	+ 0.12	— 0.09	16 20.58	23 32.36	11.78
W.	α Serpentis	30 51.38	— 0.96	+ 0.27	— 0.09	30 50.60	38 02.48	11.88
E.	β_1 Scorpii.........	50 54.54	— 1.58	+ 0.19	+ 0.09	50 53.24	58 05.15	11.91
E.	τ Herculis	8 08 44.90	+ 0.26	+ 0.54	+ 0.13	8 08 45.83	16 15 57.48	11.65
E.	η Draconis......	8 15 05.24	+ 1.30	+ 0.73	+ 0.19	8 15 07.46	16 22 19.37	+ 8 07 11.91
	Correction by J. H. Clark							+ 8 07 11.828
W.	β Bootis	6 49 59.50	0.00	+ 0.21	— 0.12	6 49 59.59	14 57 11.48	+ 8 07 11.89
W.	o^2 Libræ.........	7 08 48.10	— 1.46	+ 0.10	— 0.09	7 08 56.65	15 16 58.50	11.85
W.	α Coronæ	22 08.65	— 0.46	+ 0.28	— 0.10	22 08.37	29 20.40	12.03
W.	ε Serpentis......	37 19.66	— 1.01	+ 0.31	— 0.09	37 18.87	44 30.93	12.06
E.	Groombr. 2320.	58 46.98	+ 2.13	+ 0.87	+ 0.24	58 50.22	16 06 02.07	11.85
E.	A Draconis	8 21 02.47	+ 2.26	+ 0.93	+ 0.25	8 21 05.91	28 17.95	12.04
E.	η Herculis	8 31 22.01	— 0.07	+ 0.49	+ 0.11	8 31 22.54	16 38 34.65	+ 8 07 12.11
	Correction by W. W. Marryatt................................							+ 8 07 11.976

NORMAL EQUATIONS.

$$
\begin{array}{ll}
0=+\ 0.15+14.00\,\delta t-\ 0.71\,a+\ 0.11\,c+7.00\,x & \delta t=-0^{s}.172 \\
0=+20.88-\ 0.71\,\delta t+11.98\,a-\ 3.88\,c-0.81\,x & a=-1^{s}.715 \\
0=-11.14+\ 0.11\,\delta t-\ 3.88\,a+46.94\,c+2.31\,x & c=+0^{s}.089 \\
0=-\ 1.42+\ 7.00\,\delta t-\ 0.81\,a+\ 2.31\,c+7.00\,x & x=+0^{s}.148
\end{array}
$$

SALT LAKE CITY, SEPTEMBER 25, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T′.	AR.	△T.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
W.	ζ Aquilæ.........	10 52 40.10	— 0.73	+ 0.11	— 0.06	10 52 39.42	18 59 35.85	+ 8 06 56.43
W.	δ Draconis	11 05 33.07	+ 2.05	+ 0.28	— 0.14	11 05 35.26	19 12 31.73	56.47
W.	α Vulpeculæ	16 30.55	— 0.54	+ 0.13	— 0.06	16 30.08	23 26.89	56.81
W.	κ Aquilæ.........	23 10.25	— 1.32	+ 0 08	— 0.06	23 08.95	30 05.46	56.51
W.	γ Aquilæ.........	33 19.40	— 0.91	+ 0.14	— 0.05	33 18.58	40 15.10	56.52
E.	β Aquilæ.........	42 10.51	— 0.95	+ 0.14	+ 0.05	42 09.75	49 06.37	56.62
E.	θ Aquilæ...... ..	57 51.53	— 1.17	+ 0.14	+ 0.06	57 50.56	20 04 47.11	56.55
E.	Groombr. 3241.	12 23 33.79	+ 2.99	+ 0.55	+ 0.18	12 23 37.51	30 33.64	56.13
E.	α Cygni..........	12 30 10.63	+ 0.16	+ 0.28	+ 0.09	12 30 11.16	20 37 07.88	+ 8 06 56.72
W.	ε Aquilæ.........	10 46 57.09	— 0.79	+ 0.11	— 0.06	10 46 56.35	18 53 53.03	+ 8 06 56.68
W.	τ Draconis	11 10 58.95	+ 3.22	+ 0.35	— 0.19	11 10 02.33	19 16 59.08	56.75
W.	μ Aquilæ.........	20 59.25	— 0.98	+ 0.10	— 0.05	20 58.32	27 54.74	56.42
W.	θ Cygni..........	26 06.01	+ 0.44	+ 0.18	— 0.09	26 06.54	33 03.35	56.81
E.	α Aquilæ.........	37 41.08	— 0.94	+ 0.14	+ 0.05	37 40.33	44 37.06	56.73
E.	τ Aquilæ.........	51 02.13	— 0.98	+ 0.14	+ 0.06	51 01.35	57 58.08	56.73
E.	κ Cephei	12 06 05.62	+ 4.76	+ 0.69	+ 0.25	12 06 11.32	20 13 08.25	56.93
E.	ω_1 Cygni..........	12 16 13.44	+ 0.39	+ 0.30	+ 0.08	12 16 14.21	20 23 10.97	+ 8 06 56.76
	Correction by J. H. Clark................................							+ 8 06 56.529
	Correction by Dr. F. Kampf							+ 8 06 56.726

NORMAL EQUATIONS.

$$
\begin{array}{ll}
0=-15.23+17.00\,\delta t-\ 2.63\,a+\ 0.96\,c+8.00\,x & \delta t=+0^{s}.529 \\
0=+34.35-\ 2.63\,\delta t+18.20\,a-\ 9.46\,c-2.92\,x & a=-1^{s}.750 \\
0=-21.02+\ 9.96\,\delta t-\ 9.46\,a+67.32\,c+1.05\,x & c=+0^{s}.056 \\
0=-10.98+\ 8.00\,\delta t-\ 2.92\,a+\ 1.05\,c+8.00\,x & x=+0^{s}.197
\end{array}
$$

SALT LAKE CITY, SEPTEMBER 26, 1873.

Clamp.	Name of star.	T.	Aa.	Bb.	Cc.	T'.	AR.	ΔT.
		h. m. s.	*s.*	*s.*	*s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
E.	ε Aquilæ	10 16 57.64	— 0.86	+ 0.09	+ 0.14	10 16 57.01	18 23 53.01	+ 8 06 56.00
E.	τ Draconis......	11 10 58.60	+ 3.51	+ 0.18	+ 0.48	11 10 02.77	19 16 59.01	56.24
E.	μ Aquilæ	20 59.65	— 1.07	+ 0.03	+ 0.14	20 58.75	27 54.73	55.98
E.	θ Cygni..........	26 06.31	+ 0.48	+ 0.03	+ 0.21	26 07.03	33 03.33	56.30
W.	α Aquilæ	37 42.20	∓ 1.03	+ 0.11	— 0.13	37 41.15	44 37.05	55.90
W.	τ Aquilæ	51 03.18	∓ 1.06	+ 0.12	— 0.14	51 02.10	57 58.06	55.96
W.	κ Cephei.........	12 06 06.91	+ 5.18	+ 0.55	— 0.63	12 06 12.01	20 13 08.18	56.15
W.	ω¹ Cygni	12 16 14.72	+ 0.42	+ 0.24	— 0.21	12 16 15.17	20 23 10.94	+ 8 06 55.77
E.	ζ Aquilæ	10 52 40.34	— 0.90	+ 0.09	+ 0.14	10 52 39.67	18 59 35.84	+ 8 06 56.17
E.	δ Draconis......	11 05 32.55	+ 2.23	+ 0.10	+ 0.36	11 05 35.24	19 12 31.67	56.43
E.	α Vulpeculæ	16 31.12	— 0.59	+ 0.06	+ 0.15	16 30.74	23 26.87	56.13
E.	κ Aquilæ	23 10.77	— 1.43	+ 0.03	+ 0.14	23 09.51	30 05.44	55.93
E.	γ Aquilæ	33 19.81	— 0.99	+ 0.02	+ 0.14	33 18.98	40 15.09	56.11
W.	β Aquilæ	42 11.55	— 1.03	+ 0.11	— 0.13	42 10.50	49 06.35	55.85
W.	θ Aquilæ	57 52.48	— 1.28	+ 0.10	— 0.14	57 51.16	20 04 47.10	55.94
W.	π Capricorni	12 13 11.29	— 1.73	+ 0.08	— 0.15	12 13 09.49	20 05.41	55.92
W.	roombr. 3241	12 23 34.76	+ 3.26	+ 0.44	— 0.45	12 23 38.01	20 30 33.57	+ 8 06 55.56
	Correction by J. H. Clark							+ 8 66 56.038
	Correction by Dr. F. Kampf........							+ 8 06 56.004

NORMAL EQUATIONS.

$$0 = -\ 3.37 + 17.00\,\delta t - 1.63\,a + 1.49\,c + 9.00\,x \qquad \delta t = +\,0^{s}.038$$
$$0 = +\ 35.87 - 1.63\,\delta t + 19.02\,a - 3.47\,c + 1.29\,x \qquad a = -\,1^{s}.906$$
$$0 = +\ 2.51 + 1.49\,\delta t - 3.47\,a + 66.45\,c + 0.44\,x \qquad c = +\,0^{s}.138$$
$$0 = +\ 2.36 + 9.00\,\delta t + 1.29\,a + 0\ 44\,c + 9.00\,x \qquad x = -\,0^{s}.034$$

JANUARY 11, 1874.—PERSONAL EQUATION BETWEEN J. H. CLARK AND T. H. SAFFORD.

	T.				a.	a—T.		
	h. m. s.	*m. s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*
Groombr. 848	4 31 00.50	31 48.58	+ 7.95	+ 0.11	56.64	56.14	3.92	— 4.05
μ Eridani...............	4 38 23.18	39 09.54	+ 3.00	0.00	12.54	49.36	— 0.06	— 1.00
Groombr. 966	5 22 10.96	22 47.74	+ 7.96	+ 0.25	55.95	44.99	3.71	3.84
ζ Tauri	5 29 20.62	30 03.77	+ 3.58	+ 0.03	7.38	46.76	+ 0.39	1.07

$$6.78 = 3.98\ n - 3.05\,c \qquad -\ 1.77 = 3.32\ n + 2.77\,c$$
$$1.70 = n - 0.77\,c \qquad -\ 0.53 = n + 0.83\,c$$
$$49.46 = dt - m - 1.05\,c \qquad 46.97 = dt + m + 0.75\,c$$

Hence
$$-2.49 = 1.80\,c \qquad n = +\,0.63$$
$$(-1.38) = c \qquad c = -\,1.39 \qquad 0.143\,n$$
$$-2.23 = 1.60\,c$$
$$-1.391 = c$$

		Decl.			Jan. 11, 1874.			a.			T cor.	C.	S.
		° ′			h. m. s.	s.	s.	s.	s.	s.	s.	s.	s.
δ	Tauri........	17 15	0.311	0.020	4 15 36.78	+3.46	+0.01	40.25	+0.20	+1.40	52.50	47.75	....
ε	Tauri........	18 54	0.342	0.024	21 12.26	3.50	+0.01	15.77	+0.22	+1.47	27.85	....	47.92
α	Tauri........	16 15	0.292	0.018	28 38.22	3.44	+0.01	41.67	+0.19	+1.55	53.98	47.69	.....
	Groombr. 848	75 42	3.924	0.607	31 48.58	+7.95	+0.15	56.68	+2.47	+5.64	8.61	....	(48.07)
γ	Tauri........	22 4[illegible]	0.418	0.035	34 37.59	+3.59	+0.01	41.19	+0.26	+1.51	39.37	47.82	....
μ	Eridani......	—3 29	0.031	0.001	39 09.54	3.00	0.00	12.54	—0.04	+1.39	24.53	....	48.01
π^4	Orionis	+5 2[illegible]	0.094	0.002	44 26.84	3.19	0.00	30.03	+0.06	+1.40	42.28	47.75	....
π^5	Orionis	2 14	0.039	0.000	47 38.50	3.12	0.00	41.62	+0.0[illegible]	+1.39	0.79	....	....
ζ	Aurigæ	40 5[illegible]	0.865	0.120	53 36.50	4.18	0.04	40.72	+0.54	+1.83	53.09	47.63	....
η	Aurigæ	41 04	0.871	0.123	4 57 37.01	4.20	0.24	41.25	+0.55	+1.85	53.08	....	48.17
η	Orionis	—2 31	0.044	0.001	5 18 05.90	3.01	0.00	8.91	—0.03	—1.39	21.08	......	47.83
	Groombr. 966	74 57	3.728	0.586	22 47.74	7.96	0.25	55.95	+2.35	—5.30	7.95	(48.00)	.. ...
φ	Orionis	9 24	0.165	0.004	27 51.30	+3.29	0.01	54.60	+0.10	—1.40	6.84	......	47.76
ζ	Tauri.	21 04	0.385	0.030	30 03.77	3.58	0.03	7.38	+0.24	—1.49	19.37	48.01	....
σ	Orionis	—2 41	0.047	0.001	32 22.69	3.01	0.00	25.70	—0.03	—1.39	37.98	....	47.72
o	Aurigæ	49 46	1.182	0.190	36 04.41	+4.64	0.09	9.14	+0.74	—2.15	21.27	......	47.87
130	Tauri	17 41	0.315	0.021	40 02.32	+3.50	0.03	5.85	+0.20	—1.40	17.98	47.87	....
ν	Aurigæ	39 07	0.813	0.110	42 41.76	+4.15	0.07	45.98	+0.51	—1.79	58.04	.... ..	47.94
α	Orionis	5 48	0.101	0.002	48 18.74	+3.25	0.01	21.50	+0.06	—1.40	33.66	47.84	....
θ	Aurigæ	37 12	0.759	0.099	5 51 04.24	+4.09	0.07	8.40	+0.48	—1.74	20.36	....	48.04
												47.794	47.918
	One observation........											±.079	±0.98
	All											±.028	±.033

From the observations, the following quantities for personal equation are derived:

J. H. Clark — E. P. Austin, September 13, 1872, + 0s.076
September 16, 1872, + 0s.154
September 17, 1872, + 0s.198

J. H. Clark —W. W. Marryatt, July 2, 1873, — 0s.031
July 3, 1873, + 0s.150
July 4, 1873, — 0s.148

J. H. Clark — Dr. F. Kampf, September 25, 1873, — 0s.197
September 26, 1873, + 0s.034

J. H. Clark — Professor Safford, January 11, 1874, — 0s.123

From these results it will be readily seen that it is better to entirely neglect at present the correction for personal equation.

On the accompanying Plate 3 is a drawing of the personal-equation machine which was invented by me in the winter of 1873–'74. At *f* is a lamp, from which proceeds a beam of light; this beam is broken by the prism at *e*, passed through the diaphragm at *i*, and brought to a focus on the plate *C* by a small telescope at *d*. This point of light on the plate *C* serves as a star. The ruled lines on the plate *C* make it the reticule. A simple system of clock-work causes the plate *K* to move back and forth on the upper surface of the box-work. By motion of the plate *K*, the prism *e* and telescope *d* are carried, and thus the artificial star is made to transit the reticule. The star is observed through the tube *g*, which is without lenses. At the eye-end of the tube *g* is a prism by means of which the artificial star is given an apparent motion, always in the same direction. This is done by turning the tube *m* about its axis 180°, just as the plate *K* changes the direction of its motion. Connected and moving with the plate *K* is a metallic arm, *b*. This arm presses a point against a platinum plate, *a*. In this platinum plate are ruled fine lines, which are filled with insulating material. One wire of the circuit is attached to the plate *K* and the other to *a*, so that the circuit is broken as the arm *b* passes the insulated lines on *a*.

This automatic break with that of the observer gives in combination the double personal equation. Mr. E. Kahler (Washington, D. C.) is the constructor of the apparatus. Lieutenant Tillman and myself made three sets of observations, and found the following results:

Absolute personal equation of

	Lieut. Tillman.	Dr. Kampf.
May 1,	-0.125	-0.027
May 2,	-0.121	-0.021
May 3,	-0.116	-0.026.

I do not consider the construction of the instrument entirely satisfactory as yet. It should be so arranged that the same part of wheel *L* works opposite the same wire or line of the reticule, thus obviating inaccuracy in the construction of the cogs of the wheel. The clock-work has to be very powerful to overcome friction, which can be greatly diminished

LIST OF GEOGRAPHICAL POSITIONS OF ASTRONOMICAL STATIONS OCCUPIED IN THE YEARS 1869, 1871–'72, '73, AND '74.

The tabulated list herewith of longitudes, latitudes, and altitudes comprises only those points, the longitudes of which have been determined by means of telegraphic signals for comparisons of time.

These positions are the adopted initial points, with which are connected the bases laid out adjacent thereto and the interlying triangles between bases widely separated in latitude or longitude, or both. These initial points prove an important factor in the checking of errors in extended belts of triangles embracing areas within which longitudes and latitudes established with the accuracy attainable by the use of the improved instruments and methods now available, are comparatively few.

A part of the results of the sextant astronomical observations have appeared, from time to time, in the annual and other reports, while the large number of longitudes, latitudes, azimuths, distances, altitudes, &c., resulting from the computation of the main and secondary triangulation, will be embodied in a special report of positions, distances, altitudes, azimuths, &c., soon to be submitted for publication in octavo form. Sketches of the monuments, observing-piers, and meridian-marks at eighteen stations are shown on plats Nos. 4, 5, and 6.

Winnemucca, Nev	occupied in 1873	*Plat No.* 4.
Fort Fred. Steele, Wyo	occupied in 1872	
Laramie, Wyo	occupied in 1872	
Green River, Wyo	occupied in 1874	
Carlin, Nev	occupied in 1871	
Battle Mountain, Nev	occupied in 1871	

Pioche, Nev	occupied in 1872	Plat No. 5.
Virginia City, Nev	occupied in 1873	
Hughes, Colo	occupied in 1873	
Colorado Springs, Colo	occupied in 1873	
Labran, Colo	occupied in 1873	
Trinidad, Colo	occupied in 1873	
Beaver, Utah	occupied in 1872	Plat No. 6.
Cheyenne, Wyo	occupied in 1873	
Fort Union, N. Mex	occupied in 1873	
Georgetown, Colo	occupied in 1873	
Saint George, Utah	occupied in 1871	
Santa Fé, N. Mex	occupied in 1873	

The difficulty of recognizing at a subsequent period the exact point at which important astronomical observations had been taken has been noted, which is overcome in a measure by permanently recording for reference a sketch of the natural and artificial surroundings of the station. Should the monuments established or to be established be removed or destroyed, the plat will serve to identify the point, so that its value in further surveys shall not be lost. Subsequent special surveys are to be made at the remaining main stations already occupied, at the most practicable date.

The monuments used as observing piers and to mark the stations during the years 1872, '73, and '74 were of granite or sandstone, and of the dimensions shown in Fig. 1 herewith. The pattern employed lately is substantially of the same dimensions, but constructed of brick, with a stone cap for observing purposes. The expense and difficulty of transporting and setting are thereby decreased, and a mark of quite permanent character established. Figures 2 and 3 show the inscriptions cut on the north and south faces

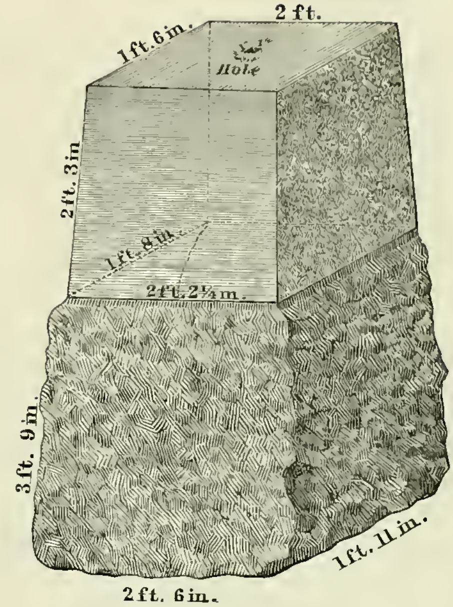


Fig. 1.

Fig. 2.

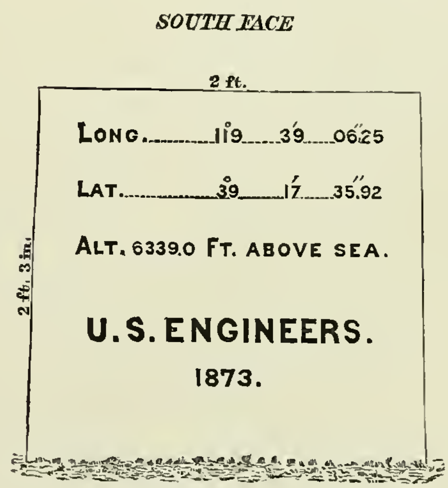


Fig. 3.

GEOGRAPHICAL POSITIONS.

Transit instrument for chronometer error; zenith telescope for latitude (Talcott's method); telegraphic time-signals for difference of longitude.

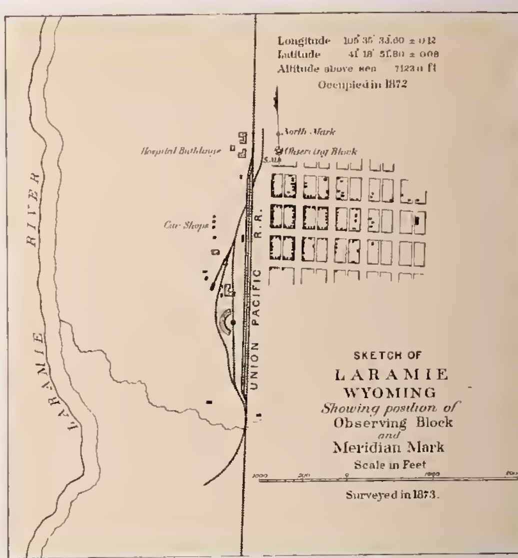
Year.	Station.	Atlas-sheet number.	Observer, Sending, Receiving.	Computer, Sending, Receiving.	Report arranged by—	Longitude. No. of exchanges.	Longitude. West from Greenwich.	Longitude. Probable error ±.	Latitude. No. of pairs of obs.	Latitude. North.	Latitude. Probable error ±.	Altitude above sea-level.	Remarks.
							° ′ ″	″		° ′ ″	″	*Feet.*	
1871	Austin, Nev	48	Prof. J. R. Eastman O. B. Wheeler E. P. Austin	Prof. J. R. Eastman O. B. Wheeler Dr. F. Kampf	Dr. F. Kampf	3	117 03 41.70	0.23	50	39 29 21.92	0.29	7520.6	Checks triangulation extending from base near astronomical monument at Virginia City, Nev.
1871	Battle Mountain, Nev	48	O. B. Wheeler E. P. Austin	O. B. Wheeler Dr. F. Kampf	Dr. F. Kampf	3	116 56 13.50	0.90	33	40 38 18.74	0.21	4508.0	Top astronomical monument.
1872	Beaver, Utah	59	E. P. Austin J. H. Clark	Dr. F. Kampf J. H. Clark	Dr. F. Kampf	3	112 38 35.90	0.26	94	38 16 23.28	0.06	5915.6	Near center of the public square.
1873	Bozeman, Mont	14	Dr. F. Kampf J. H. Clark	Dr. F. Kampf J. H. Clark	Dr. F. Kampf	3	111 02 36.64	0.53	83	45 40 51.92	0.06	4838.6	
1871	Camp Independence, Cal.	65	E. P. Austin	Dr. F. Kampf	Dr. F. Kampf	...	118 12 45.00	.....	....	36 50 10.00	....	3956.5	Longitude by lunar culmination. Zenith-telescope out of order.
1871	Carlin, Nev	40	Prof. J. R. Eastman O. B. Wheeler E. P. Austin	Prof. J. R. Eastman O. B. Wheeler Dr. F. Kampf	Dr. F. Kampf	3	116 07 20.60	0.75	34	40 42 26.67	0.17	4908.2	Railroad levels, top of monument.
1872	Cheyenne, Wyo	44	E. P. Austin J. H. Clark	J. H. Clark William A. Rogers	J. H. Clark Dr. F. Kampf	6	104 48 51.30	0.25	252	41 07 46.62	0.08	6041.0	
1874	Cimarron, N. Mex	70 (A)	Dr. F. Kampf J. H. Clark	Dr. F. Kampf	Dr. F. Kampf	3	104 54 59.04	0.20	69	36 30 10.01	0.09	6384.5	Checks base-line measured in 1874.
1873	Colorado Springs, Colo	62 (A)	J. H. Clark Dr. F. Kampf	J. H. Clark Dr. F. Kampf	Dr. F. Kampf	4	104 49 15.10	0.13	153	38 49 41.67	0.04	6009.7 6030.4	Astronomical station. Signal office.
1872	Fort Fred. Steele, Wyo	43	E. P. Austin J. H. Clark	J. H. Clark Dr. F. Kampf	Dr. F. Kampf	6	106 56 48.80	0.51	205	41 46 40.24	0.05	6840.0	
1873	Fort Union, N. Mex	70 (B)	J. H. Clark Prof. T. H. Safford	J. H. Clark Prof. T. H. Safford	Prof. T. H. Safford	4	105 00 51.15	0.13	74	35 54 24.86	0.22	6744.1	
1871	Fort Whipple, Ariz	75	A. R. Marvine	Dr. F. Kampf	Dr. F. Kampf	...	112 27 10.20	......	132	34 33 06.12	0.07	5318.0	Longitude by lunar culminations near and north of Prescott.
1873	Georgetown, Colo	52 (D)	J. H. Clark Dr. F. Kampf	J. H. Clark Dr. F. Kampf	Dr. F. Kampf	6	105 41 27.60	0.05	118	39 42 36.36	0.06	8587.8	Barometric.
1872-73	Green River, Wyo	42	E. P. Austin J. H. Clark William W. Marryatt	William W. Marryatt J. H. Clark Prof. T. H. Safford	Prof. T. H. Safford	6	109 28 06.57	0.40	178	41 31 38.12	0.10	6096.9 6140.0	Barometric. Railroad levels.
1872	Gunnison, Utah	50	E. P. Austin William W. Marryatt	William W. Marryatt William A. Rogers	Wm. W. Marryatt	5	111 49 15.00	0.42	179	39 09 25.62	0.05	5144.6	
1873	Hughes, Colo	53 (A)	J. H. Clark Dr. F. Kampf	J. H. Clark Dr. F. Kampf	Dr. F. Kampf	4	104 48 58.80	0.06	149	39 59 21.09	0.03	5021.6	

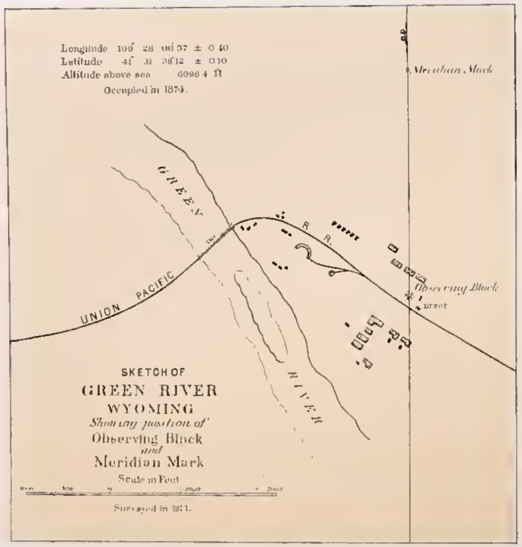
1874	Julesburg, Colo	45	Dr. F. Kampf; J. H. Clark	Dr. F. Kampf	Dr. F. Kampf	5	102 21 32.30	0.43	63	40 59 07.63	0.04	3500.0	Valuable as a point of departure in checking surveys north or south of the Union Pacific Railroad.
1873	Labran, Colo	62 (A)	J. H. Clark; Dr. F. Kampf	J. H. Clark; Dr. F. Kampf	Dr. F. Kampf	4	105 06 17.78	0.44	151	38 23 08.97	0.03	5217.8	Astronomical station.
1872	Laramie, Wyo	43	E. P. Austin; J. H. Clark	J. H. Clark; Prof. R. A. Rodgers	J. H. Clark	3	105 35 33.60	0.12	155	41 18 51.80	0.08	7123.0	R. R. level.
1874	Las Vegas, N. Mex	78 (A)	Dr. F. Kampf; J. H. Clark	Dr. F. Kampf	Dr. F. Kampf	3	105 13 27.57	0.10	99	35 35 27.66	0.07	6418.0	Checks base-line measured in 1874.
1874	North Platte, Nebr	45	Dr. F. Kampf; J. H. Clark	Dr. F. Kampf	Dr. F. Kampf	3	100 45 53.14	0.95	68	41 08 18.33	0.06	2789.0	On Union Pacific Railroad.
1873–74	Ogden, Utah	41	J. H. Clark; O. B. Wheeler; Prof. J. R. Eastman; Dr. F. Kampf	J. H. Clark; Prof. J. R. Eastman; Dr. F. Kampf	Dr. F. Kampf	16	111 59 54.64	0.40	256	41 12 08.56	0.03	4374.0	Top of east meridian-stone, west observing-room, War Department Observatory.
1872	Pioche, Nev	58	E. P. Austin; William W. Marryatt	William W. Marryatt; Prof. R. A. Rodgers	W. W. Marryatt; Dr. F. Kampf	5	114 26 18.27	1.12	189	37 55 26.07	0.07	5942.3	
1873	Santa Fé, N. Mex	69 (D)	J. H. Clark; Prof. T. H. Safford; Dr. F. Kampf	J. H. Clark; Prof. T. H. Safford; Dr. F. Kampf	Prof. T. H. Safford	10	105 56 45.22	0.32	112	35 41 19.29	0.15	7044.2	
1874	Sidney Barracks, Nebr	44	J. H. Clark; Dr. F. Kampf	Dr. F. Kampf	Dr. F. Kampf	5	102 58 13.32	0.45	80	41 08 36.75	0.05	4073.0	
1871	Saint George, Utah	67	E. P. Austin; A. R. Marvine	Dr. F. Kampf	Dr. F. Kampf	3	113 35 00.30	0.30	103	37 06 29.38	0.08	2611.0	
1873	Trinidad, Colo	70 (A)	J. H. Clark; Dr. F. Kampf	J. H. Clark; Dr. F. Kampf	Dr. F. Kampf	5	104 30 01.42	0.30	162	37 10 46.53	0.02	5989.9	Astronomical station.
1873	Virginia City, Nev	47	J. H. Clark; William W. Marryatt	J. H. Clark; Prof. T. H. Safford	Prof. T. H. Safford	6	119 39 06.35	0.36	161	39 17 35.92	0.10	6339.0	
1873	Winnemucca, Nev	39	J. H. Clark; William W. Marryatt	J. H. Clark; Prof. T. H. Safford	Prof. T. H. Safford	6	117 43 54.16	0.22	141	40 58 19.97	0.17	4355.0	
	Salt Lake City, Utah	41	Coast-Survey determin	ation		....	111 53 42.90	....	...	40 46 03.76	......	4330.4	Mormon observatory, Temple Square.
	South Pueblo, Colo	62 (A)	Longitude by trigonom	etrical connection	Dr. F. Kampf	..	104 36 57.53	....	30	38 15 42.84	0.17	4731.8	Latitude by Dr. F. Kampf.

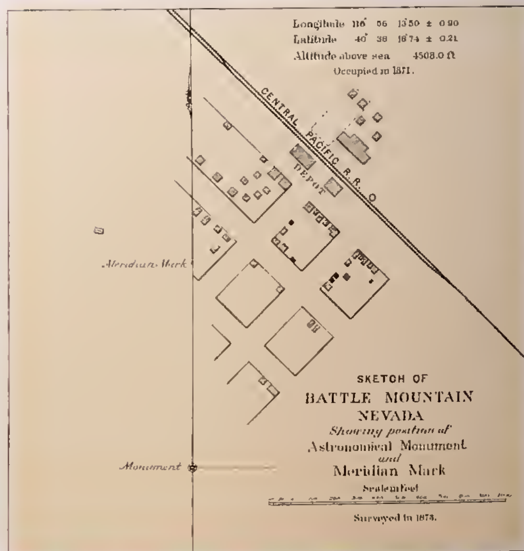
GEOGRAPHICAL POSITIONS.

Sextant and transit for time; sextant for latitude; telegraphic time-signals for difference of longitude.

Year.	Station.	Atlas-sheet No.	Object observed.	Longitude west from Greenwich.	Latitude.	Altitude.	Observers.	Computers.	Remarks.
				° ′ ″	° ′ ″	*Feet.*			
1869	Camp Halleck, Nev	40	Sun Polaris β Scorpii α Scorpii	115 19 34.05	40 48 34.35	5789.7	Lieut. Wheeler Maj. Roberts	Lieut. Wheeler Lieut. Lockwood	
1869	Camp Ruby, Nev	49	Sun α Aquilæ Polaris α Ophiuchi	115 31 06.75	40 03 38.63	6152.6	Lieut. Wheeler Lieut. Lockwood Maj. Roberts	Lieut. Wheeler Dr. F. Kampf	
1872	Deep Creek, Utah	49	Sun Polaris α Aquilæ α Bootis	113 57 16.05	40 06 01.71	5236.0	Lieut. Hoxie E. P. Austin	Lieut. Marshall	
1869	Elko, Nev	40	Sun Polaris β Scorpii α Aquilæ	115 45 37.20	40 49 38.44	5148.4	Lieut. Wheeler Maj. Roberts	Lieut. Wheeler Lieut. Lockwood Dr. F. Kampf	
1872	Near Fillmore, Utah	59	Sun Polaris ε Pegasi α Bootis	112 16 54.93	38 57 14.94	6119.8	Lieut. Hoxie Lieut. Wheeler E. P. Austin	Lieut. Marshall E. P. Austin	Camp three miles east of; on Chalk Creek.
1869	Near Hamilton, Nev	49	Sun Polaris Aquilæ α Aquilæ	115 25 58.38	39 15 48.87	7601.3	Lieut. Wheeler Maj. Roberts	Lieut. Wheeler Lieut. Lockwood	Camp east of, about 2½ miles.
1872	Kanab, Utah	67	Sun Polaris α Cygni α Tauri	112 31 39.00	37 02 25.43	4909.0	Lieut. Marshall E. P. Austin	Lieut. Marshall	Monument in square; front of bishop's residence.
1869	Monte Christo Mill, Nev	49	Sun	115 34 49.20	39 13 16.83	7596.0	Lieut. Wheeler Maj. Roberts	Lieut. Wheeler Dr. F. Kampf	West of Hamilton, Nev.
1869	Peko, Nev	40	Sun Polaris	115 30 14.50	40 55 46.35	5180.0	Lieut. Wheeler Maj. Roberts	Lieut. Wheeler Dr. F. Kampf	On Central Pacific Railroad.
1872	Pipe Springs, Ariz	67	Sun Polaris α Lyræ α Cygni	112 42 57.00	36 51 36.34	5397.2	Lieut. Marshall E. P. Austin	Lieut. Marshall	Camp near.
1872–73	Provo, Utah	50	Sun Polaris α Cygni α Lyræ α Bootis α Virginis Jupiter	111 40 27.00	40 13 47.84	4567.3	Lieut. Hoxie J. H. Clark	Lieut. Hoxie J. H. Clark	Old Camp Rawlins; longitude determined by Lieut. Hoxie, 1873; latitude by Lieut. Marshall, 1872.
1873	Richfield, Utah	59	α Herculis Sun Polaris α Serpentis α Lyræ α Bootis α Aquilæ α Ophiuchi	112 02 27.00	38 46 11.40	5282.6	Lieut. Hoxie J. H. Clark	Lieut. Hoxie J. H. Clark	Camp at.
1872	Toquerville, Utah	67	Sun Polaris	113 16 20.90	37 15 19.88	....	Lieut. Wheeler Lieut. Marshall E. P. Austin	Lieut. Marshall	Barometric records lost.



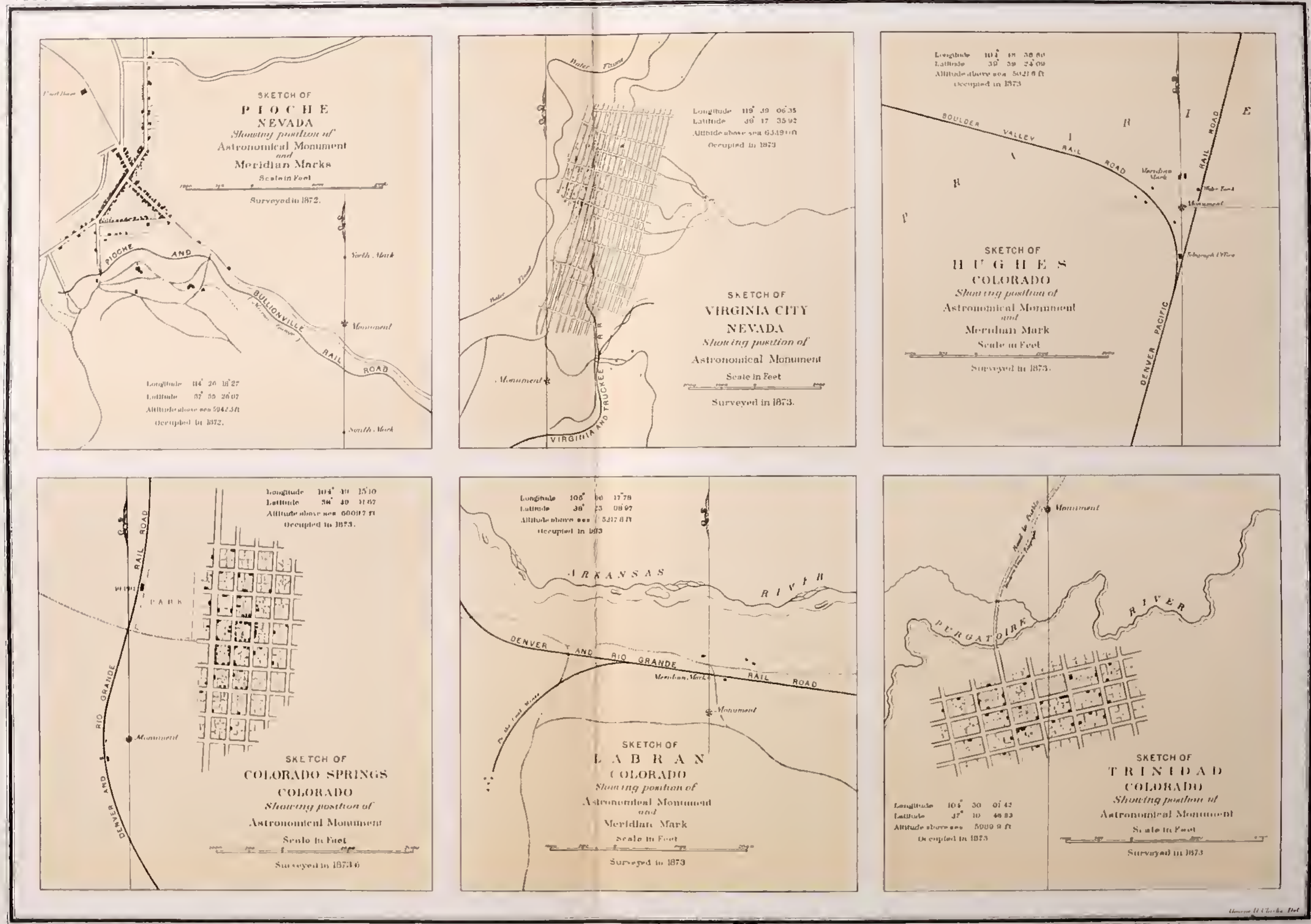




George D Clarke, Del

EXPEDITIONS of 1871, 1872, 1873 & 1874, Under the Command of 1st. Lieut. Geo. M. Wheeler, Corps of Engineers, U.S. Army

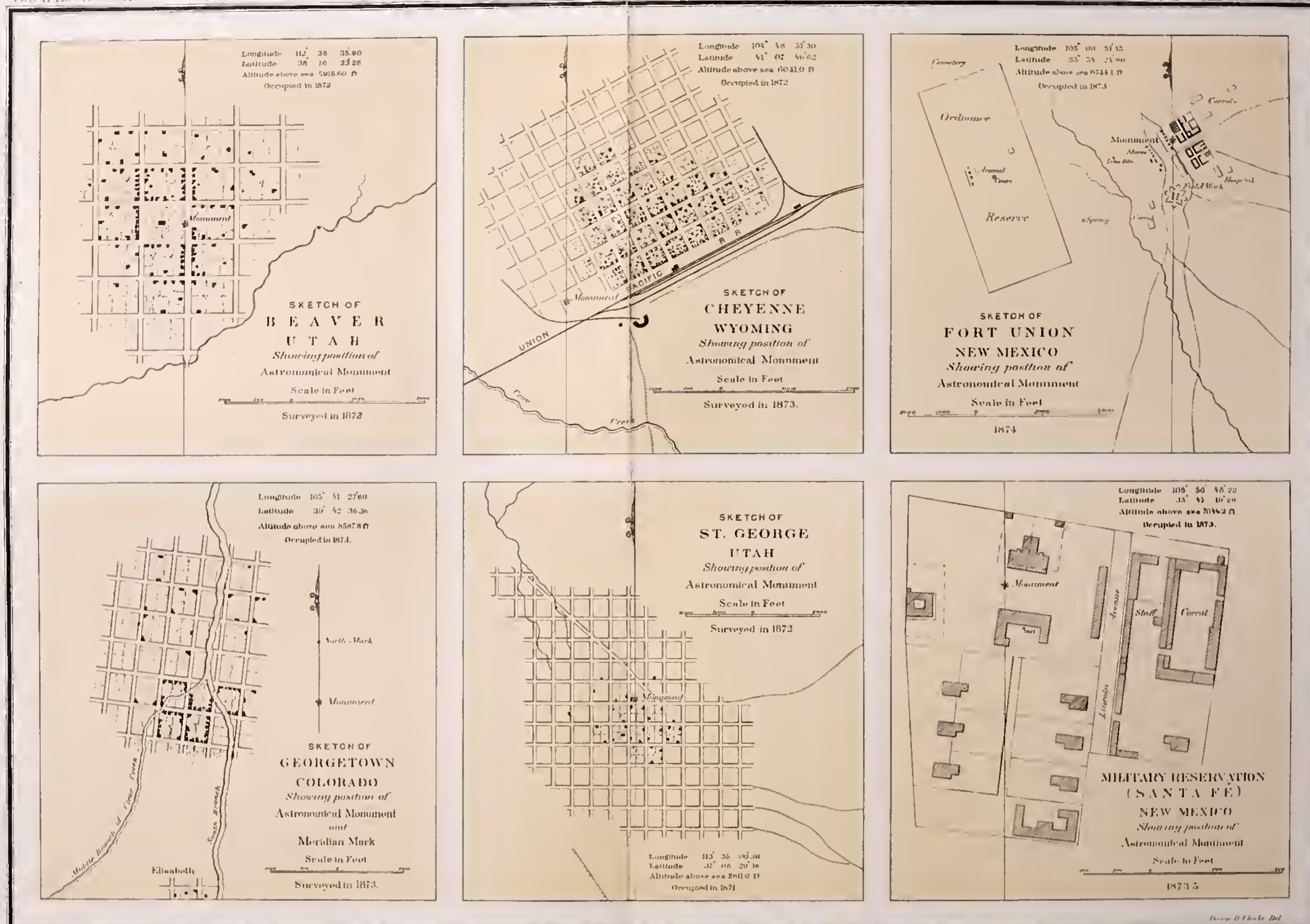
BY ORDER OF THE HONORABLE THE SECRETARY OF WAR, UNDER THE DIRECTION OF BRIG. GEN. A. A. HUMPHREYS, CHIEF OF ENGINEERS U S ARMY


SKETCH OF
PIOCHE
NEVADA
Showing position of
Astronomical Monument
and
Meridian Marks
Scale in Feet
Surveyed in 1872.
PIOCHE AND BULLIONVILLE RAIL ROAD
North Mark
Monument
South Mark
Occupied in 1872.
Water Flume
SKETCH OF
VIRGINIA CITY
NEVADA
Showing position of
Astronomical Monument
Scale in Feet
Surveyed in 1873.
Occupied in 1873
Monument
VIRGINIA AND TRUCKEE R R
Occupied in 1873
BOULDER VALLEY RAIL ROAD
PRAIRIE
Meridian Mark
Monument
Telegraph Office
SKETCH OF
HUGHES
COLORADO
Showing position of
Astronomical Monument
and
Meridian Mark
Scale in Feet
Surveyed in 1873.
DENVER PACIFIC
RAIL ROAD
Occupied in 1873.
PARK
DENVER AND RIO GRANDE RAIL ROAD
Monument
SKETCH OF
COLORADO SPRINGS
COLORADO
Showing position of
Astronomical Monument
Scale in Feet
Surveyed in 1873-6
ARKANSAS RIVER
DENVER AND RIO GRANDE RAIL ROAD
Meridian Mark
Monument
SKETCH OF
LABRAN
COLORADO
Showing position of
Astronomical Monument
and
Meridian Mark
Scale in Feet
Surveyed in 1873
Monument
PURGATOIRE RIVER
SKETCH OF
TRINIDAD
COLORADO
Showing position of
Astronomical Monument
Scale in Feet
Occupied in 1873
Surveyed in 1873

U S GEOGRAPHICAL SURVEYS WEST OF THE 100TH MERIDIAN

VOL. II-ASTRONOMY

PLATE No 6



EXPEDITIONS of 1872, 1873, 1874 & 1875, Under the Command of 1st Lieut. Geo. M Wheeler, Corps of Engineers, U S Army

BY ORDER OF THE HONORABLE THE SECRETARY OF WAR, UNDER THE DIRECTION OF BRIG GEN A A HUMPHREYS CHIEF OF ENGINEERS U.S. ARMY

Geographical positions by measurement from or by trigonometrical connection with main astronomical points.

Year.	Station.	Atlas-sheet No.	Connected with astronomical station at—	Longitude.	Latitude.	Altitude.	Connection made by—	Remarks.
				° ′ ″	° ′ ″	*Feet.*		
1873, 1874, 1877	Fort Garland, Colo...	62	Main triangulation.	105 25 33. 73	37 25 27. 33	4, 853. 7	7, 937. 0	R. R. level.
1877	Camp Douglas, Utah (new flag-staff).	41	Old flag-staff and sun-dial.	111 50 14. 22	40 45 47. 50	4, 902. 5	Dr. F. Kampf	By trigonometric connection with sun-dial and stone observing pier, established by survey.
1873	Camp Douglas, Utah (astronomical monument).	41	Salt Lake City, Utah.	111 50 14. 07	40 45 47. 58	4, 905. 0	G. Thompson.	By chaining; stone monument in same position as old flag-staff.
1873	Fort Ellis, Mont	24	Bozeman, Mont .	110 59 49. 27	45 40 08. 00	4, 878. 0	....	Approximate difference between astronomical observing pier and fort, taken from Land-Office plats, and the position of the observing pier as given by J. H. Clark.
1873	Fort Fred. Steele, Wyo. (flag-staff).	43	Fort Fred. Steele, Wyo.	106 56 54. 27	41 46 50. 63	6, 850. 0	J. E. Weyss..	Difference between monument and flag-staff determined from plats and measurements by J. E. Weyss.
1873	Fort Sanders, Wyo. (flag-staff).	43	Laramie, Wyo...	105 34 59. 56	41 17 26. 89	7, 168. 0	J. E. Weyss ..	

U. S. GEOGRAPHICAL SURVEYS WEST OF THE ONE HUNDREDTH MERIDIAN,
1st Lieut. GEO. M. WHEELER, Corps of Engineers, U. S. Army, in charge.

PART II.

RESULTS

IN

BAROMETRIC HYPSOMETRY,

OBTAINED DURING

THE YEARS 1871, 1872, 1873, 1874, AND 1875.

REPORTED BY

FIRST LIEUTENANT WM. L. MARSHALL,
CORPS OF ENGINEERS, U. S. ARMY.

WITH TABLES OF BAROMETRICALLY DETERMINED ALTITUDES.

LETTER OF TRANSMISSION.

UNITED STATES ENGINEER OFFICE,
GEOGRAPHICAL SURVEYS WEST OF THE 100TH MERIDIAN,
Washington, D. C., August 5, 1876.

SIR: I have the honor to forward herewith a report upon the meteorological work of the survey since 1871. It is confined to the hypsometrical work proper, since the data accumulated by the Survey is not sufficiently extended for general meteorological discussions; nor has the time at my disposal been sufficient to allow more than the examination and reduction of the observations for the vertical element of the survey.

The computations and reductions prior to 1874 were performed under the direction of Lieut. R. L. Hoxie, Corps of Engineers, to whom is due in great part the systematic organization of this branch of the work. The altitudes computed under his direction have not been re-examined or changed except where subsequent observations have been made, in which case a mean of the altitudes determined have been taken. The hourly work has all been re-examined and in some cases recomputed. Sixteen plates of horary curves deduced therefrom are appended to the report, and will be found interesting as exhibiting the great diurnal movement of temperature and barometric pressure in the drier portions of the continent.

In the reduction of the observations I have been assisted by First Lieut. Rogers Birnie, Thirteenth United States Infantry; First Lieut. C. W. Whipple, Third Artillery, United States Army; First Lieut. Eric Bergland, Corps of Engineers, under whose direction the observations taken by his party in California in 1875 were reduced. Hospital Steward Theodore V. Brown, United States Army; Messrs. F. M. Lee and George M. Dunn; and Privates Wm. Looram and John F. Kirkpatrick, Battalion of Engineers.

The work of computation has been mainly performed by Mr. F. M

Lee and Hospital Steward T. V Brown, United States Army, who were each attached to the Survey for over four years in this branch of work.

I am, sir, very respectfully, your obedient servant,

W. L. MARSHALL,
First Lieutenant of Engineers.

To First Lieut. G. M. WHEELER,
Corps of Engineers, United States Army, in charge, &c.

INTRODUCTION.

The meteorological observations taken by the Survey have been confined to those necessary for securing the vertical co-ordination of points for the maps, and the work in the office has been almost entirely directed to their discussion for hypsometrical purposes.

General meteorological observations have been taken and recorded, but since these necessarily are somewhat desultory, they can be of but little use to meteorologists for climatological purposes where fuller and more connected observations have been taken, nor can they add much to knowledge where the general climatic conditions of the field of survey are as well understood as in the present case.

INSTRUMENTS.—COMPARISONS AND INSTRUMENTAL ERRORS.

The instruments used in the field have been Green's mercurial cistern barometer, mountain pattern, with brass scales, adjusted in position for capillarity, reading to ″.002 by vernier; Green's, Casella's, and Pike's aneroid barometers, pocket-size, compensated for temperature, and with attached thermometers; Green's psychrometers, maximum and minimum pocket-thermometers; and at the astronomical stations anemometers (Thompson's pattern), and the ordinary Smithsonian pattern rain-gauges.

In 1871, '72, '73 the number of instruments at the disposal of the Survey was small, but where practicable two sets of instruments were assigned to each topographical party in the field; ordinarily, however, but one cistern-barometer could be assigned to each, with the necessary thermometers and aneroids In later years two or more complete sets of instruments were allotted each party, and the instrumental errors were checked by a rigid series of comparisons throughout the field-season; as a consequence, the results possess the greatest claim to confidence.

At all rendezvous-camps in the first three years of the Survey comparisons were made among all the fixed instruments for relative errors, and by these alone the instrumental errors were checked. In after years, the numerous instruments in each party afforded the means of checking their own changes.

Before taking the field, all of the meteorological instruments except the aneroids were compared with the Signal-Office standard, and their relative errors determined. They were then transported to the field by hand, and at the initial points the barometers were again compared among themselves to detect changes in the adjustments of such barometers as were affected by transportation. As a rule, these comparisons were made merely pending the organization of the expedition, and, besides their value in checking instrumental vagaries, they also afforded data for the determination of the diurnal oscillation in barometric pressure. In making the comparisons, the rules laid down in Williamson's "Use of the Barometer," &c., were observed, except that the errors of the barometers and of their attached thermometers were determined separately. In the comparison in the open air of the thermometers and psychrometers, contradictory results were obtained at different comparisons, as a rule showing errors less than the ordinary errors of observation where temperatures are read to the nearest quarter of a degree.

The comparisons have therefore been rejected and the indications of the thermometers assumed as reliable, except in a few cases where the errors are large and well shown.

At present, to avoid the local mutations in air temperature indicated by thermometers in the open air arising from the heat of the observer's body, from the change in temperature caused by currents of air entering the room where the comparisons are made, from the different capacity for absorbing and storing heat and consequent varying temperatures of different parts of the same building, &c., all which make it difficult to secure satisfactory and stable results from comparisons of many thermometers in the open air, the bulbs of all thermometers when being compared are immersed to an equal depth in a tub of mercury, which, secured in a wooden box, is less affected than the stratum of air in contact with both the body of the observer and the thermometers, and prevents to a very marked and satisfactory extent the local fluctuations already mentioned.

In the field during the past two seasons all of the meteorological instruments of each party were compared at the regular hours for observing, and when from two to five barometers were carried in a party the condition of the instruments at any required date was determined therefrom. Aneroids were compared night and morning with the cisterns, and at culminating points of the trails. In some instances the cisterns of a party were all simultaneously injured, leaving breaks in the chains of comparisons for such parties. In these instances it has generally been practicable, from comparisons with the instruments of another party or with those of the Signal-Service stations in the areas surveyed, to trace back through subsequent comparisons the individual errors of the instruments to the time of injury.

In Party No. 2, Colorado Section, during the field-season, 1875, the tubes of both barometers were accidentally broken at the beginning of the field-season, and the only possible comparison of refilled instruments during the season was with the barometer of the United States Army signal station at Santa Fé, New Mexico. A long series of comparisons was there made with that instrument, which developed a correction in our barometers of more than $-\frac{2}{10}$ of an inch to make them agree with the Signal Service barometer. Since the only probable cause of change in error of a carefully filled barometer is the difference of capillarity of the tubes, and slight difference from want of rigidity where connection is made between tube and cistern, the index being upon a movable piece, and, morever, since ingress of air into the tube depresses the mercury and causes a positive error, or the barometer to read too low, it was at once evident that the greater part of this error must be in the barometer at Santa Fé. Unfortunately the barometers did not reach the final rendezvous in order, and the entire work of this party depended upon the above comparisons of instruments at Santa Fé.

I had been led by comparisons made the previous year between new instruments and the barometer at Santa Fé, to suppose that that instrument read too low by more than one-tenth of an inch, which was further confirmed as above. Rejecting this comparison, therefore, and referring the observations made by this party at points previously well determined in altitude to Denver, Colorado Springs, Fort Mohave, and Santa Fé (with its barometric altitude), that error which gave the same or nearly the same altitudes for these points was adopted. With this error the altitudes of other points previously united were checked, and the work of the preceding two years was found to agree well with that of the past season. The results of the various comparisons of barometers are given in the tables below, from which it can be seen that the cistern-barometers seldom varied more than ″.03 during an entire field-season, which changes, if undetermined, would have caused errors of from 32 to 38 feet in the resulting heights; this is less than the probable error of a single result due to abnormal oscillation when observations are referred to quite distant reference-stations.

RESULTS OF COMPARISONS OF BAROMETERS AND ATTACHED THERMOMETERS.

Table of errors on Signal-Service standards.

Date.	Compared at—	With standard.	Barom. No. 1376, error.	Barom. No. 1611, error.	Barom. No. 1613, error.	Barom. No. 1735, error.	Barom. No. 1767, error.	Barom. No. 1768, error.	Barom. No. 1769, error.	Barom. No. 1852, error.	Barom. No. 1853, error.	Barom. No. 1985, error.	Barom. No. 1988, error.	Barom. No. 1989, error.
July 5-7, 1872	Washington, D. C	S. O. standard	.000	–.005	–.002	+.006	–.005	+.002	–.005	Not used.	Not used.	Not used.	Not used.	Not used.
July 13-31, 1872	Salt Lake City, Utah	1376	.000	–.001	–.006	–.001	–.001	±.000	–.002					
May 12-17, 1873	Washington, D. C	S. O. standard	+.027	–.050		–.010	–.001	–.003	+.002	–.002	–.008	–.009	–.002	
May 18-19, 1874	do	do												–.006
June 19-23, 1874	do	do	–.012											
June 26-28, 1874	do	1376	–.012			–.013	–.015	–.009	+.002	–.022	–.010	–.005	–.026	–.017
July 22-31, 1874	Pueblo, Colo	1769	–.016			–.009			+.002	–.018	–.020	–.006	–.021	+.005
May 5, 10, 1875	Washington, D. C	S. O. standard	–.032			–.024	–.025	–.025	–.030		–.032	–.039	–.027	–.024
May 24, 26, 1875	do	do												
June 12, 16, 1875	Los Angeles, Cal	2124				–.011	–.013					–.040	–.020	
June 1, 6, 1875	Pueblo, Colo	1989	–.019					–.018	–.036		–.017			–.024
Jan. 26-31, 1876	Washington, D. C	S. O. standard												–.024

Date.	Compared at—	With standard.	Barom. No. 1978, error.	Barom. No. A, error.	Barom. No. B, error.	Barom. No. 2031, error.	Barom. No. 2032, error.	Barom. No. 1, error.	Barom. No. 2, error.	Barom. No. 1998, error.	Barom. No. 1, error.	Barom. No. 2124, error.	Barom. No. 2143, error.
July 5-7, 1872	Washington, D. C	S. O. standard	Not used.	Not used.	Not used.	Not used.	Not used.	Not used.	Not used.	Not used.	Not used.	Not used.	Not used.
July 13-31, 1872	Salt Lake City, Utah	1376											
May 12-17, 1873	Washington, D. C	S. O. standard											
May 18-19, 1874	do	do											
June 19-23, 1874	do	do											
June 26-28, 1874	do	1376	–.032	–.029	+.111								
July 22-31, 1874	Pueblo, Colo	1769	–.014		+.004								
May 5, 10, 1875	Washington, D. C	S. O. standard		–.029	–.026				–.024	–.026	–.024		
May 24, 26, 1875	do	do										–.007	–.025
June 12, 16, 1875	Los Angeles, Cal	2124		–.021	–.024						–.020	–.007	–.016
June 1, 6, 1875	Pueblo, Colo	1989	–.057										
Jan. 26-31, 1876	Washington, D. C	S. O. standard											

From the comparisons as above, the following errors of the attached thermometers were deduced:*

Barom. No. 1376, error.	Barom. No. 1611, error.	Barom. No. 1613, error.	Barom. No. 1735, error.	Barom. No. 1767, error.	Barom. No. 1768, error.	Barom. No. 1769, error.	Barom. No. 1852, error.	Barom. No. 1853, error.	Barom. No. 1985, error.	Barom. No. 1938, error.	Barom. No. 1989, error.	Barom. No. 1978, error.	Barom. No. A, error.	Barom. No. B, error.	Barom. No. 2, error.	Barom. No. 1998, error.	Barom. No. 1, error.	Barom. No. 2124, error.	Barom. No. 2143, error.
+ 1.46°	+ 1.23°	+ 1.95°	+ 1.07°	+ 0.93°	+ 1.12°	+ 1.46°	+ 1.36°	+ 0.76°	+1.04°	+ 1.03°	+ 0.56°	+ 1.46°	+ 0.65°	– 0.75°	+ 1.00°	+ . . .°	+ 1.13°	+ 0.03°	+ 0.35°

* In the field the attached thermometers nearly invariably read *higher* than the standard open-air thermometers of the several field-parties corrected for errors, except in camps where the barometers, were left hanging a sufficient length of time for the entire volume of the mercury to acquire the air temperature. This resulted, doubtless, from the absorption of heat by the metal of the barometers, which cooled but slowly by radiation. The errors above are affected with the *minus* sign when instruments read *higher* than the standard, and *vice versa* when they read lower.

Table showing the errors of the cistern barometers as deduced from the comparisons of the instruments of the several field-parties among themselves. Field-seasons 1874–1875.

Date.	Barom. No. 1376, error.	Barom. No. 1735, error.	Barom. No. 1767, error.	Barom. No. 1768, error.	Barom. No. 1769, error.	Barom. No. 1852, error.	Barom. No. 1853, error.	Barom. No. 1985, error.	Barom. No. 1988, error.	Barom. No. 1989, error.	Barom. No. 1978, error.	Barom. No. A, error.	Barom. No. B,* error.	Barom. No. 1, error.	Barom. No. 2, error.	Barom. No. 1998, error.	Barom. No. 2124, error.	Barom. No. 2143, error.
July 1, 1874	−.012	−.013	−.015	−.009	+.002	−.022	−.010	−.005	−.026	−.017	−.032	−.029	+.111	(d)	(d)	....	(d)	(d)
August 1, 1874	−.016	−.009	−.015	−.009	+.002	−.018	−.020	−.006	−.021	+.005	−.014	(c)	+.004	(d)	(d)	−.006	(d)	(d)
September 1, 1874	−.011	−.009	+.024	−.003	−.003	−.018	−.027	+.014	−.021	....	−.012	(c)	+.209	(d)	(d)	−.006	(d)	(d)
October 1, 1874	−.011	−.009	+.015	−.003	−.010	−.010	−.005	+.005	−.003	+.014	−.012	(c)	+.307	(d)	(d)	broken	(d)	(d)
November 1, 1874	−.076	−.009	broken	−.003	−.006	−.010	−.005	+.011	−.003	broken	....	(c)	broken	(d)	(d)	broken	(d)	(d)
June 1, 1875	−.032	−.024	−.025	−.025	−.030	(a)	−.032	−.039	−.027	−.024	....	−.029	−.026	−.024	−.024	−.026	−.007	−.025
July 1, 1875	−.032	−.030	−.019	−.006	−.030	(a)	−.014	−.047	−.027	−.024	−.012	....	−.019	−.011	−.039	−.047	−.007	−.026
August 1, 1875	−.019	−.030	−.019	−.028	−.036	(a)	(b)	−.047	−.027	−.024	−.057	−.029	−.037	−.011	−.039	−.047	−.007	−.021
September 1, 1875	+.067	−.030	−.010	−.014	−.053	(a)	(b)	−.047	−.027	−.024	−.223†	−.021	−.017	−.011	−.039	−.047	−.007	−.021
October 1, 1875	−.077	−.030	−.010	−.077	−.059	(a)	(b)	−.047	−.048	+.024	−.223	−.021	−.022	−.011	−.039	+.012	−.022	+.046
November 1, 1875	−.077	−.016	+.002	+.001	−.066	(a)	(b)	−.047	−.029	+.024	−.223	−.021	−.025	−.011	−.039	+.012	−.044	+.046

a Not used in 1875. *b* Broken July 7, 1875, and not used after. *c* Left in office as standard. *d* Not used.

* Barometer B in 1874 had a cylindrical cistern instead of a constricted conical one, which seemed in some way to facilitate the ingress of air to the tube. It was refilled again and again by boiling, and the position of the tubes changed, but, while the other instruments with similar usage remained free from air, a bubble would be found in its tube after short use. The instrument was not, therefore, relied upon for altitudes. In 1875 it had been remedied and worked well. Where comparisons are not shown above, the instruments were in use at the main stations, and their errors, as determined at initial comparisons, constant.

† Barometer 1978, compared at signal office in Santa Fé, shows a greater error than can be possible. Comparisons in 1873 and in 1874 also showed that the signal-office barometer at Santa Fé reads too low, giving too great an altitude for that point.

NOTE.—Attached thermometers assumed to maintain constant errors as determined at initial comparisons. Of the barometers, the errors as adopted for the observations taken near the dates above are given. When a tube was refilled or an accident caused a change in the error of any barometer, a series of comparisons was instituted to determine the new error.

The barometers, with their long tubes unsupported and filled with heavy mercury, are carried slung across the shoulders of the meteorologists, and are subjected to severe jolts from the stumbling or plunging of the riding-animals, by which they are often broken. Many instruments are thus broken during each field-season and refilled, making the tracing of instrumental errors through the field comparisons, where from twelve to thirty barometers are used, a tedious undertaking. An attempt is now made to remedy this objection to the mercurial barometers by inclosing the tube in an outer casing of brass and filling the entire space between the brass and glass tubes with plaster of Paris, save along a narrow slot cut through the outer brass case for twelve inches of the scale for reading the instrument. The tube is thus supported throughout its entire length by a nearly rigid support, and when filled cannot easily be broken save at the top, where it is not inclosed with plaster to allow of its expansion by heat.

The objection to this arrangement is that the attached thermometer, which before gave only approximately the temperature of the mercury, is rendered still more uncertain in its indications of the temperature of a column protected by a porous and bad conductor of heat inclosing it. This can only be avoided by inclosing the attached thermometer also within the outer brass tube, which seems practicable.

ANEROID BAROMETERS.

Since the organization of the survey aneroids have been used by the topographers and geologists for relative altitudes, and when properly handled are useful, convenient, and sufficiently reliable instruments for the purposes to which they have been applied. Prior to the field-season 1873, so little was known by the individuals using them of their action and capabilities under the necessarily rough usage they must encounter in the field, and so much confidence was placed in their indications, that frequent comparisons with the more reliable mercurial barometers, which are absolutely essential if results of value are to be expected, were neglected, and when the aneroid work came to be reduced it was found useful only as indicating the manner in which the instruments should not be used, and their utter worthlessness when not employed in connection with the mercurial barometer or the level. Like all mechanical combinations of levers, screws, and springs, they are subject to continual shifting of parts when subjected to the jar and jolts encountered in ordinary use in the field, and it is essential that a continual watch be kept upon their indices of error by comparisons with more constant instruments. Besides the continual change in the position of the zero-point, from actual shifting of screws and other points, the following defects seem to be common in a greater or less degree to all aneroids.

1. They are not compensated for temperature.

2. The elasticity of the corrugated steel chamber is affected by repeated changes in pressure.

3. The graduation is not always perfect, and moreover the errors of graduation of an aneroid which has been repeatedly subjected to considerable changes of atmospheric pressure seem to vary. This variation is probably a consequence of the affected elasticity or permanent change in form of the vacuum-box.

4. The weight of the machine itself affects its indications, *i. e.*, the readings of the aneroid will differ when held in different positions. In the aneroids used by us the difference is sometimes as much as 0''.08 ; the aneroid reading lower when held with the plane of the face vertical than when held with face horizontal and upward. The amount of this variation will depend upon the construction of the instrument, its size, and the weight of its parts.

To determine and separate the errors due to these various causes, when each of from eighteen to thirty aneroids is involved, calls for more extended, careful, and expensive observations and experiments than have been practicable or advisable, considering the value of the expected results.

During the field-seasons of 1874 and 1875, whenever hourly observations were taken, all aneroids which could be assembled were compared hourly with the cisterns, which gave series of comparisons extending over several days and through quite wide ranges of temperature; when the instruments were undisturbed and read under similar conditions, their permanent adjustments were presumably constant. All of these comparisons have been examined, and, as far as they furnish data, the effects of temperature upon many aneroids in practice have been determined. The instruments were made by Pike, Ewing, and Casella, principally by the latter, of pocket-size, graduated to $0''.05$, but susceptible of being read to $0''.01$ by estimating the smaller subdivisions. The differences between the readings of each aneroid and the corresponding indications of the cistern barometer at 32° Fahrenheit were first taken to eliminate the movement in the barometric column itself, and these differences and the corresponding temperatures grouped according to the ascending scale of temperature, and the mean of each group taken. The result has been an ascending scale of temperature and a corresponding scale of aneroid differences. In a number of cases no well-marked law of variation has been apparent, which is probably due to the want of a sufficient number of careful comparisons where compensation is nearly attained. Certainly in these cases the want of compensation for ordinary ranges of temperature affects the readings by a quantity less than the errors of observation. Other errors share this want of compensation even in a short series of comparisons. Of these, some are *over-compensated*, or the movement produced by heat is the reverse of that seen in the mercurial barometer; others are *under-compensated*, or the movement is in the same direction as the temperature. It is probable that no aneroid is perfectly compensated, but it is also true that in a number of the aneroids in use by us this desideratum is so nearly approximated that for all intents and purposes it is practically attained for ordinary ranges of temperature.

Of about thirty aneroids examined one was affected $0''.046$ by a change of 39°.5 Fahrenheit. Two others were affected $0''.035$–$0''.037$ by a change of 40° Fahrenheit, and these three showed the greatest variation. These comparisons indicate but approximately the effects of temperature, but show that in the special cases examined the extreme errors in the results cannot from this cause alone exceed fifty feet. In practice the range of temperature during each day's travel was much less than given above and the errors from this source correspondingly less.

The comparisons were made not so much for determining tables of corrections for temperature as for getting a definite idea of the value of aneroid results, when corrections for temperature were not applied to the readings. The above-mentioned results, however, are no criterion for judging of the action of aneroids other than those compared, since each instrument possesses its own individual qualities, which may be as unexceptionally bad as the above were unexpectedly good.

The aneroids in use by the survey, though made and graduated to order, have been unaccompanied by tables of scale-error, and it has been impracticable to have them tested under the air-pump after arrival in the office. In following out the system of comparisons, however, the aneroids have been compared with mercurial cistern-barometers at numerous points, varying in altitude from 8,000 to 14,000 feet, which comparisons have all been examined and reduced. As a rule these comparisons are not satisfactory for determining accurately scale-errors when small, since the effects of this source of inaccuracy may be combined with actual changes in the adjustments of the instruments themselves, from which they cannot be separated. Whenever the errors of scale are large, however, they become apparent from the comparisons, and the observations made with such aneroids have been rejected as unreliable.

Below are given comparisons of aneroids by Casella, Nos. 2094, 2075, and 2087, at bases and summits of high mountains. Numerous comparisons of these and other instruments at bases and summits of the higher mountain peaks of Southwestern Colorado and Eastern California give similar results and show good graduation and excellent working when the indices of error remained constant. On the other hand, comparisons of instruments made by the same maker, under the same contract and specifications, show poor graduation, as shown in the table for aneroid 2088.

In the table below all the aneroids in use by two of the field-parties are given as examples. The aneroids used by the other field-parties show similar action.

Date.	Number of comparisons.	Temperature.	Cistern-barom. at 32° Fahr.	Aneroid errors.	
				No. 2094.	No. 2094.
1875.		°	"	"	"
August 8	3	53.6	21.500	+.713	....
August 7	2	48.0	18.909	+.719	....
August 7	2	64.0	19.553	+.717	....
August 9	3	59.4	18.137	+.721	....
August 10*	4	57.4	21.501	+.718	....
August 8–10	7	57.4	21.501	....	+.408
August 11	2	49.6	18.057	....	+.397
August 13	2	56.2	18.607	....	+.410
August 11–16	9	50.7	20.304	....	+.413
August 17†	2	56.5	18.735	±.000	....
August 25	3	62.9	20.968	+.003	....
August 29	5	50.2	20.950	+.006	....
August 31‡	2	56.6	19.369	+.077	....
September 1	2	41.2	21.421	+.069	....

* Same place as on August 8.

† Aneroid set to agree with cistern at 32° Fahrenheit.

‡ Index error changed 0″.07; 2088, poor graduation; observations rejected.

Date.	Number of comparisons.	Temperature.	Cistern-barom. at 32° Fahr.	Aneroid errors.	
				No. 2088.	No. 2087.
1875.		°	"	"	"
November 18, 19	2	57.8	26.718	+.198	....
November 22, 23	2	70.6	28.633	+.038	....
November 23, 24	2	74.4	29.107	—.008	....
November 24–27	7	68.5	29.581	—.028	....
September 8	12	47.0	19.413	....	—.084
September 10	7	69.4	21.481	....	—.076
June 27	4	66.9	28.558	....	—.141
June 28	3	69.8	30.032	....	—.148

Under all the circumstances of actual use in the field the merits of the aneroids have been carefully examined, and the sum of the errors due to the above causes determined, and whenever unadjustable errors, which are so great as to materially affect the resulting altitudes, have become apparent from any cause, the observations have been discarded as worthless. So also in nearly every case where no checks have been had upon the changes for several days, unless the comparisons before and after these intervals show nearly constant index errors. At best, however, there is always a feeling of doubt as to the accuracy of a result from an aneroid observation, unless the greatest care is observed in testing and using it.

OBSERVATIONS.

The observations taken in the field were made in accordance with the printed instructions published by the Survey, and were of the following classes:

1. Hourly observations of cistern-barometers and psychrometers at all of the main astronomical stations established since 1871, for the purpose of securing tables of horary corrections to be used in the reduction of isolated observations and the aneroid work. Such series were from eight to forty days at each station.

2. Hourly observations at rendezvous and other camps for the same purpose.

3. Cistern-barometer and psychrometer observations in camp every three hours, or at 7 a. m., 2 and 9 p. m., at which hours also all meteorological instruments of each party were compared for determining the altitudes of camps, and to furnish the means of detecting changes in instrumental adjustments.

4. Cistern-barometer and psychrometer observations on peaks and topographical stations simultaneously with observations in camp.

From the nature of the case, these observations were taken whenever they could be, and not in all cases at the best hours. The summits of the peaks in most instances were high above the upper limit of arborescent vegetation, where wood for fires could not be secured, making it impracticable to remain over night upon the station for the purpose of observation, and rendering it necessary for the ascending parties to return to camp before nightfall. The observations for these reasons are, as a rule, recorded as taken near the hottest part of the day. When, however, the ascending parties camped high up upon the flanks of the peaks ascended, the bad effects of high-temperature observations have been in a great measure obviated, as will be shown hereafter.

5. Aneroids and thermometers were read in connection with the odometer at meander stations along roads and trails, for securing definite profiles, along meander lines, at towns and settlements, and upon the summits of divides, &c. Cistern barometers and psychrometers were also read.

6. Aneroid and psychrometer readings taken by various members of the different field parties at points which can be identified and located upon the maps without the aid of topographical notes.

In addition to the readings as above given, taken for hypsometrical purposes alone, general meteorological observations, such as are prescribed by the Smithsonian Institution, were taken and recorded. A mass of meteorological data has thus been accumulated which, though not sufficiently extended to be of much use in general meteorological discussions, may be of interest for comparison.

OFFICE REDUCTIONS.

In the computation of altitudes the observations have been compared with simultaneous observations taken at fixed reference stations, determined in altitude by the best practicable means at the disposal of the Survey. The Signal-Service stations at Corinne, Utah; Denver and Colorado Springs, Colorado; Santa Fé, New Mexico; San Francisco and San Diego, California, have been used as well as stations established by the Survey. The altitudes of Corinne, Denver, San Francisco, and San Diego have been determined from lines of level connected with sea-level. The altitude of the zero point of the barometer of signal stations at Colorado Springs and Santa Fé, New Mexico, was determined by referring these stations, by means of five months' tri-daily observations, to corresponding observations at Denver, Colorado. The height above the sea of the top of the meridian-pier in the Mormon observatory at Salt Lake City, Utah, was determined by a line of levels run, under the direction of Lieut. R. L. Hoxie, Corps of Engineers, by Assistant Engineer Gilbert Thompson, of this Survey, from the Central Pacific Railroad bench-mark at Corinne, Utah, using the mean water-level of the Great Salt Lake as a connecting level, and this point assumed as one of the datum points for our barometric work of 1872–'73. A bench-mark was established in 1875 at Los Angeles, California, with which the zero of the barometer at the reference station there was connected, by level, by Assistant Engineer Frank Carpenter, of this Survey, with the United States engineer tide-gauge at the Wilmington Breakwater, California.

The above-mentioned stations were the points to which all the barometric observations taken by the Survey have been ultimately referred, including those taken at the temporary reference stations established during the progress of the work. These included the main astronomical stations where hourly observations were taken, camps for a longer period than three days, and tri-daily stations established at camps of supply, &c., which secondary reference stations were established sufficiently near the field of operations to give good results for relative heights, when observations were referred to them by daily means; the altitudes of these stations themselves were determined from the means of the series of observations taken at them. A list of the reference stations used during the progress of the work at which observations were taken for a longer period than four days, is given in the following table:

List of reference stations used in the reduction of the hypsometric work.

Station.	Atlas-sheet.	Altitude above sea (feet).	How determined.	Observations.		
				Year.	Dates.	Taken.
Beaver, Utah (astronomical station)	59	5, 915. 6	Barometer	1872	Aug. 8 to Sept. 7	Hourly.
Corinne, Utah (signal-office)	41	4, 244. 4	C. P. R. R. levels	1871	May 1 to Dec. 30	Tri-daily.
Do	41	4, 244. 4	....do	1872	July 13 to Dec. 31	Do.
Do	41	4, 244. 4	....do	1873	May 1 to July 23	Do.
Colorado Springs, Colo. (signal-office)	62*a*	6, 030. 4	Barometer	1874	July 1 to Nov. 30	Do.
Do	62*a*	6, 030. 4	....do	1875	June 1 to Nov. 19	Do.
Colorado Springs, Colo. (astronomical station)	62*a*	6, 009. 7	....do	1873	July 28 to Aug. 10	Hourly.
Denver, Colo. (signal-station)	53*c*	5. 244. 6	K. P. R. R. levels	1872	July 13 to Dec. 22	Tri-daily.
Do	53*c*	5, 244. 6	....do	1873	June 1 to Dec. 30	Do.
Do	53*c*	5, 244. 6	....do	1874	July 1 to Dec. 1	Do.
Gunnison, Utah (astronomical station)	50	5, 144. 6	Barometer	1872	Oct. 30 to Dec. 2	Hourly.
Georgetown, Colo. (astronomical station)	52*a*	8, 487. 2	....do	1873	June 15 to July 6	Do.
Kanab, Utah	59	5, 072. 3	... do	1873	Nov. 1 to Nov. 21	Tri-daily.
Labran, Colo. (astronomica lstation)	62*a*	5, 217. 8	....do	1873	Aug. 12 to Aug. 28	Hourly.
Los Angeles, Cal. (rendezvous camp)	73*c*	312. 5	Level by survey	1875	June 14 to July 3	Do.
Los Angeles, Cal. (Gartner's office)	73*c*	325. 6	....do	1875	June 29 to Nov. 11	Tri-daily.
Los Angeles, Cal. (Lieut. Bergland's office)	73*c*	323. 2	....do	1875	Oct. 16 to Nov. 15	Do.
Fort Mojave, Ariz. (bench-mark)	74*b*	755. 8	Barometer	1875	July 8 to Sept. 5	Hourly.
Ogden, Utah (astronomical station)	41	4, 376. 8	....do	1873	Sept. 26 to Oct. 3	Do.
Pioche, Nev. (astronomical station)	58	5, [illegible]42. 3	....do	1872	Sept. 27 to Oct. 14	Do.
Santa Fé, N. Mex. (signal-station)	69*d*	7, 044. 2	....do	1871	Nov. 20 to Dec. 10	Tri-daily.
Do	69*d*	7, 044. 2	....do	1873	Aug. 1 to Nov. 3	Do.
Do	69*d*	7, 044. 2	....do	1874	July 1 to Nov. 30	Do.
Do	69*d*	7, 044. 2	....do	1875	June 1 to Nov. 25	Do.
San Diego, Cal. (signal-office)	80	62. 0	Level	1875	June 15 to Nov. 1	Do.
San Francisco, Cal. (signal-office)	55	60. 0	....do	1875	June 15 to Nov. 1	Do.
Salt Lake City, Utah (observatory)	41	4, 330. 4	....do	1873	June 23 to Oct. 5	Do.
Do	41	4, 330. 4	....do	1872	July 13 to Aug. 2	Hourly.
Trinidad, Colo. (astronomical station)	70*a*	6, [illegible]43. 1	Barometer	1873	Sept. 3 to Sept. 19	Tri-daily.
Austin, Nev., camp near	48	7, 520. 6	....do	1871	June 10 to June 15	Do.
Amargosa River, Cal	65*b*	3, 106. 6	....do	1875	Sept. 12 to Sept. 18	Do.
Big Tijongo Cañon	73*c*	1, 556. 0	....do	1875	July 16 to July 22	Do.
Camp Independence, Cal	65*a*	3, 956. 5	....do	1871	July 18 to Aug. 10	Hourly.

List of reference stations used in the reduction of the hypsometric work—Continued.

Station.	Atlas-sheet.	Altitude above sea (feet).	How determined.	Observations. Year.	Observations. Dates.	Observations. Taken.
Camulas Ranch, Cal	73*c*	799. 0	Barometer	1875	Sept. 11 to Sept. 17	Tri-daily.
Caliente, Cal	73*a*	1, 344. 1	...do	1875	Oct. 14 to Oct. 19	Do.
Carlin, Nev	40	4, 849. 4	...do	1871	May 27 to June 5	Do.
Chama River, Forks, N. Mex	69*b*	8, 367. 1	...do	1875	June 24 to June 30	Do.
Cañon Station, Cal	65*d*	2, 650. 0	...do	1875	Aug. 8 to Aug. 28	Do.
Cottonwood Springs, Nev	65*b*	3, 449. 5	...do	1871	Aug. 31 to Sept. 15	Hourly.
Cottonwood Island, Cal	74*b*	787. 2	...do	1875	July 14 to July 28	Tri-daily.
Cottonwood Creek, Puncho Park, Colo	61*b*	9, 381. 1	...do	1875	June 27 to July 2	Do.
Dolores River, Colo., camp on	61*c*	9, 020. 6	...do	1875	Sept. 5 to Sept. 11	Do.
Edgar's Spring, Cal	65	4, 060. 8	...do	1871	Aug. 17 to Aug. 22	Do.
Fort Wingate, N. Mex	76	7, 037. 7	...do	1873	Aug. 5 to Sept. 9	Do.
Fort Tejon, Cal	73	3, 245. 7	...do	1875	July 25 to Aug. 14	Do.
Furnace Creek, Cal	65*a*	405. 1	...do	1875	Sept. 2 to Sept. 12	Do.
Kincaid Ranch, Cal	73*a*	1, 769. 5	...do	1875	Sept. 24 to Oct. 1	Do.
Little Yosemite, Cal	65*c*	6, 442. 1	...do	1875	Sept. 27 to Oct. 14	Do.
Lake City, Colo	61*c*	8, 753. 4	...do	1875	Aug. 2 to Aug. 8	Do.
Las Vegas, Nev	66	2, 017. 8	...do	1871	Sept. 15 to Sept. 20	Do.
Leach's Point, Cal	73	3, 408. 6	...do	1871	Aug. 21 to Aug. 25	Do.
Linn Creek, Colo., camp on	61*c*	9, 531. 2	...do	1871	Sept. 12 to Sept. 19	Do.
Martin's Ranch, Cal	73*d*	2, 037. 6	...do	1875	June 25 to July 4	Do.
Moreno Valley, N. Mex. (camp)	70*a*	8, 152. 2	...do	1875	June 26 to July 6	Do.
Puncho Creek, Colo., camp on	61*b*	8, 576. 0	...do	1875	July 3 to July 7	Do.
Ray's Creek, Cal. (camp)	73*c*	4, 978. 9	...do	1875	Aug. 26 to July 1	Do.
San Fernando, Cal	73	1, 038. 0	...do	1875	July 8 to July 18	Do.
Santa Paula, Cal	73*c*	384. 0	...do	1875	Sept. 6 to Sept. 11	Do.
San Pedro, N. Mex	77*b*	6, 364. 0	...do	1875	Sept. 26 to Oct. 1	Do.
Saguache, Colo	61*d*	7, 723. 1	...do	1875	July 7 to July 15	Do.
Saguache Creek, South Fork, Colo., camp on	61*d*	10, 059. 7	...do	1875	July 17 to July 23	Do.
Saguache Creek, West Fork, Colo., camp on	61*d*	10, 079. 9	...do	1875	July 23 to July 28	Do.
San Miguel and Uncompahgre Divide, Colo. (camp).	61*c*	9, 689. 4	...do	1875	Aug. 23 to Aug. 28	Do.
San Miguel and South Fork, Colo. (camp)	61*c*	9, 700. 1	...do	1875	Sept. 1 to Sept. 5	Do.
San Juan City, Colo	61*c*	8. 900. 8	...do	1875	Oct. 18 to Oct. 26	Do.
Silver Peak, Nev	57	4, 256. 6	...do	1871	July 6 to July 11	Do.
Silver Cañon, Nev., camp in	58	6, 661. 6	...do	1871	July 11 to July 20	Do.
Tehachapai Pass, Cal., camp in	73*a*	3, 831. 9	...do	1875	Oct. 19 to Oct. 22	
Tellurium post-office, Colo. (camp)	61*c*	10, 878. 2	...do	1875	Aug. 10 to Aug. 16	
Tierra Amarilla, N. Mex	69*b*	7, 651. 0	...do	1875	June 30 to July 5	Tri-daily.
Weldon, Cal	65*c*	2, 716. 9	...do	1875	Oct. 18 to Nov. 12	Do.
Walker's Basin, Cal	73*c*	3, 157. 2	...do	1875	Oct. 11 to Oct. 15	

In addition to the stations enumerated above, which have been used as reference stations, hourly observations were taken at Bozeman, Mount Cimmaron, Fort Union, and Las Vegas, New Mexico; Fort Garland, Hughes, Pagosa, Hot Springs, and Julesburg, Colorado; Cheyenne, Fort Steele, Green River Station, and Laramie Station, Wyoming; Prescott and Truxton Springs, Arizona; Virginia City and Winnemucca, Nevada; and Sidney Barracks, Nebraska. These points were occupied at times when they could not be used to advantage in the hypsometric work of the Survey as reference stations, but the horary curves have been deduced and used whenever applicable.

The observations were all corrected for instrumental errors and reduced to 32° Fahrenheit. Those taken at the hourly and main reference stations were then plotted, and the erratic or erroneous observations thus revealed were corrected by interpolation, using for the interpolated values those derived from an approximate horary curve deduced from all the observations taken at the station under consideration, combined with the abnormal movement for the day. These approximate tables were also used for interpolating observations where wanting; thus reversing the operations of eliminating the abnormal and horary oscillations of the barometer, as given in Williamson's treatise.

The hourly observations were then "reduced to level" by Colonel Williamson's method, and the observations for those days whose well-marked horary fluctuations not materially affected by the non-periodic motion, were selected for the formation of the horary corrections given in the plates and tables hereto appended.

Observations taken at hours other than those which give close approximation to the mean of the day were then corrected for horary oscillation, as far as the tables were deemed applicable. In addition to the horary tables deduced from the work of the Survey, those given by Williamson for points on the Pacific Coast were used for reducing the work of the California parties in 1875, when considered suitable, and approximate daily means thus secured.

At camps and on the march approximate daily mean temperatures were secured from observations at 7 a. m., 2 and 9 p. m.; at other points the observed temperatures approximately reduced were employed. For mountain stations the following method, whenever practicable, was followed. This applied when the ascending parties camped high up on the flanks of the peaks on the nights preceding and following the ascent, viz: For want of more reliable law connecting observed temperatures at two points with the difference in altitude, the observations taken by the ascending party at their timber-line camp at 7 a. m., before the ascent, and at 9 p. m., after the occupation of the peak, were reduced three degrees Fahrenheit for each inch of the mercurial column, between the readings in camp and on the summit, and the reduced temperatures were taken in connection with the 2 p. m. observations on the summit, for an approximate mean daily temperature to be used in the barometric formula, with the observed height of the barometer reduced to 30° Fahrenheit, for determining the height of the peak above the reference station at its base. In the work of the Colorado section, among the high peaks of that portion of the continental divide, this method gave very satisfactory and uniform results. Where the observed temperatures upon the summits of the peaks in the same area, many of them being occupied during a short time—one nearly every day—were altogether different, and, when used in the ordinary barometric formula, gave results not agreeing with the relative differences as determined by angles of elevation and depression; but when reduced, as above-described, the mean daily temperatures varied among themselves but a few degrees, as we should expect in the same region and season, and gave much more harmonious results.

It is essential in determining the altitudes of high points where it is necessary to refer to stations at their bases, or many feet below their summits, and where the want of wood for fuel makes it impracticable to remain overnight upon the summit, to adopt some device for securing approximate daily mean temperatures. Granting that the barometric formula is correct, it is at best difficult to secure the mean temperature of the stratum of air between base and summit.

The atmosphere is heated only by contact with a heated body; by the absorption of heat-rays; by aqueous vapor; by convection or by freeing of latent heat during the condensation of aqueous vapor in the formation of clouds and dew. In the almost dry air of the Western plains and mountains, little heat is absorbed and little disappears by evaporation where there are so few surfaces of water; but for this very reason the solar and terrestrial radiation is astonishingly great. In a single twenty-four hours the range of temperature in the shade is often equal to or greater than it is during the entire year at points in a more humid climate in the same latitude near the sea. For instance, at Labran, Colorado, at 4 a. m. August 27, 1873, the thermometer registered 52°.2 Fahrenheit in eight hours, or at 12 m. it had risen to 110°.6 Fahrenheit, a difference in air temperature of 58°.4 Fahrenheit. At Hughes, Colorado, at 1 p. m., July 13, 1873, the temperature was 107°.1; at 5 a. m. next morning it was 52°.8, a range of 54°.3 Fahrenheit; and again, at Cheyenne, Wyoming, October 9, 1872, at 6 a. m. the temperature in the shade was 20°.0 Fahrenheit, and at 2 p. m. same day it stood at 76°.0, a range of 56° in air temperature in eight hours.

Such fluctuations are impossible in moist climates where a thick stratum of air intercepts by its moisture and more nearly equalizes the heat received from the sun throughout this stratum, and where so much of the heat received from the sun becomes latent during evaporation and again freed by deposition of dew at night. But they are not unusual, and are no doubt often exceeded in the interior of this continent in localities still drier than those given. The same causes which produce such fluctuations near the surface, prevent to a great degree the dissemination of diurnal heat throughout the upper strata. The action of the sun's rays and their effects on the temperature of the stratum considered in hypsometrical work are supposed to be as follows: The heat-rays pass through the dry air of the region under consideration without great absorption, and heat the surface of the earth. The air in contact with it becomes heated, expands and rises, losing much of its sensible heat in the work of expansion and in overcoming the resistance to its upward motion. A continual current of expanded air ascends, which rapidly cools from radiation and work, and the sensible heat, disappearing from these causes, is not replaced, as in moister regions, by increments of heat absorbed by particles of vapor in the passage of heat-rays through them, nor becomes apparent by the condensation of moisture in the formation of clouds. The heated particles soon radiate or lose their heat, communicating comparatively little heat to others, and are soon sufficiently cooled to again take part in the vertical circulation moving now downward, and before the increased temperature affects materially the upper strata not in direct contact with the earth, the air below is becoming cold, by radiation in the afternoon and night. It is probable then that although there are great fluctuations in temperature, as observed, within a few feet of the heating body of the earth, that the higher strata are not much affected, although there is a gradual change in the general temperature of the atmosphere from one season to another, not only from the effects of the thermal conditions of the earth-crust, but also from the varying position of the sun with reference to the sphere of the atmosphere itself; the lack of perfect freedom of motion of its particles by which equalization of temperature would be brought about; and the capacity it has for absorbing part of the radiated heat of the sun.

In summer the sun is longer above than below the horizon, and consequently the earth receives more heat than it loses by radiation. The mean temperature of the stratum of air in contact with the earth is, therefore, while this increase of heat is being received, too great to represent the mean temperature of the stratum between. In the winter the reverse is the case. The earth loses more heat than it receives, and while in summer it is the heating body, in winter its crust is the cooling surface. Here, too, the transmission of the cooling effect of the earth is not aided by the particles receiving the residual heat of the upper strata by actual contact from actual motion in a vertical direction, but the quantity of the cooled particles being increased they remain near the surface, the lower strata being generally the coldest during this season of the year; therefore the mean of the temperatures, even if correctly taken at two points respectively gives at different heights above the ground-level, too low mean temperatures for the stratum between. The surmise that the diurnal movement of temperature does not extend to a great height is shown by experiment to be confirmed by results by the barometric formula. When it is assumed that the mean of the temperatures at the high and low stations gives the mean temperature of the stratum between, different results are attained for the twenty-four hours, too great temperature-corrections resulting during the warm parts of the day and too small during the night; whereas a constant temperature for the twenty-four hours continued, with the observed heights of the barometer corrected for diurnal movement, gives much more concordant results. If it be true that the diurnal movement of temperature is not very appreciable in the higher strata, remaining nearly constant throughout the day, the yearly movement only being apparent, it would be better to use in the barometric formula the means of the observed temperatures for a longer time than one day, in connection with the observed mean daily height of the barometer at the two stations, disregarding the mean observed temperature for any single day of the series. Now that the Army Signal Service has established stations upon the summit and at the base of one of the lofty peaks in the dry region of this continent, it would be well to discuss the observations taken thereat, if only with reference to the best practice in regard to the temperature-terms of the formula in use; added to this consideration is the value of the sines in further investigating the constants of the barometric formula which seem to require modification.

It is contended above that even if the thermometers indicated the temperature of the air at the surface, the mean of the readings of the thermometers at two points of different altitudes near the surface would not indicate the true temperature of the stratum between, on account of the various ways that sensible heat may and does disappear and reappear. Besides these reasons, thermometers at the surface of the heating and cooling body are subject to many causes of error in their indications, that tend to produce the same results. When the earth is warmer than the air they are affected by the radiated heat from the earth itself and from all surrounding solid bodies, and by reflected rays of the sun, which make the readings too large. When the earth is colder than the air the reverse takes place. When, therefore, the earth is the heating body, as in summer, the indications will be too great, and *vice versa* in winter.

The consequences of the facts that the earth in summer is the heating and in winter the cooling body, and that the observed temperatures near the surface in the summer are too high and in the winter too low for use in determining the mean temperature of the air, are seen in the results from the application of the barometric formula by which too great differences of level are derived in summer and too low in winter. This may, perhaps, by the investigation of observations taken at such stations as those established by the Signal-Service upon Pike's Peak and Colorado Springs, and at other high and low barometric stations in different parts of the world, be corrected for in the constant of the pressure term of the barometric formula by multiplying the mean value of this constant by a factor of the form $(1 + f(L))$; the second term in the parenthesis giving the values of a periodic function depending not upon the differences in level so much, perhaps, as upon the latitude of the place and declination of the sun, and which, increasing or diminishing the constant factor by a variable quantity, may cause the barometric formula to give identical results throughout the year. Disregarding the effects of influences that are small and complex, it seems reasonable to hope that the form of the function in the second term of the above value may, by examination, be empirically discovered and not be too complex for ordinary use. Or else the form of a function expressing the law, if there be one, of the relation of the observed to the true temperature of the air.

The observations of the psychrometer were reduced by the use of the tables in Williamson's treatise, neglecting the correction for altitude. So little is known of hygrometry at high altitudes, and the influence of the factor depending on moisture in the barometric formula of Plantamour, is so small, that the neglect of this small correction affects the results so far as altitudes are concerned inappreciably, while its application would call for nearly double the amount of work in computing the humidity only to attain results of doubtful value. From the difficulty of securing good observations and results from the psychrometer, the mean daily humidity, or where practicable, the mean monthly values were taken for use in the barometric formula for the reference station, and the mean for as long a time as practicable at the required station. Each observation has not been separately computed, but the force of vapor and humidity in the tables has been derived from the *mean* wet bulb and *mean* differences.

From the difficulty and expense of establishing numerous reference stations in the thinly-settled regions surveyed, and the increased labor in the reduction of observations at many stations, it has been necessary to refer the observations to places in some cases three hundred miles from points whose altitudes above the sea were sought, which introduces into the results the effects of *differences in phase* of the atmospheric waves continually sweeping over the area surveyed. From the known facts in regard to the motions and variety of contour of these waves it would be practically impossible to make corrections for abnormal oscillations where, as in the case of moving field-parties, the necessary data for determining the barometric gradients cannot be secured. In making corrections for abnormal movements, attempts have been made to reduce the readings at the two stations to the mean values for the entire period covered by the field-work, without reference to the *motion* of the waves or to the differences in barometric gradients at different points or parts of the waves. The motions and shapes of barometric waves or areas of high and low barometer have indeed but lately, or since the establishment of the Army Weather Bureau, attracted general attention, and as yet in the Territories of the United States, in which this Survey has been engaged, the workings of this bureau are not sufficiently extended. In this connection a few general remarks are made to explain the methods which have been adopted, as far as the data at hand would allow, in reducing our work, and which will be more strictly and fully carried out in future.

The areas of high and low barometer move with varying rates and in directions not constant in a *general* west to east course. The forms of the waves or rather areas of high and low pressure and of the isobars are innumerable: sometimes like troughs or waves of the sea; sometimes nearly circular or elliptical; sometimes irregularly shaped, with projecting arms, as it were, of low barometer, with barometric gradients of different degrees of steepness on different sides of the periphery of the bowls or troughs of low barometer.

The laws of propagation of the waves or the extent of the oscillations seem to be different at different altitudes; or from some cause unknown the same rules of interpretation will not apply to observations taken at high stations as to those taken at low points. This, however, may be due to the defective formulæ for reducing observations to a fixed datum plane for comparison.

From which it results that while we may succeed in eliminating the effects of abnormal oscillation at the fixed station, the application of the corrections deduced thereat to isolated observations at a distance would leave the results with precisely the same errors expressed in inches of the barometric column; and that this correction cannot be made unless from numerous fixed stations the isobars can be accurately traced, and the forms and gradients of the waves correctly determined, from which the observations may be corrected. This process, however, would evidently involve labor and expense wholly incommensurate with the value of the results attained, and practically impossible of application where a great number of observations at different points and at various hours of the day are involved. From the practical difficulty of securing corrections of doubtful utility no attempt has been made to correct directly for abnormal oscillations in the preparation of the pressure term, but the observations have been referred to the nearest of the reference stations established in the field of survey without such corrections. From the shapes of the surfaces of the waves, as shown by the isobars on the weather maps of the United States Army Signal-Service, it is seen that the surface covered by the crests and troughs of barometric waves, and the width of the areas included between isobars expressing differences of, say, 0''.1 in barometric height (which would correspond to errors of from 100 to 130 feet from this cause), though great, do not justify distances so great as we have been forced to use between our points of observation and those to which the observations have been referred. To lessen the errors which must necessarily enter the results from this cause, as far as the computing force and the time at our disposal would allow, important points where altitudes have been reached with a closer approximation to accuracy have been referred to several reference stations in presumably different *phases* of abnormal or non-periodic disturbance, the point whose altitude is required falling within the polygon found by connecting the reference stations by right lines. Assuming the formula correct, the resulting computed altitude of the point, if referred to one of the stations, would be too high; if to another, too low; and if to a third, perhaps nearly correct. A mean height in accordance with the relative distances of the point from these reference stations, provided the same wave in its different phases embraced all the reference stations, is evidently better than the result from any one determination.

Reasoning thus theoretically, or without sufficient facts or results from actual experiment, it seems that the following is perhaps the best and most expeditious method for a party working in thinly settled regions of the West, where numerous reference stations well determined in altitude cannot be established near the field of operations, to approximately eliminate the effects of atmospheric waves, from the resulting altitudes from barometric readings, viz: To establish, say at least three stations, near the periphery of the area to be surveyed, and on high points within the area. Each cistern-barometer station made during the progress of the work, or at least each station of importance, should then be referred to each of the three, and a proper mean be taken for the result. When it is considered that it is at any rate necessary to establish as many stations—we have always had as many—and that the main portion of the labor comes, not in the final computations of results, which, with the full tables in use, are short and simple operations, but in the checking of instrumental vagaries in the field, and in the correction and preparation of the observations, which, for the reference stations, may be done as rapidly as the observations are taken, the amount of additional work in the office for the four stations is not twice that for one, with results probably enhanced in value in proportion to the number of such stations, if judiciously selected. It will be remembered, however, that the hypsometrical work of the Survey is simply intended for general information relating to the physical geography of the regions traversed by the surveying parties, and for the assistance of the topographers in representing on a comparatively small scale the topographical features of the country, and not for special purposes where the greatest attainable accuracy in the results, and consequent nicety in manipulation of instruments and in the treatment of observations are absolutely requisite. The methods used where several thousands of points must be quickly computed in order that the results may be on hand for the use of the topographers in constructing their maps, which are drawn at equal pace with the computations, are such as are most expedient and best adapted to gain at reasonable expense of time and labor such results as are needed for their purposes. We are thus forced to follow such rules as may be most rapidly and effectively applied, rejecting unnecessary refinements, or such as give results not commensurate in value to the labor involved in their application; but it seems at least practicable to cancel the effects of abnormal or non-periodic oscillations from the results, in so far as it may be done as above described, and this without unjustifiable expenditure of time and work. This method presupposes that that portion of the wave included within the reference stations is a plane, which is true only for small areas; nor can the abnormal oscillation be cancelled by this method unless the observations are simultaneous, since the waves, as above stated, are in motion, and time is therefore an essential element.

In the lists of altitudes hereto attached are many points where observations have been taken either by the same or different parties of the expeditions and at intervals widely separated. It is to be presumed that the relative *phases* of the non-periodic waves at the two stations in each set are different in the several cases, and that the differences in altitude are in great measure due to these differences in phase, and may be taken as representing imperfectly, but approximately, the variations and errors we may expect in other altitudes not so checked. For instance, at Fort Garland, Colorado, the following determinations were made at different times for the height of the same point above the sea:

Station.	No. of readings.	Dates.	Altitude above sea (feet).	Referred to—
Fort Garland, Colo	30	August 10–17, 1874	7,868.0	Santa Fé, N. Mex.
Do	1	November 20, 1874	7,849.7	Do.
Do	2	August 14, 15, 1874	7,863.6	Do.
Do	1	August 17, 1874	7,873.4	Do.
Do	3	July 29, 30, 1874	7,847.8	Do.
Do	1	November 8, 1874	7,837.5	Do.
Do	4	June 19, 1874	7,863.7	Do.

An extreme variation of 30.5 feet. Fort Garland, however, is nearly north from the reference station, and since the atmospheric waves move, as a rule, from west to east, their phases were probably nearly the same at the two stations, and we attain results with differences similar to those experienced in barometric determinations where the stations are near together horizontally.

At Fort Wingate the following results were attained:

Station.	No. of readings.	Dates.	Altitude above sea (feet).	Referred to—
Fort Wingate, N. Mex	18	July 11–18, 1873	7,095.4	Santa Fé, N. Mex.
Do	3	September 22, 23, 1873	6,918.1	Do.
Do	18	July 12–18, 1873	7,067.8	Denver, Colo.
Do	3	August 2, 1873	6,998.8	Santa Fé, N. Mex.
Do	18	July 22–28, 1875	7,098.8	Fort Mojave and Santa Fé, N. Mex.

A difference of 181. feet between the greatest and least determination. Of the determinations above, however, the 1st, 3d, and 5th were from quite long series of tri-daily observations, and the agreement between the results is invariably good, and not to be expected where the distances to reference stations are so great (180 to 400 miles). Other determinations show similar differences, but it is rare that discrepancies of 100 feet occur between independent results. Sometimes, however, discrepancies of over 200 feet appear. From the method of carrying the barometer, on mules, strapped to the back of the rider, and exposed to jars and jolts, and from the improper means for preserving them in the field, it would be strange if changes in their adjustment did not occasionally take place. These, if undetected, would cause many of those discrepancies we attribute to non-periodic motions in the atmosphere and to other causes.

The high station recommended above and prescribed in the instructions printed for the use of the field-parties of the Survey, is for use in reducing the observations taken at similar high points. Where the points occupied are in the vicinity of this station the observations are referred directly to simultaneous observations taken thereat, being mean daily temperatures, thus reducing the errors from defective temperature observations, which are directly proportional to the difference in altitude as given by the barometric pressure term. For points at such a distance from the high station that errors may result from referring the observations direct, the following course is prescribed: A semi-permanent camp will be established for several days, the altitude of which will be determined from a mean of the series of observations taken thereat, and all observations taken in the vicinity of the semi-permanent camp will be referred to it for differences of altitude, to avoid, as far as practicable, the errors from differences in phase of non-periodic waves, which would become apparent if referred to a point at a distance.

The observations taken at the high station will be referred by weekly means to synchronous observations at the permanent base station, and the barometric difference of altitude deduced for each week of the series. The quotients arising from dividing the true by the computed heights will be tabulated for each week of the field-season, and will give a series of factors by which all barometric differences of altitude determined during the period covered by the table, in latitudes and places where the diurnal range of temperature and other climatic characteristics are similar to the same elements at the permanent high stations, will be multiplied to secure results approximately freed from the effects of the cause of inaccuracy just mentioned; or,

Let

$h =$ the absolute difference of level between high and low station, determined by level, if practicable, or else assumed as determined from the means of the entire six months' observations; and

$H =$ the computed difference in feet; then will

$h - H =$ total correction to be applied to the computed difference of level; and

$\frac{h-H}{H} = \left\{ \text{correction to be applied to each foot of computed difference in level.} \right.$

Now let

$h' =$ computed difference of altitude between two other stations, under similar conditions; then it is assumed that

$\frac{h-H}{H} \times h' = \left\{ \text{correction to be applied to this computed difference to obtain true result; and} \right.$

$$\left. \begin{array}{l} h' + \frac{h-H}{H} h' \\ \qquad \text{or} \\ \frac{h}{H} h' \end{array} \right\} = \text{true altitude of station.}$$

This method is adopted, instead of referring the observations direct to the high station, to carry out the system by which a semi-permanent reference station shall be established near the point determined, at which observations shall be taken for a sufficient period to proximately eliminate the effects of *differences* in phase of non-periodic waves from the altitude of this camp deduced from them; to do which requires that observations shall be taken at both stations in all phases of the waves or in corresponding phases.

In making the computations for altitude the formula of Plantamour, as represented by the tables in Williamson's treatise on the use of the barometer, has been used wherever humidity observations have been taken; otherwise the formula of La Place has been employed.

REDUCTION OF ANEROID OBSERVATIONS.

In the reduction of aneroid observations the ordinary defects of these instruments have been kept constantly in mind, and the observations have been closely examined to determine the amount of dependence to be placed upon them. The records of the various aneroids have been examined, and those observations when the instruments were working satisfactorily have been taken for computation. All observations made with an aneroid when used away from a cistern for several days have been given little weight as far as absolute heights are concerned, but have been computed in many instances, and approximate altitudes secured for the use of the topographers in constructing their maps, and in representing the relief of the country surveyed by them. As a rule, the aneroid has been considered as an adjunct of the cistern, to be used in connection with it, and not relied upon for the determination of the altitudes of points other than those along meander lines between camps, as explained below. Along the lines of march continuous profiles have been made with the aneroid; at each meander station the odometer recorders have been required to record the readings of the odometer, aneroids, and attached thermometers, and the topographers have located the points, either trigonometrically or by their meander courses and odometer distances. At culminating points of the trails and at camps the aneroids have been compared with the mercurial barometers, so that their indications are constantly checked. In this manner it has been practicable to furnish the topographers with numerous barometric bases from which by angles of elevation or depression they may determine the approximate heights of surrounding natural objects. Used with frequent checks by comparison with mercurial barometers, the aneroid is merely an indispensable instrument for rapid profiling, since it would be impracticable to set up, adjust, and read a mercurial barometer at such frequent intervals, and at the same time make the progress on the march rendered necessary by the scarcity of watering-places in the areas surveyed by the various expeditions of this Survey.

In the computation of the profiles between camps the following method has been followed (except in 1874, when observed temperatures were used). The altitudes of camps are determined from a longer or shorter series of cistern-barometer and psychrometer observations, as already described herein. The mean of the errors of the aneroid referred to the mercurial cistern-barometer at 32° Fahrenheit, as determined at the two camps between which the profile is run, is taken as the error of the aneroid for the day, and all observations corrected by it, unless the comparisons with mercurial barometers show that the instrument has materially changed its error between the two camps, in which case the observations are rejected *in toto*, unless from our knowledge of the actual grades of the route we are enabled to detect the place in the profile where the change occurred, and to correct the observations before and after accordingly.

The observations are then reduced to the mean of the day by applying the corrections for horary oscillation, and each station then referred to the preceding one (or to camps), the mean daily temperature, or when that cannot be approximated, the mean of the temperatures observed during the march, being used in the computation. Thus, since the aneroid is referred constantly to its own indications (which, observed by the same person, may be presumed to be affected all in the same direction by personal errors), instrumental errors are nearly eliminated from the final results or enter as differential quantities, and the error in the determination of the place of the zero-point of the aneroid does not appreciably enter the results, unless this differential error is large. Beginning at camp, the successive differences of altitude between the meander stations are then added each to the altitude of the station preceding, and the profile carried over to the next camp by successive steps. The difference in the altitude of this camp, as brought over from the preceding camp by the aneroid differences, and that determined by the series of cistern-barometer observations, is the error to be distributed throughout the profile to make the two coincide. It is evident that in thus computing this profile, we assume that there has been no non-periodic or abnormal fluctuation in barometric height, whereas the air is seldom or never in a state of equilibrium, and the barometer is therefore continually varying in height. Should the barometer be *rising*, the difference in level between the two camps as determined by this profile will be *too great* if we go from a *higher* to a *lower* camp, and *too small* if we go from a *lower* to a *higher*; and *vice versa* if there be a *falling* barometer. In the first case, when the barometer is *rising*, the altitude of the second camp, as carried over by the aneroid differences, will be *too low* by the amount in feet at that altitude of the abnormal or non-periodic movement, while the profile is being measured, and *vice versa* when the barometer is falling, provided the observations and the barometric formula are perfect.

In distributing the error it is assumed that the non-periodic movement is uniform during the few hours that the party may be engaged in running the profile-line, and that the error from this source in the altitude of each station is directly proportional to the time; or,

Let

$E =$ difference in feet in the altitude of Camp 2, carried by aneroid from Camp 1, and that computed from simultaneous observations of cistern-barometer.

$T =$ entire interval of time in minutes between instant of leaving Camp 1 and arriving at Camp 2.

$t =$ interval in minutes, between leaving Camp 1 and arriving at any profile-station.

$C =$ correction in feet to be applied to the altitude of that station.

Then

$$C = \frac{t}{T} E.$$

In unimportant profiles it is sufficiently accurate for the purposes of map construction to divide the errors equally between the various stations.

By this method of computation the observations are reduced with great rapidity; most of the reductions, indeed all except the final operations, can be performed in the field after the day's field-work is over; the connection between the aneroid differences and the absolute altitudes of the camps being made after the cistern-barometer observations are computed in the office.

Where important routes of communication are to be profiled, however, the aneroid should not be used, but careful cistern-barometer observations should be substituted and the observations reduced separately.

Appended hereto are condensed tables and summaries, with plates, representing the hourly fluctuations of barometrical pressure, temperature, relative humidity, and force of vapor, at some of the reference stations. The results are given as observed, and the curves are not in all cases smooth, but are published as material for what they are worth, and it is considered best to give the results with only such corrections as are evidently erroneous, shown by plotting the individual observations, and with no discussion. The series are not of sufficient length to cancel in the means erratic, accidental, or abnormal observations of movements, particularly in the barometric and vapor curves, but are perhaps sufficient to show the main peculiarities of the meteorological conditions existing in the interior of the continent for the times of the year to which they relate. Of these, the following are the most striking:—

1. An unusually great diurnal movement in barometric height. At low points, as Fort Mojave, Arizona, 755 feet above sea-level, in the interior, this oscillation reaches in August 0″.160. Near the seaboard, at Los Angeles, California, it does not reach half this amount. At high altitudes, as at Georgetown, Colorado, where the barometric pressure is 22 inches, the oscillation is as great, or greater than, in the same latitudes near the seaboard where the pressure is 30 inches. The supposed causes of this will be mentioned briefly below.

2. Very small relative humidities and little change during the day in the absolute quantity of aqueous vapor in the air, and consequent great changes in the relative humidity on the temperature changes and non-formation of dew and clouds, save by condensation by the highest of the mountain ranges. Small rain-fall and great ratio of clear to clouded sky, save in the higher mountains.

3. A great fluctuation in diurnal temperature, due to the dryness of

the air and consequent free terrestrial and solar radiation; to the non-freeing of latent heat in the upper strata by the formation of clouds, and during the colder parts of the night by the deposition of dew, which rarely, if ever, forms; and to the lack of free surfaces of evaporation, by the conversion of the water of which into vapor heat may become latent during the day. Variations of from 40° to 60° Fahrenheit in twenty-four hours are frequent during the summer; and from many degrees below freezing to near summer heat in winter. All of which causes produce a very rigorous continental climate, equalled only by the high interior regions of Asia.

4. Rapid responses of thermometer to the action of the sun, by which the maximum temperature is attained near noon, or some hours before it is near the seaboard, and by which the earth is shown to radiate its heat as rapidly as it is received. The temperature-curves show very abrupt movements of the thermometer during the day, dependent upon the free radiation and non-concentration of heat by moisture.

All of the above are direct consequences of the dryness of the climate. In moister regions such fluctuations of temperature would be impossible in the same latitudes, and, if possible, would render them utterly uninhabitable from the heating and freezing consequent upon the rapid deposition and evaporation of water, which would attend such changes in temperature.

While the diurnal oscillation of the barometer is not materially affected by the change in weight of the atmosphere due to the expansion and contraction from the temperature oscillation and the varying amounts of aqueous vapor in the air, the rapid expansion of the atmosphere by heat received by contact with the earth, puts the entire upper air in motion in a vertical direction, and the barometer by its diurnal oscillation exhibits the effects of the resistance of the inertia of the upper air to the motion developed by expansion below, as far as its maximum, which should occur when the temperature is increasing most rapidly. The motion subsequent to the maximum expresses only the varying effects of the momentum of the moving column of air pressing upon the mercury in the cistern, upon the barometric column.

The weight of the column of air being the same or nearly the same, therefore the oscillation should be and is greatest for the same diurnal motion of temperature at the equator, where the same weight corresponds to a greater mass, and should grow less toward the poles. The weights diminishing as we ascend above the earth, the oscillation should be greatest at the level of the sea, and less as we ascend above it. Hence, three elements should be taken into consideration in comparing the range of the horary oscillation:

1. The mean barometric pressures.
2. The diurnal range of temperature.
3. The latitudes of the places of observation.

The diurnal movements of the barometers at the points occupied by the Survey as reference stations have not been deduced from sufficiently long series to cancel non-periodic motions, nor to properly eliminate individual errors, but they go to confirm the theory that the momentum and inertia of the air developed by the heat of the sun is the efficient cause, though aided by other causes, which produce small motions in the barometric column. It is evident that if the weight of the air is diminished the only way in which, under this theory, the oscillation can be as great as before is by an increased rate of motion developed in this column, or by more rapid expansion and contraction at its base. If, therefore, we have a station at considerable altitude we would expect a less oscillation than at or near sea-level; but if the temperature at the high station increased in the proper ratio the oscillation would be equal at the two stations, or even greater at the higher.

This is supposed to be the explanation of the greater oscillations observed in the interior of the continent, even at high altitudes, given in the plates hereto attached.

SUMMARY OF HOURLY OBSERVATIONS AT GEORGETOWN, COLORADO, FROM JUNE 16 TO JULY 5, 1873.

Latitude, 39° 42′. Altitude above sea-level, 8,587.8 feet.

[Pl. 7, fig. 1; Pl. 11, fig. 25; Pl 14, fig. 43; Pl. 17, fig. 63; Pl. 20, fig. 79.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff. wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.037*	+11.7	+5.7	+.021	—.109*	1.42	2.3
8 a. m	—.029	+ 2.0	+2.0	—.014	—.036	1.37	2.3
9 a. m	—.014	— 4.4	—1.9†	—.017	+.035	1.37	2.9
10 a. m	—.016	—10.9	—6.2	—.020	+.094	1.53	3.6
11 a. m	—.008	—13.8	—7.0	—.037*	+.101	1.32	4.0
12 m	—.609	—14.3	—7.7	—.032	+.109	1.42	4.1
1 p. m	+.013	—14.3	—7.7	—.032	+.109	1.21	4.9
2 p. m	+.023	—15.5*	—8.8	—.028	+.125†	1.42	5.5
3 p. m	+.035	—14.3	—7.7*	—.032	+.109	1.63	6.1
4 p. m	+.043	—12.7	—6.3	—.037	+.090	1.79	6.1
5 p. m	+.050†	—11.1	—6.5	—.017	+.095	1.63	6.0
6 p. m	+.036	— 3.8	—2.5	—.003	+.049	1.36	6.1
7 p. m	+.029	— 0.3	0.0	—.005	+.007	1.42	4.6
8 p. m	+.018	+ 3.3	+2.0	—.001	—.031	1.32	4.0
9 p. m	+.005	+ 4.8	+2.5	+.006	—.039	2.31	2.1
10 p. m	—.009	+ 7.9	+3.9	+.004	—.072	2.11	2.1
11 p. m	—.013	+ 8.0	+4.2	+.010	—.076	1.79	1.1
12 p. m	—.017*	+ 9.3	+4.5	+.017	—.082	1.95	1.1
1 a. m	—.016	+10.1	+5.2	+.026	—.100	1.89	1.1
2 a. m	—.010†	+11.5	+5.3	+.025	—.092	1.84	1.1
3 a. m	—.012	+12.1	+5.3	+.031	—.092	1.95	1.2
4 a. m	—.023	+13.2	+5.6	+.036	—.095	1.95	2.4
5 a. m	—.029	+14.0†	+6.0	+.036	—.100	1.95	2.5
6 a. m	—.028	+13.2	+5.2	+.041*	—.083	1.53	3.1
Grand means	22.012	64.4	15.9	.204	.350	1.65	3.3

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	60.05
Nimbus	9.04
Cumulus	5.65
Cirrus	2.94
Stratus	4.45
Cirro-cumulus	6.85
Cirro-stratus	2.71
Cumulo-stratus	8.31
Total	100.00

WINDS.

	Calms.	N.	S.	E.	W.
Per cent	8.33	14.20	37.07	0.70	0.02
Force	....	1.7	4.4	0.3	0.1

	N.E.	N.W.	S.E.	S.W.
Per cent	3.28	5.26	19.08	12.06
Force	0.4	0.6	2.3	1.4

BAROMETER.

Extreme range of abnormal waves:
From 22.227 inches on June 22, 1873, (5 a. m.)
To 21.718 inches on June 27, 1873. (3 p. m.)

THERMOMETER.

Extreme range of diurnal temperature:
From 92°.5 F., at 4 p. m., on June 18, 1873,
To 53°.0 F., at 4 a. m., on June 18, 1873.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
		°	°	°	″	
1873. June 24	3 p. m.	92.0	61.2	30.8	.270	.170

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Thunder and rain, 2.13 to 2.23 p. m., June 12; thunder at 2 p. m., June 14; heat-lightning on evening of 14th; thunder and rain at 7.30 p. m., June 17; thunder and lightning at 3 p. m., June 19; thunder at 11 a. m., June 20; heat-lightning at 11.20 p. m., June 28.

Rain, 2.13 to 2.23 p. m., June 12; light shower at 2.45 p. m., June 13; shower, 11 to 10 a. m., 14th; two showers between 4 and 5 p. m., 14th; shower at 5 p. m., June 16; storm in southwest, 3.55 to 4.29 p. m., June 19; rain from 1.25 to 2.35 p. m., June 20; intermitting rain, 9.15 to 9.40 p. m., June 20; rain from 6.10 to 12.30 p. m., June 30; again, at 1.35, July 1; turned to snow at 2.45 a. m., and to rain again 5 a. m. to 6.35 a. m., same date.

Aurora borealis, pale and indistinct, 12.30 p. m., June 20.

Slight *fog*, from 4.10 to 6.50 a. m., June 24.

Snow at 2.45 a. m., July 1 (1½ in.); large flakes, ¼ inch in diameter; lasted until 5 a. m., same date.

SUMMARY OF HOURLY OBSERVATIONS AT GREEN RIVER, WYOMING, FROM JUNE 5 TO JUNE 29, 1873.

Latitude, 41° 31′. Altitude above sea-level, 6,096 feet.

[Pl. 7, fig. 2; Pl. 11, fig. 26; Pl. 14, fig. 44; Pl. 17, fig. 66; Pl. 20, fig. 84.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff. wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.028	+ 2.6	+ 3.1	—.015	—.026	0.8	2.3
8 a. m	—.032*	— 1.4	+ 0.9	—.021	+.017	0.7	1.8
9 a. m	—.029	— 7.4	— 2.8	—.027	+.076	1.1	1.8
10 a. m	—.018	—14.0	— 6.2	—.044	+.117	1.4	1.9
11 a. m	—.007	—16.3	— 8.4	—.034	+.144	1.4	2.2
12 m	+.008	—17.1*	— 9.9	—.019	+.164	2.0	2.8
1 p. m	+.016	—16.8	— 9.7	—.019	+.160	2.4	3.7
2 p. m	+.029	—16.0	—10.4	—.001	+.172	2.8	4.0
3 p. m	+.034	—15.0	— 9.7	—.001	+.165	2.4	4.2
4 p. m	+.040	—12.9	— 8.4	+.001	+.153	2.8	4.2
5 p. m	+.042*	—11.8	— 7.8	+.003	+.147	2.7	4.1
6 p. m	+.041	— 9.9	— 7.2	+.013	+.144	2.5	4.0
7 p. m	+.036	— 5.6	— 4.1	+.011	+.107	2.0	3.6
8 p. m	+.017	+ 2.0	+ 1.9	—.002	+.005	1.6	3.1
9 p. m	—.010	+ 5.6	+ 3.6	+.007	—.028	1.2	2.2
10 p. m	—.015	+ 8.7	+ 5.8	+.011	—.080	1.1	1.3
11 p. m	—.019*	+10.9	+ 6.6	+.011	—.102	1.1	1.2
12 p. m	—.017	+12.9	+ 7.3	+.017	—.119	0.7	1.2
1 a. m	—.017	+15.2	+ 8.3	+.023	—.146	1.1	1.6
2 a. m	—.016	+17.5	+ 9.4	+.026	—.185	1.0	1.4
3 a. m	—.010	+18.8	+10.1	+.026	—.213	0.9	1.5
4 a. m	—.006†	+21.0†	+11.6	+.020	—.282	0.7	1.5
5 a. m	—.014	+20.1	+11.5	+.015	—.280	1.0	1.9
6 a. m	—.019	+ 9.7	+ 6.8	—.005	—.115	0.9	1.9
Grand means	24.075	65.6	16.7	.213	.371	1.5	2.5

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	75.4
Nimbus	2.3
Cumulus	6.2
Cirrus	4.9
Stratus	1.3
Cirro-cumulus	7.1
Cirro-stratus	2.8
Cumulo-stratus	0.0
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent	25.5	1.0	5.5	5.0	21.0
Force	......	2.8	2.0	1.8	2.3

	N. E.	N. W.	S. E.	S. W.
Per cent	0.2	35.0	4.3	2.5
Force	1.0	1.8	1.9	2.1

BAROMETER.

Extreme range of abnormal waves:
From 24.310 inches on June 27 (6 a. m.), 1873
To 23.763 inches on June 21 (9 p. m.), 1873

THERMOMETER.

Extreme range of diurnal temperature:
From 91°.8, at 11 a. m., on June 27, 1873,
To 38°.9, at 4 a. m., on June 28, 1873.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1873.		°	°	°	″	
June 20	2 p. m.	94.5	59.5	35.0	.233	.144

NOTE.—At 6 p. m., June 17, dry bulb 98.3, wet bulb 54.5. This reading must be erroneous; not used for "extreme range" nor for "greatest difference."

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain, 1.39 to 1.57 p. m., June 6; same, 3.20 to 5.08 p. m., June 7; quantity about 0.20 inch; same (a few drops), at 1 p. m., June 11; same, 4.20 to 4.22 p. m., June 13; same, 8.55 to 9.05, June 14; same, 5.47 to 5.49 a. m., June 22; and from 7.15 to 7.35 a. m., same date.

Thunder-storm from 1.52 to 2.30 p. m., June 7.

SUMMARY OF HOURLY OBSERVATIONS AT LOS ANGELES, CALIFORNIA, FROM JUNE 11 TO JUNE 28, 1875.

Latitude, 34° 03'. Altitude above sea-level, 325 feet.

[Pl. 7, fig. 5; Pl. 11, fig. 27; Pl. 14, fig. 45; Pl. 17, fig. 62; Pl. 20, fig. 82.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	"	°	°	"			
7 a.m	—.032	+ 2.4	+1.2	+.010	—.042	0.66	7.89
8 a.m	—.044*	— 1.5	—1.1	+.011	+.060	1.00	7.56
9 a.m	—.036	— 5.2	—2.1	—.026	—.092	1.00	6.67
10 a.m	—.033	— 8.9	—3.6	—.047	—.141	1.22	2.44
11 a.m	—.022	—10.4	—4.6	—.045	+.172	1.56	0.56
12 m	—.012	—11.9*	—5.1	—.058	+.186	2.00	0.11
1 p.m	—.005	—11.1	—4.5	—.061	+.168	3.11	0.11
2 p.m	+.004	— 7.9	—3.1	—.043	+.124	3.11	0.11
3 p.m	+.013	— 7.1	—3.0	—.032	+.123	3.00	0.00
4 p.m	+.026	— 6.4	—2.9	—.022	+.121	3.33	0.00
5 p.m	+.033†	— 5.4	—2.2	—.024	+.096	3.00	0.00
6 p.m	+.033	— 3.6	—1.4	—.016	+.067	2.78	0.00
7 p.m	+.028	+ 1.5	+1.0	.000	—.034	1.11	0.00
8 p.m	+.019	+ 5.1	+2.7	+.009	—.123	0.89	0.33
9 p.m	+.010	+ 6.7	+3.1	+.022	—.146	0.56	1.00
10 p.m	+.006*	+ 6.6	+2.2	+.035	—.115	0.44	3.56
11 p.m	+.007	+ 7.4	+2.9	+.039	—.132	0.11	5.89
12 p.m	+.009	+ 7.6	+3.3	+.030	—.157	0.11	7.56
1 a.m	+.006	+ 7.7	+3.3	+.030	—.157	0.00	8.11
2 a.m	+.007	+ 7.7	+3.3	+.030	—.157	0.11	8.11
3 a.m	+.006†	+ 7.9	+2.8	+.049	—.125	0.22	8.56
4 a.m	—.004	+ 8.0†	+3.1	+.042	—.144	0.44	8.56
5 a.m	—.012	+ 7.6	+3.1	+.036	—.145	0.56	9.56
6 a.m	—.017	+ 5.4	+2.6	+.017	—.117	0.44	8.56
Grand means	29.674	63.9	4.8	.439	.744	1.28	3.97

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	60.6
Nimbus	26.0
Cumulus	4.2
Cirrus	2.4
Stratus	1.3
Cirro-cumulus	2.7
Cirro-stratus	0.1
Cumulo-stratus	0.8
Fog	1.9
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent	44.4	1.4	6.5	0.5	30.10
Force	......	2.0	2.0	1.0	2.4

	N. E.	N. W.	S. E.	S. W.
Per cent	2.3	2.8	0.9	10.2
Force	1.6	1.7	1.5	2.9

BAROMETER.

Extreme range of abnormal waves:
From 29.797 inches on June 13 (12 m.), 1875,
To 29.541 inches on June 25 (9 p.m.), 1875.

THERMOMETER.

Extreme range of diurnal temperature:
From 48°.8, at 5 a.m., on June 17, 1875,
To 82°.1, at 1 p.m., on June 16, 1875.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
		°	°	°	"	
1875. June 20	12 m.	85.2	67.5	17.7	.448	.371

SUMMARY OF HOURLY OBSERVATIONS AT SANTA FÉ, NEW MEXICO, FROM JUNE 11 TO JUNE 20, 1873.

Latitude, 35° 41′. Altitude above sea-level, 7,044.2 feet.

[Pl. 7, fig. 6; Pl. 11, fig. 29; Pl. 14, fig. 47; Pl. 17, fig. 65; Pl. 20, fig. 81.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.026	— 6.0	—1.1	—.048	+.053	1.3	2.0
8 a. m	—.027*	— 9.6	—3.8	—.048	+.099	1.0	1.4
9 a. m	—.029	—12.4	—5.8	—.044	+.132	1.3	1.6
10 a. m	—.025	—13.4	—7.5	—.022	+.160	1.4	1.5
11 a. m	—.020	—13.6	—7.6	—.023	+.162	1.3	3.4
12 m	—.006	—13.9	—8.0	—.033	+.168	1.6	3.1
1 p. m	+.004	—14.1	—8.2	—.019	+.171	2.0	4.1
2 p. m	+.018	—14.2	—8.3	—.011	+.178	1.7	6.2
3 p. m	+.028	—14.3*	—9.1	—.003	+.186	2.1	7.4
4 p. m	+.037	—10.8	—7.2	+.007	+.163	2.0	7.3
5 p. m	+.044†	— 8.8	—5.4	—.004	+.134	1.9	6.8
6 p. m	+.037	— 4.2	—2.7	+.005	+.090	1.6	6.6
7 p. m	+.033	+ 2.1	+1.4	+.006	+.007	1.3	5.1
8 p. m	+.025	+ 5.2	+3.2	+.008	—.036	1.6	5.2
9 p. m	+.004	+ 7.6	+5.1	±.000	—.097	1.4	4.6
10 p. m	—.006	+ 9.9	+6.0	+.009	—.124	1.6	2.9
11 p. m	—.012*	+10.4	+6.4	+.006	—.140	1.0	1.8
12 p. m	—.010	+11.6	+6.9	+.010	—.157	1.8	2.4
1 a. m	—.008	+13.3	+7.7	+.014	—.187	0.7	1.6
2 a. m	—.004	+15.0	+8.6	+.016	—.223	0.9	1.8
3 a. m	—.002†	+16.1	+8.7	+.027	—.224	1.1	1.2
4 a. m	—.007	+17.2	+8.6	+.042	—.215	1.1	2.2
5 a. m	—.020	+17.4†	+8.9	+.038	—.230	1.1	2.3
6 a. m	—.023	+ 5.2	+4.4	—.018	—.079	1.0	2.6
Grand means	23.361	70.1	14.1	.308	.449	1.4	3.5

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	64.2
Nimbus	3.7
Cumulus	8.8
Cirrus	1.3
Stratus	1.9
Cirro-cumulus	6.4
Cirro-stratus	5.3
Cumulo-stratus	8.4
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent	11.3	27.3	3.3	8.0	8.0
Force	......	1.4	1.1	2.3	1.7

	N. E.	N. W.	S. E.	S. W.
Per cent	20.8	1.9	15.6	3.8
Force	1.4	1.5	1.8	1.5

BAROMETER.

Extreme range of abnormal waves:
From 23.550 inches on June 12, 1873,
To 23.288 inches on June 18, 1873.

THERMOMETER.

Extreme range of diurnal temperature:
From 49°.4, at 4 a. m., on June 15, 1873,
To 96°.0, at 2 p. m., on June 15, 1873.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.)
		°	°	°	″	
1873. June 18	4 p. m.	98.3	64.5	33.8	.299	.164

SUMMARY OF HOURLY OBSERVATIONS AT COLORADO SPRINGS, COLORADO, FROM JULY 29 TO AUGUST 10, 1873.

Latitude, 38° 49′. Altitude above sea-level, 6,030.4 feet.

[Pl. 7, fig. 4; Pl. 11, fig. 30; Pl. 14, fig. 48; Pl. 17, fig. 61; Pl. 20, fig. 80.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a.m.	—.030*	+ 0.6	+2.6	—.058	—.081	0.75	3.58
8 a.m.	—.028	— 5.7	0.0	—.097	—.014	1.08	4.17
9 a.m.	—.028	— 8.5	—2.6	—.070	+.101	1.33	3.83
10 a.m.	—.021	—12.9	—6.1	—.050	+.195	1.08	4.25
11 a.m.	—.013	—13.3	—6.5	—.046	+.205	1.58	5.08
12 m.	—.001	—13.3*	—7.0	—.032	+.218	1.58	4.83
1 p.m.	+.014	—13.4	—7.3	—.025	+.225	2.17	6.00
2 p.m.	+.034	— 9.9	—6.6	+.017	+.217	2.75	6.83
3 p.m.	+.043	— 8.6	—5.6	+.013	+.194	2.33	7.08
4 p.m.	+.045	— 7.0	—4.3	+.006	+.160	2.33	7.42
5 p.m.	+.047†	— 5.4	—3.0	—.002	+.124	1.83	7.75
6 p.m.	+.042	— 2.2	—1.0	—.003	+.063	2.25	7.25
7 p.m.	+.022	+ 1.6	+1.1	+.003	—.010	1.58	6.67
8 p.m.	+.005	+ 3.5	+1.9	+.013	—.041	1.50	6.17
9 p.m.	—.006	+ 4.8	+2.2	+.025	—.051	2.58	6.42
10 p.m.	—.017	+ 5.7	+2.8	+.023	—.078	1.58	6.25
11 p.m.	—.017*	+ 8.2	+3.6	+.039	—.114	1.50	5.17
12 p.m.	—.017	+10.1	+4.6	+.041	—.165	1.33	5.17
1 a.m.	—.014	+10.8	+4.9	+.042	—.181	1.58	5.25
2 a.m.	—.013	+10.9	+4.8	+.046	—.174	1.50	4.25
3 a.m.	—.011	+11.9	+5.3	+.047	—.202	1.09	4.45
4 a.m.	—.011†	+12.5	+5.2	+.059	—.196	1.08	4.92
5 a.m.	—.013	+12.7†	+5.3	+.059	—.201	1.17	4.08
6 a.m.	—.023	+ 9.1	+4.6	+.026	—.167	0.92	4.50
Grand means	24.262	67.8	7.5	.431	.654	.156	.547

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	41.10
Nimbus	10.20
Cumulus	2.80
Cirrus	.30
Stratus	3.70
Cirro-cumulus	1.80
Cirro-stratus	9.90
Cumulo-stratus	30.20
Total	100.00

WINDS.

	Calms.	N.	S.	E.	W.
Per cent	9.4	17.2	5.2	2.8	5.6
Force	......	1.61	1.80	1.87	2.25

	N.E.	N.W.	S.E.	S.W.
Per cent	9.4	22.00	21.00	7.4
Force	1.89	1.71	1.67	1.43

BAROMETER.

Extreme range of abnormal waves:
From 24.108 inches on July 30 (1 p.m.), 1873,
To 24.387 inches on Aug. 2 (9 a.m.), 1873.

THERMOMETER.

Extreme range of diurnal temperature:
From 91°.1, at 4 p.m., on July 31, 1873,
To 50°.0, at 4 a.m., on Aug. 1, 1873.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1873.		°	°	°	″	
July 31	1 p.m.	91.1	63.6	27.5	.317	.217
Aug. 4	3 p.m.	84.9	64.0	20.9	.....	.....
Aug. 5	2 p.m.	90.2	67.3	22.9	.....	.....

SUMMARY OF HOURLY OBSERVATIONS AT SALT LAKE CITY, UTAH, FROM JULY 13 TO AUGUST 1, 1872.

Latitude, 40° 47′. Altitude above sea-level, 4,330.4 feet.

[Pl. 7, fig. 3; Pl. 11, fig. 28; Pl. 14, fig. 46; Pl. 17, fig. 64; Pl. 20, fig. 83.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	"	°	°	"			
7 a. m	—.031	— 0.3	+ 4.9	—.104	—.100	....	2.8
8 a. m	—.036*	— 4.1	+ 1.9	—.088	—.026	....	2.5
9 a. m	—.032	— 6.3	— 0.7	—.069	+.024	....	2.3
10 a. m	—.029	—10.3	— 4.4	—.046	+.081	....	2.3
11 a. m	—.022	—11.4	— 5.3	—.042	+.094	....	1.9
12 m	—.014	—14.4	— 8.4	—.020	+.138	....	2.1
1 p. m	—.003	—15.1	— 9.3	—.014	+.141	....	2.4
2 p. m	+.010	—15.7*	—10.5	+.001	+.162	....	2.6
3 p. m	+.015	—15.2	— 9.7	—.008	+.147	....	2.6
4 p. m	+.029	—15.7	— 9.7	—.020	+.152	....	2.5
5 p. m	+.040	—12.6	— 7.4	—.016	+.128	....	2.2
6 p. m	+.043†	— 7.1	— 4.4	.000	+.092	....	1.6
7 p. m	+.037	+ 0.4	0.0	+.011	+.026	....	1.8
8 p. m	+.029	+ 6.0	+ 1.7	+.046	+.007	..	1.6
9 p. m	+.014	+ 8.0	+ 2.8	+.052	—.017	....	1.9
10 p. m	+.010	+ 8.8	+ 3.3	+.062	—.029	...	1.6
11 p. m	+.005	+11.3	+ 5.2	+.044	—.071	....	1.7
12 p. m	+.005	+13.0	+ 6.5	+.040	—.108	....	1.9
1 a. m	.000	+13.3	+ 6.5	+.044	—.107	....	2.6
2 a. m	—.004	+13.3	+ 6.4	+.045	—.103	....	1.8
3 a. m	—.007	+15.1	+ 7.2	+.050	—.126	....	1.9
4 a. m	—.013	+17.2	+ 8.6	+.047	—.170	....	2.4
5 a. m	—.022	+17.9†	+ 9.4	+.038	—.201	...	3.1
6 a. m	—.023	+ 7.2	+ 6.1	—.024	—.115	...	3.1
Grand means	25.650	74.5	17.1	.305	.377	....	2.2

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	77.1
Nimbus	3.3
Cumulus	9.3
Cirrus	3.3
Stratus	0.5
Cirro-cumulus	3.4
Cirro-stratus	0.1
Cumulo-stratus	3.0
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent....	61.7	......	4.6	4.1	7.2
Force	....	......	2.2	1.4	1.3

	N. E.	N. W.	S. E.	S. W.
Per cent....	4.1	8.7	5.9	3.7
Force	1.2	1.7	2.0	1.6

BAROMETER.

Extreme range of abnormal waves:
From 25.953 inches on July 30 (9 a. m.), 1872,
To 25.442 inches on July 28 (6 p. m.), 1872.

THERMOMETER.

Extreme range of diurnal temperature:
From 87°.0, at 3 p. m., on July 30, 1872.
To 44°.8, at 5 a. m., on July 30, 1872.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1872.		°	°	°	"	
July 19	1 p. m.	99.0	63.7	35.3	.281	.151

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain-fall, slight sprinkles between 1 and 5 a. m., July 14; from 9 to 9.30 a. m., 14th; at 9 p. m., 18th; and at 1 a. m., 19th. Thunder and lightning, 10 to 12 p. m., 23d; the same, with sprinkling of rain, at 11 a. m., 24th. Thunder to the north, from 11 to 12 a. m., 26th.

SUMMARY OF HOURLY OBSERVATIONS AT HUGHES, COLORADO, FROM JULY 12 TO JULY 23, 1873.

Latitude, 39° 59′. Altitude above sea-level, 5,021 feet.

[Pl. 8, fig. 7; Pl. 12, fig. 35; Pl. 15, fig. 53; Pl. 18, fig. 71; Pl. 21, fig. 87.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	°			
7 a. m	—. 029	+ 7. 9	+ 6. 3	—. 018	—. 094	1. 3	4. 2
8 a. m	—. 035*	— 1. 2	+ 1. 1	—. 034	+. 022	1. 3	2. 8
9 a. m	—. 034	— 8. 7	— 3. 4	—. 044	+. 097	1. 2	2. 3
10 a. m	—. 024	—15. 5	— 8. 7	—. 031	+. 167	1. 1	2. 4
11 a. m	—. 015	—17. 6	—10. 6	—. 023	+. 188	1. 3	2. 6
12 m	—. 007	—20. 0	—12. 6	—. 018	+. 206	1. 6	2. 9
1 p. m	+. 017	—22. 2*	—14. 4	—. 014	+. 222	1. 3	2. 9
2 p. m	+. 034	—22. 1	—15. 2	+. 004	+. 230	1. 5	3. 8
3 p. m	+. 041	—20. 1	—13. 8	+. 006	+. 220	1. 2	4. 0
4 p. m	+. 047†	—15. 1	—10. 0	+. 003	+. 186	1. 4	4. 9
5 p. m	+. 045	—10. 8	— 7. 4	+. 011	+. 161	1. 4	5. 7
6 p. m	+. 045	— 8. 4	— 5. 4	+. 004	+. 135	1. 5	5. 8
7 p. m	+. 027	— 1. 8	0. 0	—. 018	+. 046	1. 0	5. 2
8 p. m	+. 006	+ 6. 4	+ 4. 9	—. 007	—. 056	1. 2	4. 5
9 p. m	—. 006	+ 8. 7	+ 6. 1	—. 001	—. 084	1. 2	3. 7
10 p. m	—. 009*	+11. 1	+ 7. 3	+. 004	—. 117	1. 1	2. 9
11 p. m	—. 007	+11. 6	+ 7. 3	+. 011	—. 115	1. 2	3. 8
12 p. m	—. 001	+13. 7	+ 8. 3	+. 018	—. 144	1. 5	3. 6
1 a. m	—. 001†	+15. 1	+ 8. 8	+. 026	—. 159	1. 7	4. 3
2 a. m	—. 004	+16. 6	+ 9. 3	+. 033	—. 175	1. 1	3. 3
3 a. m	—. 008	+17. 6	+10. 2	+. 026	—. 210	1. 0	2. 7
4 a. m	—. 010	+19. 0	+10. 8	+. 030	—. 233	0. 8	2. 3
5 a. m	—. 024	+21. 3†	+12. 0	+. 033	—. 283	0. 9	2. 0
6 a. m	—. 029	+16. 8	+10. 6	+. 006	—. 231	1. 1	3. 9
Grand means	25. 094	76. 8	17. 1	. 333	. 411	1. 2	3. 6

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	64. 1
Nimbus	2. 6
Cumulus	3. 1
Cirrus	0. 0
Stratus	13. 3
Cirro-cumulus	1. 5
Cirro-stratus	4. 2
Cumulo-stratus	11. 2
Total	100. 0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent...	6. 6	9. 7	24. 0	3. 5	3. 5
Force	......	1. 2	1. 2	1. 2	1. 4

	N. E.	N. W.	S. E.	S. W.
Per cent....	9. 7	7. 3	20. 1	15. 6
Force	1. 3	1. 6	1. 2	1. 3

BAROMETER.

Extreme range of abnormal waves:
From 25.404 inches on July 18 (8 a. m.), 1873,
To 24.829 inches on July 12 (7 p. m.), 1873.

THERMOMETER.

Extreme range of diurnal temperature:
From 107°.1, at 1 p. m., on July 13, 1873,
To 52°.8, at 5 a. m., on July 14, 1873.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1873.		°	°	°	″	
July 15	2 p. m.	108. 3	62. 1	46. 2	*. 233	*. 083

* Approximate.

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Thunder in the south at 12 m., July 12; same, in southeast, 2.30 p. m., July 22; same, in northwest. 3.25 p. m., July 23.

Thunder and *lightning* at 4.35 p. m., July 14; same, at 2.35 p. m., July 22; same, at 7 p. m., July 22.

Lightning to the north, 9 p. m., July 16; same, to the south, 10 p. m., July 17; same, to the south, 8 p. m., July 18; same, to the northwest, at 5 p. m., and to the southeast, at 5.20 and 9 p. m., July 23.

Rain, 7.30 to 7.40 p. m., July 14; same, 11.30 to 11.40 a. m., July 16; drizzling rain at 11 p. m., July 17; slight rain at 3.40 p. m., and from 7.30 to 7.40 p. m., July 21; intermittent rains, 3.40 to 7.40 p. m., July 22.

SUMMARY OF HOURLY OBSERVATIONS AT CAMP INDEPENDENCE, CALIFORNIA, JULY 19 TO AUGUST 9, 1871.

Latitude, 36° 50′. Altitude above sea-level, 3,956 feet.

[Pl. 8, fig. 8; Pl. 12, fig. 34; Pl. 15, fig. 52; Pl. 18, fig. 72; Pl. 21, fig. 85.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers	Force of vapor.	Relative humidity (p. r M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.039	+ 5.3	+3.4	+.007	—.056	1.1	1.3
8 a. m	—.044*	+ 1.3	+1.2	—.003	—.016	1.3	1.5
9 a. m	—.040	— 3.7	—1.5	—.017	+.027	1.2	1.1
10 a. m	—.036	— 7.7	—2.8	—.045	+.042	1.0	1.4
11 a. m	—.027	—10.7	—3.8	—.067	+.052	1.1	1.5
12 m	—.018	—12.2	—4.8	—.065	+.067	1.3	1.6
1 p. m	+.001	—13.7	—6.0	—.063	+.081	1.8	2.3
2 p. m	+.019	—14.5*	—6.9	—.056	+.093	1.5	2.1
3 p. m	+.037	—14.0	—6.4	—.059	+.086	2.0	2.4
4 p. m	+.053	—13.1	—6.2	—.050	+.086	1.8	2.0
5 p. m	+.069†	—10.3	—4.2	—.052	+.061	1.7	2.0
6 p. m	+.052	— 4.7	—2.1	—.017	+.037	1.9	2.0
7 p. m	+.042	+ 0.9	+0.1	+.013	+.007	1.4	1.7
8 p. m	+.029	+ 3.2	+1.1	+.016	—.007	1.3	1.9
9 p. m	+.006	+ 5.0	+2.4	+.027	—.023	1.0	1.3
10 p. m	—.007	+ 6.4	+3.1	+.025	—.044	0.7	1.0
11 p. m	—.008	+ 7.0	+3.1	+.032	—.041	0.8	1.1
12 p. m	—.012*	+ 8.3	+3.4	+.042	—.044	0.8	1.0
1 a. m	—.008	+ 9.7	+3.7	+.052	—.047	1.0	0.7
2 a. m	—.006†	+10.7	+3.8	+.061	—.045	1.0	0.7
3 a. m	—.008	+11.5	+3.9	+.069	—.045	0.9	1.0
4 a. m	—.014	+12.9	+5.0	+.065	—.072	0.7	0.7
5 a. m	—.022	+13.2†	+6.1	+.048	—.106	0.8	0.6
6 a. m	—.042	+ 9.0	+4.5	+.030	—.072	1.1	0.6
Grand means	25.983	75.4	17.7	.303	.349	1.2	1.4

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	86.1
Nimbus	6.2
Cumulus	3.8
Cirrus	0.2
Stratus	0.4
Cirro-cumulus	1.0
Cirro-stratus	0.5
Cumulo-stratus	1.8
Total	100.0

WINDS.

	Calms	N.	S.	E.	W.
Per cent	26.9	10.4	7.4	4.9	4.8
Force	......	1.3	2.2	1.1	1.8

	N. E.	N. W.	S. E.	S. W.
Per cent	2.3	20.8	19.9	2.6
Force	1.3	1.9	1.6	1.9

BAROMETER.

Extreme range of abnormal waves:
From 26.126 inches on July 23 (8 a. m.), 1871,
To 25.681 inches on July 27 (5 p. m.), 1871.

THERMOMETER.

Extreme range of diurnal temperature:
From 94°.5, at 2 p. m., on July 25, 1871,
To 52°.0, at 5 a. m., on July 26, 1871.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (p r M.).
1871.		°	°	°	″	
July 27	12 m.	87.6	55.8	31.8	.207	.159

SUMMARY OF HOURLY OBSERVATIONS AT BEAVER, UTAH, FROM AUGUST 8 TO AUGUST 25, 1872.

Latitude, 38° 16′. Altitude above sea-level, 5,915.6 feet.

[Pl. 8, fig. 9; Pl. 12, fig. 31; Pl. 15, fig. 49; Pl. 18, fig. 67; Pl. 21, fig. 86.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.038	+ 5.7	+5.2	—.019	—.086	0.35	2.09
8 a. m	—.048*	+ 1.1	+3.0	—.037	—.042	0.29	2.53
9 a. m	—.040	— 4.6	—1.2	—.025	+.034	0.71	2.35
10 a. m	—.035	— 8.1	—4.3	—.013	+.081	1.23	3.00
11 a. m	—.023	—10.7	—6.0	—.014	+.101	1.47	3.08
12 m	—.008	—12.3	—7.3	—.012	+.116	1.76	3.25
1 p. m	+.005	—13.3	—8.2	—.008	+.127	1.88	3.72
2 p. m	+.018	—14.2*	—8.6	—.011	+.129	2.18	3.99
3 p. m	+.038	—14.4	—9.1	—.006	+.136	2.23	3.80
4 p. m	+.047	—13.2	—8.3	—.006	+.128	2.12	2.96
5 p. m	+.054†	—10.8	—6.9	—.002	+.114	1.89	3.08
6 p. m	+.051	— 8.3	—5.4	+.002	+.098	1.82	3.10
7 p. m	+.037	— 2.1	—1.0	—.001	+.039	1.18	2.89
8 p. m	+.025	+ 2.5	+1.4	+.010	+.004	0.82	2.71
9 p. m	+.012*	+ 4.3	+1.9	+.021	—.001	0.59	2.45
10 p. m	+.005	+ 5.7	+2.5	+.026	—.011	0.71	2.38
11 p. m	+.001†	+ 6.4	+3.1	+.023	—.024	1.00	2.62
12 p. m	—.005	+ 7.5	+4.2	+.017	—.050	0.65	2.32
1 a. m	—.009	+10.2	+5.8	+.017	—.091	0.59	1.71
2 a. m	—.011	+12.2	+6.9	+.019	—.115	0.47	1.29
3 a. m	—.011	+13.4	+7.3	+.025	—.123	0.47	1.18
4 a. m	—.018	+15.4†	+8.9	+.019	—.173	0.47	1.29
5 a. m	—.027	+13.8	+9.0	+.001	—.184	0.29	1.71
6 a. m	—.032	+12.1	+9.2	—.022	—.200	0.29	2.06
Grand means	24.288	69.5	17.8	.235	.343	1.00	2.6

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	74.10
Nimbus	1.59
Cumulus	7.35
Cirrus	0.04
Stratus	0.64
Cirro-cumulus	3.75
Cirro-stratus	0.56
Cumulo-stratus	11.95
Total	100.00

WINDS.

	Calms.	N.	S.	E.	W.
Per cent	40.68	3.92	7.84	0.24	2.70
Force	......	1.31	1.53	1.00	1.73

	N. E.	N. W.	S. E	S. W
Per cent	1.72	3.68	10.78	28.43
Force	1.14	1.40	1.50	2.17

BAROMETER.

Extreme range of abnormal waves:
From 24.140 inches on Aug. 18 (6 p. m.), 1872,
To 24.450 inches on Aug. 21 (9 a. m.), 1872.

THERMOMETER.

Extreme range of diurnal temperature:
From 4[illegible]°.0, at 5 a. m., on Aug. 17, 1872,
To 87°.6, at 6 p. m., on Aug. 17, 1872.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.)	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1872.		°	°	°	″	
Aug. 4	3 p. m.	86.9	54.8	32.1	.197	.156

SUMMARY OF HOURLY OBSERVATIONS AT LABRAN, COLORADO, FROM AUGUST 12 TO AUGUST 27, 1873.

Latitude, 38° 23′. Altitude above sea-level, 5,217.8 feet.

[Pl. 8, fig. 10; Pl. 12, fig. 32; Pl. 15, fig. 50; Pl. 18, fig. 69; Pl. 21, fig. 90.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.031	+ 2.0	+ 3.4	—.040	—.056	1.75	3.63
8 a. m	—.031	— 4.4	+ 0.7	—.080	+.012	2.19	3.25
9 a. m	—.029	— 9.9	— 3.1	—.073	+.098	2.06	3.06
10 a. m	—.023	—15.5	— 7.0	—.070	+.166	1.62	3.13
11 a. m	—.012	—20.4	—10.6	—.065	+.218	1.19	3.69
12 m	+.001	—21.0*	—12.1	—.043	+.239	1.06	4.50
1 p. m	+.017	—19.3	—11.0	—.033	+.227	.94	5.19
2 p. m	+.033	—17.5	— 9.8	—.032	+.212	1.44	5.75
3 p. m	+.032	—14.3	— 8.3	—.014	+.195	1.50	6.63
4 p. m	+.034†	—10.6	— 6.0	—.008	+.161	1.75	5.94
5 p. m	+.030	— 6.9	— 3.7	—.004	+.120	1.75	5.56
6 p. m	+.026	— 0.9	— 0.5	+.013	+.056	1.31	5.81
7 p. m	+.014	+ 4.8	+ 2.6	+.027	—.020	1.50	6.81
8 p. m	—.002	+ 6.0	+ 2.5	+.048	—.012	1.19	5.44
9 p. m	—.009	+ 9.3	+ 4.8	+.042	—.085	.87	4.31
10 p. m	—.011	+11.1	+ 6.2	+.032	—.136	1.62	4.63
11 p. m	—.012*	+11.3	+ 6.2	+.035	—.135	1.12	4.06
12 p. m	—.009	+12.2	+ 6.7	+.036	—.155	1.19	3.75
1 a. m	—.007	+13.1	+ 7.1	+.038	—.170	.87	3.31
2 a. m	—.007†	+14.1	+ 7.6	+.040	—.183	0.87	3.13
3 a. m	—.016	+14.8	+ 7.5	+.052	—.185	0.62	2.56
4 a. m	—.019	+15.3	+ 7.9	+.050	—.202	0.81	2.75
5 a. m	—.029	+16.5†	+ 8.3	+ 054	—.220	.94	3.06
6 a. m	—.034*	+11.2	+ 7.5	—.001	—.197	1.00	3.44
Grand means	24.944	74.7	13.0	.408	.503	1 30	4.31

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	57.0
Nimbus	2.3
Cumulus	1.2
Cirrus	0.5
Stratus	5.4
Cirro-cumulus	1.1
Cirro-stratus	7.6
Cumulo-stratus	24.1
Nimbus-cumulo-stratus	0.8
Total	100 0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent...	16.5	0.6	3.3	7.0	2.0
Force	......	1.00	1.03	1.43	1.20

	N. E.	N. W.	S. E.	S. W.
Per cent...	20.3	41.5	4.4	4.4
Force	1.33	1.74	1.44	1.40

BAROMETER.

Extreme range of abnormal waves:
From 25.137 inches on Aug. 15 (11 a. m.), 1873,
To 24.739 inches on Aug. 22 (5 p. m.), 1873.

THERMOMETER.

Extreme range of diurnal temperature:
From 110°.6, at 12 m., on Aug. 27, 1873,
To 5[illegible]°.2, at 4 a. m., on Aug. 27, 1873.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1873.		°	°	°	″	
Aug. 14	1 p. m.	107.0	70.3	36.7	*.36	*.157

* Approximate.

SUMMARY OF HOURLY OBSERVATIONS AT COTTONWOOD SPRINGS, NEVADA, FROM AUGUST 31 TO SEPTEMBER 14, 1871.

Latitude, 36° 03′. Altitude above sea-level, 3,449 feet.

[Pl. 8, fig. 11; Pl. 12, fig. 36; Pl. 15, fig. 54; Pl. 18, fig. 68; Pl. 21, fig. 88.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.027	+ 3.9	+4.1	—.024	—.051	0.9	0.7
8 a. m	—.033*	— 2.3	+0.2	—.028	+.002	1.2	0.8
9 a. m	—.030	— 4.9	—2.5	—.013	+.038	1.3	1.2
10 a. m	—.024	— 7.9	—4.9	—.007	+.063	1.5	1.3
11 a. m	—.022	—11.9	—6.5	—.007	+.077	1.2	1.3
12 m	—.013	—12.3	—8.1	—.006	+.089	1.4	1.7
1 p. m	+.006	—13.3*	—8.9	—.005	+.096	1.5	2.4
2 p. m	+.021	—13.2	—8.7	—.007	+.094	1.6	2.5
3 p. m	+.036	—13.2	—8.4	—.012	+.091	1.5	2.5
4 p. m	+.045†	—11.4	—7.1	—.012	+.076	1.5	1.7
5 p. m	+.045	—10.0	—5.7	—.018	+.067	1.0	1.4
6 p. m	+.034	— 3.5	—1.8	—.009	+.031	1.2	1.1
7 p. m	+.028	+ 0.8	+0.8	—.003	+.002	0.8	0.7
8 p. m	+.016	+ 2.9	+1.0	—.016	+.004	0.6	0.3
9 p. m	+.008	+ 3.9	+2.0	+.011	—.011	0.9	0.0
10 p. m	—.005	+ 5.9	+3.3	+.011	—.028	0.9	0.1
11 p. m	—.014	+ 7.3	+4.0	+.016	—.036	0.9	0.1
12 p. m	—.018*	+ 9.3	+5.3	+.017	—.056	1.1	0.1
1 a. m	—.015	+ 9.6	+5.6	+.015	—.061	1.0	0.6
2 a. m	—.010	+10.7	+6.3	+.016	—.074	0.9	0.6
3 a. m	—.008†	+11.5	+6.6	+.019	—.078	0.9	0.7
4 a. m	+.004	+12.3	+7.1	+.020	—.087	1.1	0.9
5 a. m	—.009	+14.4†	+8.5	+.019	—.115	1.2	0.1
6 a. m	—.017	+11.0	+8.0	—.009	—.115	1.1	0.0
Grand means	26.468	77.9	22.8	.241	.264	1.1	1.0

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	90.6
Nimbus	2.9
Cumulus	3.8
Cirrus	0.6
Stratus	0.4
Cirro-cumulus	0.9
Cirro stratus	---
Cumulo-stratus	0.8
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent ..	17.2	5.0	1.7	4.4	10.3
Force	.....	1.4	1.3	1.8	1.1

	N. E.	N. W.	S. E.	S. W.
Per cent...	11.7	23.9	22.8	3.0
Force	1.5	1.1	1.5	1.4

BAROMETER.

Extreme range of abnormal waves:
From 26.676 inches on Sept. 9 (9 a. m.), 1871,
To 26.243 inches on Sept. 7 (7 p. m.), 1871.

THERMOMETER.

Extreme range of diurnal temperature:
From 94°.0, at 4 p. m., on Sept. 12, 1871,
To 53°.0, at 5 a. m., on Sept. 12, 1871.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
		°	°	°	″	
1871. Sept. 1	2 p. m.	99.2	58.4	40.8	.208	.118

* Maxima. † Minima.

SUMMARY OF HOURLY OBSERVATIONS AT BEAVER, UTAH, FROM AUGUST 30 TO SEPTEMBER 7, 1872.

Latitude, 38° 16′. Altitude above sea-level, 5,915.6 feet.

[Pl. 8, fig. 12; Pl. 12, fig. 33; Pl. 15, fig. 51; Pl. 18, fig. 70; Pl. 21, fig. 89.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	"	°	°	"			
7 a. m	—.026	+ 4.2	+4.5	—.031	—.122	0.66	3.66
8 a. m	—.028	— 0.4	+2.0	—.038	—.036	0.66	3.33
9 a. m	—.034*	— 3.8	—0.5	—.029	+.038	1.22	3.44
10 a. m	—.033	— 7.2	—3.0	—.022	+.098	1.33	4.11
11 a. m	—.021	— 8.3	—3.8	—.021	+.113	1.55	5.44
12 m	—.006	—10.1	—5.5	—.012	+.148	1.55	4.22
1 p. m	+.007	—10.6	—6.1	—.008	+.164	1.88	3.88
2 p. m	+.022	—11.6*	—6.6	—.001	+.170	1.88	4.22
3 p. m	+.033	—10.8	—6.7	+.001	+.173	2.22	4.33
4 p. m	+.037	—10.6	—6.4	—.002	+.167	2.00	3.77
5 p. m	+.042†	— 8.6	—5.1	—.001	+.144	1.77	3.77
6 p. m	+.042	— 5.2	—2.8	—.002	+.099	1.44	3.00
7 p. m	+.030	— 0.7	—0.1	.000	+.036	0.88	3.33
8 p. m	+.013	+ 1.1	+0.5	+.009	+.022	0.77	1.66
9 p. m	+.008	+ 3.4	+2.2	+.003	—.031	0.88	1.22
10 p. m	+.002	+ 5.2	+2.9	+.010	—.051	0.55	1.22
11 p. m	—.002	+ 6.5	+3.7	+.009	—.079	0.77	1.11
12 p. m	—.009	+ 7.8	+4.5	+.008	—.108	1.00	1.88
1 a. m	—.010*	+ 8.6	+4.5	+.017	—.105	0.88	1.55
2 a. m	—.010	+ 9.3	+4.5	+.024	—.102	0.66	1.44
3 a. m	—.008	+10.5	+5.0	+.027	—.120	0.77	1.66
4 a. m	—.008†	+10.9	+5.3	+.026	—.133	0.55	2.00
5 a. m	—.018	+11.6†	+5.6	+.027	—.145	0.77	3.16
6 a. m	—.022	+ 9.8	+5.2	+.017	—.133	0.77	2.99
Grand means	24.249	61.7	11.3	.260	.497	1.1	2.9

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	70.37
Nimbus	3.24
Cumulus	7.91
Cirrus	0.31
Stratus	0.83
Cirro-cumulus	5.56
Cirro-stratus	0.28
Cumulo-stratus	11.50
Total	100.00

WINDS.

	Calms.	N.	S.	E.	W.
Per cent ..	39.35	1.39	15.28	0.46	0
Force	.....	2.00	2.15	1.00	0

	N. E.	N. W.	S. E.	S. W.
Per cent ..	8.33	2.75	19.27	12.84
Force	1.11	1.66	1.95	2.11

BAROMETER.

Extreme range of abnormal waves:
From 24.044 inches on Sept. 3 (3 p. m.), 1872,
To 24.367 inches on Sept. 7 (10 a. m.), 1872.

THERMOMETER.

Extreme range of diurnal temperature:
From 39°.5, at 5 a. m., on Sept. 7, 1872,
To 72°.9, at 4 p. m., on Sept. 7, 1872.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1872.		°	°	°	"	
Sept. 5	2 p. m.	77.5	51.1	26.4	.186	.197

SUMMARY OF HOURLY OBSERVATIONS AT TRINIDAD, COLORADO, FROM SEPTEMBER 4 TO SEPTEMBER 19, 1873.

Latitude, 37° 10. Altitude above sea-level, 5,989.9 feet.

[Pl. 9, fig. 13; Pl. 13, fig. 37; Pl. 16, fig. 55; Pl. 19, fig. 75; Pl. 22, fig. 92.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—. 031*	+ 5. 1	+ 3. 1	—. 001	—. 064	2. 0	3. 9
8 a. m	—. 027	— 2. 2	+ 0. 3	—. 035	+. 009	1. 8	3. 8
9 a. m	—. 021	— 7. 5	— 2. 7	—. 045	+. 076	1. 6	3. 8
10 a. m	—. 009	—12. 8	— 5. 7	—. 056	+. 133	1. 6	3. 9
11 a. m	—. 002	—14. 7	— 7. 7	—. 039	+. 169	1. 7	4. 4
12 m	+. 010	—16. 6*	— 9. 3	—. 032	+. 195	1. 6	5. 2
1 p. m	+. 023	—16. 5	— 8. 8	—. 040	+. 186	1. 6	5. 9
2 p. m	+. 036	—14. 5	— 7. 7	—. 036	+. 170	1. 7	6. 4
3 p. m	+. 041†	—12. 1	— 6. 7	—. 024	+. 174	1. 5	6. 2
4 p. m	+. 039	—11. 2	— 6. 6	—. 015	+. 156	1. 6	6. 1
5 p. m	+. 038	— 6. 9	— 4. 1	—. 007	+. 114	1. 5	6. 2
6 p. m	+. 029	— 1. 0	+ 0. 1	—. 015	+. 020	1. 3	6. 6
7 p. m	+. 008	+ 1. 9	+ 1. 5	—. 007	—. 016	1. 5	5. 4
8 p. m	—. 008	+ 4. 5	+ 2. 7	. 000	—. 051	1. 6	4. 7
9 p. m	—. 016	+ 6. 6	+ 3. 7	+. 005	—. 083	1. 7	4. 3
10 p. m	—. 016*	+ 7. 5	+ 3. 5	+. 019	—. 072	2. 1	3. 7
11 p. m	—. 016	+ 8. 1	+ 3. 7	+. 022	—. 078	2. 4	3. 6
12 p. m	—. 012	+ 9. 0	+ 4. 4	+. 018	—. 104	2. 4	3. 8
1 a. m	—. 006	+ 9. 9	+ 4. 8	+. 021	—. 118	2. 6	3. 3
2 a. m	—. 004†	+11. 4	+ 5. 4	+. 026	—. 139	2. 4	2. 8
3 a. m	—. 006	+12. 9	+ 6. 1	+. 029	—. 168	2. 4	3. 1
4 a. m	—. 008	+14. 0	+ 6. 4	+. 036	—. 179	2. 4	3. 3
5 a. m	—. 017	+15. 7†	+ 7. 2	+. 038	—. 215	2. 3	3. 2
6 a. m	—. 026	+12. 5	+ 6. 2	+. 023	—. 174	2. 3	3. 8
Grand means	24. 256	65. 3	11. 7	. 288	. 489	1. 9	4. 5

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	55. 1
Nimbus................................	1. 8
Cumulus................................	3. 6
Cirrus	0. 4
Stratus	15. 2
Cirro-cumulus	1. 1
Cirro-stratus.........................	8. 1
Cumulo-stratus	14. 7
Total	100. 0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent....	2. 3	3. 9	2. 1	2. 6	7. 3
Force	......	1. 3	1. 9	1. 2	1. 7

	N. E.	N. W.	S. E.	S. W.
Per cent...	16. 7	4. 7	7. 0	53 4
Force	1. 7	1. 1	1. 6	2. 3

BAROMETER.

Extreme range of abnormal waves:
From 24.542 inches on Sept. 7 (8 a. m.), 1873,
To 24 623 inches on Sept. 17 (4 p. m.), 1873.

THERMOMETER.

Extreme range of diurnal temperature:
From 94°.0, at 12 m., on Sept. 16, 1873,
To 48°.2, at 5 a. m., on Sept. 16, 1873.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1873.		°	°	°	″	
Sept. 16	2 p. m.	93. 2	62. 8	30 4	. 291	. 187

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Thunder and lightning, September 5, 2 p. m. to 1 a. m.; same, on 6th, 5 p. m.; same, 10th, 5 to 8 p. m.; same, on 13th, 1 to 9 p. m.

Rain, 2.10 to 2.55 p. m., September 5; same, 12 to 1.50 a. m., September 6; same, 2.45 to 5.20 p. m., September 6; same, 6.25 to 8.15 p. m., 6th; same (slight), 10 p. m., 6th, to 3.40 a. m., 7th; same, 5.40 p. m., 10th; same, 7 to 8 p. m., September 13.

Large circle around moon, 11 p. m., September 7; very plain and increasing in diameter at 3 a. m., September 8; clearing up from the east at 4 a. m., September 8.

Heavy dew at 4 a. m., September 9.

Rainbow in east, 5 p. m., September 11.

Sudden and violent squall of wind at 10.25 a. m., September 17, lasting 10 minutes.

SUMMARY OF HOURLY OBSERVATIONS AT CHEYENNE, WYOMING, FROM SEPTEMBER 15 TO OCTOBER 21, 1872.

Latitude, 41° 08′. Altitude above sea-level, 6,011 feet.

[Pl. 9, fig. 14; Pl. 13, fig. 38; Pl. 16, fig. 56; Pl. 19, fig. 78; Pl. 2 ', fig. 93.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.014	+12.3	+4.1	+.003	—.111	0.6	2.6
8 a. m	—.022	— 0.1	+1.4	—.013	—.016	0.9	2.1
9 a. m	—.029*	— 8.8	—3.0	—.027	+.097	1.1	2.4
10 a. m	—.026	—13.4	—5.2	—.037	+.140	1.2	2.2
11 a. m	—.018	—15.7	—6.4	—.042	+.161	1.1	2.6
12 m	—.002	—17.8	—7.2	—.051	+.172	1.2	2.9
1 p. m	+.014	—19.2	—8.2	—.050	+.188	1.5	3.0
2 p. m	+.025	—19.8*	—8.4	—.054	+.190	1.4	3.1
3 p. m	+.034	—19.4	—8.3	—.051	+.189	1.4	3.6
4 p. m	+.036†	—17.4	—8.0	—.035	+.190	1.3	3.9
5 p. m	+.030	—11.5	—4.7	—.026	+.135	1.2	3.8
6 p. m	+.026	— 2.9	—0.9	—.004	+.057	0.7	3.5
7 p. m	+.012	+ 2.0	+1.2	+.008	+.004	0.6	3.2
8 p. m	.000	+ 5.1	+2.3	+.017	—.030	0.5	2.5
9 p. m	—.008	+ 7.9	+3.4	+.022	—.068	0.5	2.5
10 p. m	—.014*	+ 9.3	+4.1	+.023	—.097	0.5	2.5
11 p. m	—.014	+11.6	+4.9	+.029	—.129	0.5	2.5
12 p. m	—.007	+13.0	+5.3	+.033	—.145	0.6	1.9
1 a. m	—.005†	+13.8	+5.6	+.035	—.154	0.7	1.7
2 a. m	+.002	+14.5	+5.8	+.038	—.162	0.5	1.5
3 a. m	+.003	+15.3	+6.0	+.040	—.168	0.4	1.6
4 a. m	+.005	+15.1	+6.0	+.039	—.170	0.4	1.6
5 a. m	+.007	+15.3†	+6.2	+.038	—.183	0.5	1.6
6 a. m	—.017	+15.0	+6.1	+.037	—.159	0.4	2.0
Grand means	24.101	51.1	9.9	.182	.502	0.8	2.5

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	74.5
Nimbus	1.8
Cumulus	3.9
Cirrus	4.2
Stratus	0.0
Cirro-cumulus	7.2
Cirro-stratus	2.1
Cumulo-stratus	6.3
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent...	43.9	8.9	0.4	0.7	7.1
Force	.....	1.5	1.0	1.0	1.5

	N. E.	N. W.	S. E.	S. W.
Per cent ..	8.7	18.7	3.7	7.9
Force	1.3	1.0	1.7	1.3

BAROMETER.

Extreme range of abnormal waves:
From 23.761 inches on Sept. 23 (3 p. m.), 1872,
To 24.411 inches on Oct. 9 (8 p. m.), 1872.

THERMOMETER.

Extreme range of diurnal temperature:
From 20°.0 at 6 a. m., on Oct. 9, 1872,
To 76°.0, at 2 p. m., on Oct. 9, 1872.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1872.		°	°	°	″	
Sept. 19	12 m.	85.0	58.0	27.0	.251	.208
Oct. 14	2 p. m.	79.6	54.0	25.6	.216	.214
Oct. 15	4 p. m.	69.9	44.3	25.6	.132	.181

* Maxima. † Minima.

SUMMARY OF HOURLY OBSERVATIONS AT PIOCHE, NEVADA, FROM SEPTEMBER 27 TO OCTOBER 14, 1872.

Latitude, 37° 55′. Altitude above sea-level, 5,942.3 feet.

[Pl. 9, fig. 15; Pl. 13, fig. 41; Pl. 16, fig. 59; Pl. 19, fig. 73; Pl. 22, fig. 91.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.022	+ 7.1	+ 4.2	+.005	—.057	1.5	1.2
8 a. m	—.025	+ 3.3	+ 3.1	—.011	—.050	1.4	1.3
9 a. m	—.028*	— 1.7	+ 0.3	—.017	—.010	0.9	1.6
10 a. m	—.025	— 6.4	— 2.3	—.025	+.021	0.6	1.6
11 a. m	—.020	— 8.7	— 3.5	—.030	+.032	0.9	1.8
12 a. m	—.009	—10.7	— 5.3	—.025	+.053	1.0	2.3
1 p. m	+.004	—11.3*	— 5.6	—.027	+.054	0.9	2.6
2 p. m	+.019	—13.2	— 6.8	—.028	+.065	1.1	2.8
3 p. m	+.025	—12.1	— 6.3	—.025	+.062	1.2	2.1
4 p. m	+.029	—10.9	— 5.8	—.021	+.059	1.2	2.3
5 p. m	+.029†	— 4.5	— 2.8	—.002	+.037	1.1	2.3
6 p. m	+.026	— 2.5	— 1.9	+.003	+.030	1.2	2.2
7 p. m	+.019	— 0.5	— 1.0	+.007	+.021	1.2	2.0
8 p. m	+.011	+ 0.7	— 0.8	+.014	+.014	1.1	1.7
9 p. m	+.003	+ 2.5	+ 0.3	+.015	+.010	1.2	1.5
10 p. m	—.003	+ 3.3	+ 1.3	+.010	—.008	0.9	1.4
11 p. m	—.006*	+ 5.4	+ 2.3	+.014	—.019	0.9	0.8
12 p. m	—.006	+ 7.4	+ 3.5	+.016	—.036	1.1	0.8
1 a. m	—.003	+ 8.0	+ 3.9	+.015	—.043	1.2	0.6
2 a. m	—.002	+ 9.0	+ 4.5	+.016	—.052	1.5	0.3
3 a. m	+.002	+ 9.4	+ 4.5	+.020	—.049	1.5	0.5
4 a. m	—.001†	+ 9.9	+ 4.4	+.024	—.043	1.3	0.5
5 a. m	—.005	+10.2†	+ 4.2	+.029	—.036	1.4	0.6
6 a. m	—.021	+ 9.3	+ 4.7	+.016	—.055	1.4	1.0
Grand means	24.233	62.7	19.5	.145	.259	1.2	1.5

* Maxima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	86.9
Nimbus	2.0
Cumulus	3.0
Cirrus	6.1
Stratus	0.0
Cirro-cumulus	1.3
Cirro-stratus	0.5
Cumulo-stratus	0.2
Total	100.00

WINDS.

	Calms	N.	S.	E.	W.
Per cent	16.2	4.4	2.5	0.7	4.9
Force	....	1.0	1.1	1.0	0.9

	N. E.	N. W.	S. E.	S. W.
Per cent	5.6	44.6	16.7	4.4
Force	1.0	1.3	1.6	1.1

BAROMETER.

Extreme range of abnormal waves:
From 24.376 inches on Sept. 29, (8 a. m.), 1872,
To 24.069 inches on Oct. 3 (10 p. m.), 1872.

THERMOMETER.

Extreme range of diurnal temperature:
From 40°.5, at 3 a. m., on Oct. 5, 1872,
To 72°.4, at 3 p. m., on Oct. 5, 1872.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1872.		°	°	°	″	
Oct. 8	3 p. m.	81.7	50.6	31.1	.165	.152

† Minima.

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain, with thunder and lightning, at 9 p. m., September 26; same, 6.15, p. m., October 1; same, from 6 to 7 p. m., October 1; ceased at 12.30 p. m.; in all, ″.5.

Meteors, numerous.

SUMMARY OF HOURLY OBSERVATIONS AT OGDEN, UTAH, FROM SEPTEMBER 26 TO OCTOBER 3, 1873.

Latitude, 41° 13′. Altitude above sea-level, 4,374 feet.

[Pl. 9, fig. 16; Pl. 13, fig. 39; Pl. 16, fig. 57; Pl. 19, fig. 77; Pl. 22, fig. 96.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—. 031	+15. 4	+4. 5	+. 067	—. 048	0. 57	2. 86
8 a. m	—. 036	+ 1. 7	+1. 1	+. 070	. 000	1. 00	2. 43
9 a. m	—. 040	— 6. 1	—1. 6	—. 021	+. 050	1. 43	2. 29
10 a. m	—. 042*	—11. 8	—3. 8	—. 049	+. 087	1. 14	1. 71
11 a. m	—. 034	—16. 1	—6. 1	—. 051	+. 122	1. 00	1. 28
12 m	—. 023	—19. 0	—6. 8	—. 072	+. 126	1. 00	0. 86
1 p. m	—. 019	—20. 9	—8. 4	—. 066	+. 151	0. 71	1. 28
2 p. m	+. 001	—21. 0	—8. 4	—. 066	+. 152	0. 86	1. 14
3 p. m	+. 018	—21. 2*	—9. 1	—. 058	+. 163	1. 00	0. 71
4 p. m	+. 025	—20. 6	—9. 0	—. 053	+. 156	1. 00	1. 00
5 p. m	+. 031	—15. 0	—6. 6	—. 031	+. 136	0. 86	1. 28
6 p. m	+. 032†	— 6. 8	—3. 0	—. 008	+. 087	0. 57	0. 86
7 p. m	+. 031	+ 4. 2	+2. 6	+. 009	—. 040	0. 71	0. 43
8 p. m	+. 028	+ 7. 1	+4. 2	+. 010	—. 095	1. 00	1. 28
9 p. m	+. 020	+ 8. 7	+4. 5	+. 017	—. 099	1. 00	1. 86
10 p. m	+. 015	+10. 1	+4. 6	+. 020	—. 095	0. 86	1. 86
11 p. m	+. 014	+ 9. 7	+4. 6	+. 024	—. 098	1. 00	1. 17
12 p. m	+. 005	+11. 0	+4. 9	+. 029	—. 104	0. 83	0. 67
1 a. m	+. 005	+11. 9	+4. 9	+. 034	—. 108	0. 83	0. 67
2 a. m	+. 003	+13. 1	+5. 4	+. 038	—. 079	1. 00	0. 43
3 a. m	+. 001	+14. 4	+5. 0	+. 052	—. 084	1. 00	1. 00
4 a. m	+. 005	+16. 2	+5. 8	+. 055	—. 110	0. 86	1. 14
5 a. m	+. 001	+16. 8	+6. 0	+. 058	—. 118	0. 86	1. 28
6 a. m	—. 008	+17. 2†	+6. 7	+. 050	—. 153	0. 71	2. 14
Grand means	25. 525	53. 6	11. 9	. 177	. 436	0. 95	1. 32

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	86. 80
Nimbus	0. 00
Cumulus	0. 54
Cirrus	4. 28
Stratus	2. 41
Cirro-cumulus	1. 69
Cirro-stratus	4. 28
Cumulo-stratus	0. 00
Total	100. 00

WINDS.

	Calms.	N.	S.	E.	W.
Per cent...	16. 5	4. 3	7. 9	3. 0	8. 5
Force	....	1. 15	1. 0	1. 20	1. 07

	N. E.	N. W.	S. E.	S. W.
Per cent...	15. 3	21. 3	15. 9	7. 3
Force	1. 11	1. 11	1. 00	0. 92

BAROMETER.

Extreme range of abnormal waves:
From 25.788 inches on Sept. 29 (10 a. m.), 1873,
To 25.169 inches on Sept. 26 (7 p. m.), 1873.

THERMOMETER.

Extreme range of diurnal temperature:
From 31°.6, at 3 a. m., on Sept. 30, 1873,
To 79°.4, at 1 p. m., on Sept. 30, 1873.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1873.		°	°	°	″	
Oct. 2	3 p. m.	85. 3	59. 7	25. 6	. 277	. 227

SUMMARY OF HOURLY OBSERVATIONS AT TRUXTON SPRINGS, ARIZONA, FROM OCTOBER 23 TO OCTOBER 25, 1871.

Latitude 35° 25′. Altitude above sea-level, 3,885 feet.

[Pl. 9, fig. 17.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	"	°	°	"			
7 a. m	—.029*	+ 2.5	+ 2.2	—.005	—.056	1.0	0.5
8 a. m	—.027	— 5.5	+ 2.5	—.138	—.090	0.5	1.0
9 a. m	—.023	—10.0	— 1.0	—.113	+.061	0.5	0.5
10 a. m	—.019	—16.6	— 5.6	—.099	+.205	0.5	0.0
11 a. m	—.013	—17.1	— 7.6	—.056	+.261	1.0	0.0
12 m	+.012	—17.7	— 9.0	—.031	+.296	1.0	1.5
1 p. m	+.033	—18.7	— 9.3	—.040	+.300	1.0	1.0
2 p. m	+.036†	—19.1*	— 8.3	—.070	+.273	1.0	0.0
3 p. m	+.030	—15.7	— 7.9	—.027	+.273	1.5	0.0
4 p. m	+.024	— 4.6	— 2.3	+.006	+.130	1.5	0.0
5 p. m	+.028	— 1.6	+ 0.2	—.012	+.033	2.0	0.0
6 p. m	+.019	— 0.6	+ 0.6	—.009	+.017	0.0	0.0
7 p. m	+.020	+ 0.9	+ 2.5	—.036	—.077	0.0	0.0
8 p. m	+.010	+ 2.0	+ 4.0	—.060	—.161	0.0	0.0
9 p. m	—.002	+ 7.0	+ 3.8	+.015	—.140	0.5	0.0
10 p. m	—.010*	+ 9.4	+ 4.4	+.029	—.175	0.5	0.0
11 p. m	—.009	+10.2	+ 4.8	+.031	—.201	0.5	0.0
12 p. m	—.008	+12.1	+ 4.5	+.059	—.177	1.0	0.0
1 a. m	—.010	+13.7	+ 3.8	+.091	—.126	0.5	0.0
2 a. m	—.006†	+13.5	+ 4.5	+.074	—.176	1.0	0.0
3 a. m	—.008	+13.5	+ 3.5	+.095	—.106	1.5	0.0
4 a. m	—.007	+14.3	+ 3.7	+.099	—.118	1.0	0.0
5 a. m	—.014	+14.4	+ 4.2	+.090	—.152	1.0	0.0
6 a. m	—.027	+14.5†	+ 3.7	+.101	—.118	1.0	0.0
Grand means	26.059	58.9	6.1	.341	.703	0.8	0.2

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	98.1
Nimbus	0.0
Cumulus	1.3
Cirrus	0.4
Stratus	0.0
Cirro-cumulus	0.2
Cirro-stratus	0.0
Cumulo-stratus	0.0
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent	31.25	27.08	8.33	2.09	.....
Force	......	1.4	1.0	1.0	0.0

	N. E.	N. W.	S. E.	S. W.
Per cent	6.25	14.58	4.16	6.26
Force	1.0	1.0	1.1	1.3

BAROMETER.

Extreme of abnormal waves:
From 26.102 inches on Oct. 23 (10 p. m.), 1871,
To 25.986 inches on Oct. 24 (2 p. m.), 1871.

THERMOMETER.

Extreme range of diurnal temperature:
From 80°.9, at 12 m., on Oct. 24, 1871,
To 41°.5, at 6 a. m., on Oct. 24, 1871.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB TERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
		°	°	°	"	
1871. Oct. 24	12 m.	80.9	59.8	21.1	.305	.290

SUMMARY OF HOURLY OBSERVATIONS AT FORT FRED. STEELE, WYOMING, FROM OCTOBER 30 TO NOVEMBER 27, 1872.

Latitude, 41° 47'. Altitude above sea-level, 6,840 feet.

[Pl. 9, fig. 18; Pl. 13, fig. 42; Pl. 16, fig. 60; Pl. 19, fig. 76; Pl. 22, fig. 94.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	"	°	°	"			
7 a. m	—.022	+4.5	+1.5	+.002	—.071	1.2	5.1
8 a. m	—.024*	+2.3	+1.0	+.002	—.022	1.4	5.1
9 a. m	—.022	—0.9	0.0	+.003	+.036	1.3	5.7
10 a. m	—.020	—4.7	—0.9	—.010	—.002	1.3	5.4
11 a. m	—.014	—6.0	—1.4	—.016	—.017	1.8	5.9
12 m	+.005	—6.3	—1.5	—.018	—.023	2.2	5.8
1 p. m	+.017	—6.6	—1.5	—.021	—.036	2.0	6.0
2 p. m	+.034	—7.3*	—2.2	—.020	—.023	2.1	5.4
3 p. m	+.036†	—7.1	—2.2	—.018	—.011	2.0	5.3
4 p. m	+.035	—5.0	—1.2	—.009	+.009	1.8	5.3
5 p. m	+.026	—2.6	—0.4	—.001	+.028	1.5	5.3
6 p. m	+.014	—1.0	+0.1	+.002	+.023	1.1	4.4
7 p. m	+.008	+0.3	+0.2	+.006	+.041	1.1	4.1
8 p. m	+.003	+0.6	+0.3	+.006	+.036	1.3	3.8
9 p. m	—.003	+1.3	+0.3	+.009	+.049	1.3	3.9
10 p. m	—.003	+2.1	+0.3	+.012	+.061	1.4	3.6
11 p. m	—.004	+2.8	+0.5	+.012	+.056	1.2	4.0
12 p. m	—.006*	+2.8	+0.5	+.012	+.056	1.2	4.3
1 a. m	—.005	+3.4	+0.9	+.008	+.006	1.5	4.7
2 a. m	—.006†	+3.9	+1.1	+.006	—.016	1.2	5.1
3 a. m	—.008	+4.4	+1.1	+.008	—.010	1.3	4.8
4 a. m	—.012	+5.5	+1.3	+.007	—.030	1.4	4.5
5 a. m	—.014	+5.8	+1.4	+.007	—.045	1.0	4.3
6 a. m	—.017	+6.7†	+1.9	.000	—.132	1.2	4.4
Grand means	23.572	23.8	3.7	.047	.364	1.5	4.8

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	51.4
Nimbus	4.0
Cumulus	16.4
Cirrus	1.3
Stratus	0.2
Cirro-cumulus	22.9
Cirro-stratus	1.6
Cumulo-stratus	2.2
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent....	24.1	0.4	0.5	0.0	30.4
Force	....	1.5	1.0	0.0	1.8

	N. E.	N. W.	S. E.	S. W.
Per cent....	0.10	1.22	0.0	43.40
Force	0	2.7	0	1.8

BAROMETER.

Extreme range of abnormal waves:
From 24.065 inches on Nov. 12 (9 a. m.), 1872,
To 23.156 inches on Nov. 14 (7 a. m.), 1872.

THERMOMETER.

Extreme range of diurnal temperature:
From —10°.0, at 5 a. m., on Nov. 16, 1872,
To 26°.4, at 2 p. m., on Nov. 16, 1872.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
1873. Nov. 8	8 p. m.	° 42.8	° 31.0	° 11.8	" .093	.388

SUMMARY OF HOURLY OBSERVATIONS AT PRESCOTT, ARIZONA, FROM NOVEMBER 1 TO NOVEMBER 8, 1871.

Latitude, 34° 33′. Altitude above sea-level, 5,318 feet.

[Pl. 10, fig. 19; Pl. 13, fig. 40; Pl. 16, fig. 58; Pl. 19, fig. 74; Pl. 22, fig. 95.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	"	°	°	"			
7 a. m	—. 021	+ 4. 4	+ 1. 2	+. 019	—. 041	3. 0	0. 4
8 a. m	—. 028	— 6. 9	— 1. 8	—. 026	+. 065	2. 7	1. 0
9 a. m	—. 030*	—11. 0	— 2. 9	—. 046	+. 094	3. 0	1. 1
10 a. m	—. 023	—12. 7	— 3. 8	—. 047	+. 122	3. 0	1. 4
11 a. m	—. 015	—14. 4	— 4. 7	—. 050	+. 148	2. 4	1. 6
12 m.	+. 020	—16. 1	— 5. 7	—. 051	+. 174	3. 0	1. 9
1 p. m	+. 029	—22. 8*	— 8. 0	—. 081	+. 221	1. 9	1. 9
2 p. m	+. 041	—20. 9	— 7. 4	—. 071	+. 210	3. 0	1. 9
3 p. m	+. 041†	—15. 7	— 6. 3	—. 037	+. 206	3. 0	1. 9
4 p. m	+. 035	—10. 1	— 2. 7	—. 040	+. 090	3. 4	1. 8
5 p. m	+. 019	— 3. 4	+ 1. 2	—. 046	—. 081	2. 8	1. 5
6 p. m	+. 009	+ 0. 3	+ 2. 5	—. 037	—. 153	1. 5	1. 0
7 p. m	+. 001	+ 2. 7	+ 2. 4	—. 015	—. 137	1. 2	1. 3
8 p. m	—. 005	+ 5. 4	+ 2. 3	+. 009	—. 111	1. 0	1. 3
9 p. m	—. 010	+ 6. 8	+ 2. 4	+. 019	—. 104	0. 4	0. 8
10 p. m	—. 013	+ 7. 9	+ 2. 6	+. 026	—. 102	0. 4	0. 8
11 p. m	—. 015*	+ 9. 6	+ 3. 1	+. 034	—. 110	0. 5	0. 8
12 p. m	—. 008	+11. 3	+ 3. 6	+. 041	—. 120	0. 4	0. 4
1 a. m	+. 003	+11. 4	+ 3. 6	+. 042	—. 117	0. 2	0. 5
2 a. m	+. 008†	+13. 0	+ 3. 7	+. 055	—. 086	0. 2	0. 6
3 a. m	+. 007	+14. 1	+ 3. 8	+. 062	—. 075	0. 7	0. 8
4 a. m	—. 011	+15. 2	+ 3. 9	+. 068	—. 066	1. 4	0. 6
5 a. m	—. 018	+16. 3†	+ 4. 0	+. 073	—. 061	2. 1	0. 5
6 a. m	—. 022	+13. 4	+ 3. 2	+. 070	—. 001	2. 1	0. 4
Grand means	24. 731	41. 8	5. 3	. 169	. 632	1. 8	1. 1

* Maxima. † Minima

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	82. 4
Nimbus........................	5. 9
Cumulus........................	3. 4
Cirrus	4. 9
Stratus	0. 1
Cirro-cumulus	3. 3
Cirro-stratus........................	0. 0
Cumulo-stratus	0. 0
Total	100. 0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent....	28. 4	4. 4	4. 9	1. 6	14. 2
Force	......	1. 3	1. 3	1. 0	1. 6

	N. E.	N. W.	S. E.	S. W.
Per cent....	13. 7	3. 8	6. 0	23. 0
Force	1. 4	1. 7	1. 0	1. 6

BAROMETER.

Extreme range of abnormal waves:
From 24.854 inches on Nov. 7 (12 p. m.), 1871,
To 24.476 inches on Nov. 5 (1 p. m.), 1871.

THERMOMETER.

Extreme range of diurnal temperature:
From 81°.2, at 1 p. m., on Nov. 2, 1871,
To 29°.0, at 2 a. m., on Nov. 3, 1871.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
		°	°	°	"	
1871. Nov. 2	1 p. m.	81. 2	58. 8	27. 4	. 206	. 194

SUMMARY OF HOURLY OBSERVATIONS AT GUNNISON, UTAH, FROM NOVEMBER 1 TO DECEMBER 1, 1872.

Latitude, 39° 10′. Altitude above sea-level, 5,145 feet.

[Pl. 10, fig. 20.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.023	+12.9	+3.9	+.016	—.219	0.8	4.1
8 a. m	—.037	+ 6.4	+2.9	+.017	—.046	0.7	4.3
9 a. m	—.041*	— 1.9	+0.6	—.002	—.002	0.4	4.5
10 a. m	—.035	— 8.2	—1.5	—.036	—.061	0.6	4.6
11 a. m	—.029	—12.7	—2.8	—.051	—.038	0.7	4.4
12 m	—.008	—16.3	—4.1	—.060	—.003	0.9	4.6
1 p. m	+.010	—18.4	—4.9	—.064	—.018	1.2	5.3
2 p. m	+.023	—19.9*	—4.4	—.082	—.013	1.4	5.2
3 p. m	+.033	—16.2	—4.0	—.070	—.007	2.0	5.6
4 p. m	+.043†	—12.5	—3.6	—.038	.000	1.9	5.4
5 p. m	+.040	— 8.9	—3.3	—.024	+.016	1.6	4.3
6 p. m	+.037	— 2.5	—0.7	+.009	+.049	1.1	3.7
7 p. m	+.033	+ 0.2	+0.2	+.023	+.219	0.9	3.5
8 p. m	+.021	+ 2.0	+0.8	+.028	+.125	1.1	3.5
9 p. m	+.004	+ 3.7	+1.0	+.034	+.140	1.2	4.3
10 p. m	—.002*	+ 5.5	+1.1	+.041	+.179	1.1	3.8
11 p. m	.000	+ 7.4	+1.5	+.043	+.165	1.2	3.5
12 p. m	+.003	+ 8.3	+1.9	+.040	+.129	1.4	3.3
1 a. m	+.005†	+10.0	+2.4	+.037	+.076	1.2	3.2
2 a. m	—.003	+11.5	+2.7	+.036	+.036	1.4	3.2
3 a. m	—.011	+13.1	+3.1	+.032	—.035	1.0	2.7
4 a. m	—.014	+13.9	+3.6	+.025	—.143	1.1	2.6
5 a. m	—.017	+14.7†	+3.7	+.025	—.166	0.9	2.8
6 a. m	—.020	+13.9	+3.5	+.027	—.119	1.3	3.7
Grand means	24.975	28.2	4.9	.075	.455	1.1	4.0

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	58.6
Nimbus	6.2
Cumulus	2.1
Cirrus	15.1
Stratus	1.0
Cirro-cumulus	2.4
Cirro-stratus	11.4
Cumulo-stratus	3.2
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent....	22.7	9.1	1.5	0.3	0.9
Force	......	1.4	1.0	1.0	1.0

	N. E.	N. W.	S. E.	S. W.
Per cent...	3.9	54.6	2.2	4.8
Force.......	1.0	1.2	1.3	1.9

BAROMETER.

Extreme range of abnormal waves:
From 25.470 inches on Nov. 17 (12 p. m.), 1872,
To 24.475 inches on Nov. 8 (11 p. m.), 1872.

THERMOMETER.

Extreme range of diurnal temperature:
From 62°.9, at 2 p. m., on Nov. 2, 1872,
To 17°.6, at 4 a. m., on Nov. 2, 1872.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
		°	°	°	″	
1872. Nov. 23	3 p. m.	60.0	41.5	18.5	.136	.364

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain began at 6 a. m., November 3; ceased 6.30 a. m.; a few drops at 1 p. m., same day. Light rain with strong gusts of wind at 11.40 p. m., November 11. Rain and snow at 1.30 a. m., November 12.

Snow, 6 a. m. to 2.30 p. m., November 13; same, 1.30 to 4.50 a. m.; and 7.30 to 9.30 a. m., November 15; same, 8.45 p. m. to 12.40 a. m., November 23.

Mock sun in cirro-stratus clouds at 4.15 p. m., November 7, lasting 20 minutes.

Circle around moon at 12 p. m., November 9.

SUMMARY OF HOURLY OBSERVATIONS AT LARAMIE, WYOMING, FROM DECEMBER 6 TO DECEMBER 20, 1872.

Latitude, 41° 19′. Altitude above sea-level, 7,123 feet.

[Pl. 10, fig. 21.]

Hour.	Barometer red. to level.	Temp. (Fah.).	Mean diff., wet and dry thermometers.	Force of vapor.	Relative humidity (per M.).	Winds, mean force (10 max.).	Clouds, amount (10 max.).
	″	°	°	″			
7 a. m	—.026*	+ 7.9	+ 1.8	+.009	—.103	0.6	4.9
8 a. m	—.023	+ 4.4	+ 1.2	+.011	+.022	0.6	5.0
9 a. m	—.021	— 2.6	0.0	+.014	+.167	0.6	5.6
10 a. m	—.017	— 9.7	— 1.2	—.002	+.140	0.9	5.7
11 a. m	—.011	—15.6	— 3.0	—.036	+.032	1.0	4.6
12 m	+.006	—16.6	— 3.5	—.040	+.026	1.1	4.4
1 p. m	+.020	—18.3	— 4.4	—.046	+.029	0.9	4.3
2 p. m	+.035	—19.0*	— 4.9	—.046	+.041	1.3	3.9
3 p. m	+.043†	—15.3	— 3.8	—.025	+.089	1.1	4.0
4 p. m	+.035	—11.5	— 2.7	+.001	+.184	1.0	4.1
5 p. m	+.028	— 3.2	— 0.3	+.016	+.193	0.8	4.1
6 p. m	+.025	+ 1.0	+ 1.0	+.008	+.051	0.5	4.8
7 p. m	+.014	+ 2.5	+ 1.2	+.007	+.018	0.5	4.7
8 p. m	+.009	+ 4.0	+ 1.4	+.007	—.017	0.4	4.5
9 p. m	+.008	+ 4.8	+ 1.5	+.006	—.037	0.3	4.0
10 p. m	—.002	+ 7.5	+ 1.8	+.008	—.103	0.4	3.1
11 p. m	—.011	+ 8.6	+ 2.0	+.008	—.149	0.7	4.0
12 p. m	—.017*	+ 9.4	+ 2.1	+.008	—.174	0.5	3.5
1 a. m	—.016	+ 9.6	+ 1.8	+.013	—.101	0.7	3.8
2 a. m	—.015	+ 9.2	+ 1.3	+.021	+.014	0.5	3.1
3 a. m	—.016	+10.0	+ 1.6	+.018	—.053	0.5	2.8
4 a. m	—.011†	+10.8	+ 1.9	+.015	—.123	0.5	3.5
5 a. m	—.012	+11.9†	+ 2.0	+.016	—.146	0.4	3.6
6 a. m	—.019	+11.2	+ 1.8	+.018	—.100	0.4	3.5
Grand means	23.026	17.3	3.2	.046	.469	0.7	4.1

* Maxima. † Minima.

REMARKS.

PROPORTION OF CLEAR AND CLOUDED SKY.

	Per ct.
Clear	58.5
Nimbus	5.7
Cumulus	8.7
Cirrus	3.6
Stratus	0.3
Cirro-cumulus	12.8
Cirro-stratus	8.0
Cumulo-stratus	2.4
Total	100.0

WINDS.

	Calms.	N.	S.	E.	W.
Per cent	62.8	3.3	0.8	0.0	14.7
Force	......	1.9	1.7	.....	1.9

	N. E.	N. W.	S. E.	S. W.
Per cent	0.0	5.0	0.6	12.8
Force	......	1.7	1.0	1.7

BAROMETER.

Extreme range of abnormal waves:
From 23.300 inches on Dec. 11 (11 a. m.), 1872
To 22.718 inches on Dec. 20 (5 a. m.), 1872.

THERMOMETER.

Extreme range of diurnal temperature:
From 63°.0, at 1 p. m., on Dec. 8, 1872,
To 9°.1, at 7 a. m., on Dec. 8, 1872.

GREATEST DIFFERENCE BETWEEN WET AND DRY BULB THERMOMETERS.

Date.	Hour.	Dry (Fah.).	Wet (Fah.).	Diff. (Fah.).	F. vapor.	Humidity (per M.).
		°	°	°	″	
1872. Dec. 13	3 p. m.	58.0	36.0	22.0	.090	.187

GENERAL REMARKS UPON METEOROLOGICAL PHENOMENA OBSERVED.

Rain, 9.30 to 11.15 p. m., December 5; same, 6.10 to 7.10 p. m., December 10; same, 6 to 6.10 a. m. December 15; same, 7 to 9 p. m., December 18; same, 7 a. m., December 20.

Horary corrections, for reducing barometric readings to daily means.

Station.	Georgetown, Colo.	Green River, Wyo.	Los Angeles, Cal.	Santa Fé, N. Mex.	Colorado Springs, Colo.	Salt Lake City, Utah.	Hughes, Colo.	Camp Independence, Cal.	Beaver, Utah.	Labran, Colo.	Cottonwood Springs, Nev.	Beaver, Utah.	Trinidad, Colo.
Latitude	39° 42′	41° 31′	34° 03′	35° 41′	38° 49′	40° 47′	39° 59′	36° 50′	38° 16′	38° 23′	36° 03′	38° 16′	37° 10′
Altitude (feet)	8,587	6,096	325	7,044	6,030	4,339	5,021	3,956	5,915	5,217	3,449	5,915	5,989
Month	June.	June.	June.	June.	July, Aug.	July.	July.	July.	Aug.	Sept.	Sept.	Sept.	Sept.
7 a. m.	−.037	−.028	−.032	−.026	−.030	−.031	−.029	−.039	−.038	−.031	−.027	−.026	−.031
8 a. m.	.029	.032	.044	.027	.028	.036	.035	.044	.048	.031	.033	.028	.027
9 a. m.	.014	.029	.036	.029	.028	.032	.034	.040	.040	.029	.030	.034	.021
10 a. m.	.016	.018	.033	.025	.021	.029	.024	.036	.035	.023	.024	.033	.009
11 a. m.	.008	−.007	.022	.020	.013	.022	.015	.027	.023	−.012	.022	.021	−.002
12 m.	−.009	+.008	−.012	−.006	−.001	.014	−.007	−.018	−.008	+.001	−.013	−.006	+.010
1 p. m.	+.013	.016	+.005	+.004	+.014	−.003	+.017	+.004	+.005	.017	+.006	+.007	.023
2 p. m.	.023	.029	.004	.018	.034	+.010	.034	.019	.018	.033	.021	.022	.036
3 p. m.	.035	.034	.013	.028	.043	.015	.041	.037	.038	.032	.036	.033	.041
4 p. m.	.043	.040	.026	.037	.045	.029	.047	.053	.047	.034	.045	.037	.039
5 p. m.	.050	.042	.033	.044	.047	.040	.045	.069	.054	.030	.045	.042	.038
6 p. m.	.036	.041	.033	.037	.042	.043	.045	.052	.051	.026	.034	.042	.029
7 p. m.	.029	.036	.028	.033	.022	.037	.027	.042	.037	+.014	.028	.030	+.008
8 p. m.	.018	+.017	.019	.025	+.005	.029	+.006	.029	.025	−.002	.016	.013	−.008
9 p. m.	+.005	−.010	.010	+.004	−.006	+.014	−.006	+.006	.012	.009	+.008	.008	.016
10 p. m.	−.009	.015	.006	−.006	.017	.010	.009	−.007	.005	.011	−.005	+.002	.016
11 p. m.	.013	.019	.007	.012	.017	.005	.007	.008	+.001	.012	.014	−.002	.016
12 p. m.	.017	.017	.009	.010	.017	.005	.001	.012	−.005	.009	.018	.009	.012
1 a. m.	.016	.017	.006	.008	.014	+.000	.001	.008	.009	.007	.015	.010	.006
2 a. m.	.010	.016	.007	.004	.013	−.004	.004	.006	.011	.007	.010	.010	.004
3 a. m.	.012	.010	+.006	.002	.011	.007	.008	.008	.011	.016	−.008	.008	.006
4 a. m.	.023	.006	−.004	.007	.011	.013	.010	.014	.018	.019	+.004	.008	.008
5 a. m.	.029	.014	.012	.020	.013	.022	.024	.022	.027	.029	−.009	.018	.017
6 a. m.	−.028	−.019	−.017	−.023	−.023	−.023	−.029	−.042	−.032	−.034	−.017	−.022	−.026

Horary corrections, for reducing barometric readings to daily means—Continued.

Station.	Cheyenne, Wyo.	Pioche, Nev.	Ogden, Utah.	Truxton Springs, Ariz.	Fort Fred. Steele, Wyo.	Prescott, Ariz.	Gunnison, Utah.	Laramie, Wyo.	Camp Mohave, Ariz.	Pagosa, Colo.	Bozeman, Mont.	Virginia City, Nev.	Winnemucca, Nev.
Latitude.......	41° 08′	37° 55′	41° 13′	35° 25′	41° 47′	34° 33′	39° 10′	41° 19′	35° 02′	37° 16′	45° 41′	39° 18′	40° 58′
Altitude (feet)..	6, 041	5, 942	4, 374	3, 885	6, 840	5, 318	5, 145	7, 123	755	7, 057	4, 839	6, 339	4, 355
Month	Oct.	Oct.	Sept., Oct.	Oct.	Nov.	Nov.	Nov.	Dec.	Aug., Sept.	Sept.	Sept.	Aug.	July.
7 a. m.........	−.014	−.022	−.031	−.029	−.022	−.021	−.023	−.026	−.067	−.039	−.017	−.029	−.045
8 a. m.........	.022	.025	.036	.027	.024	.028	.037	.023	.068	.044	.026	.029	.051
9 a. m	.029	.028	.040	.023	.022	.030	.041	.021	.071	.035	.036	.029	.047
10 a. m.........	.026	.025	.042	.019	.020	.023	.035	.017	.063	.030	.031	.027	.035
11 a. m.........	.018	.020	.034	−.013	−.014	−.015	.029	−.011	.048	−.025	.022	.017	.019
12 m	−.002	−.009	.023	+.012	+.005	+.020	−.008	+.006	.027	+.003	.013	−.009	−.012
1 p. m.........	+.014	+.004	−.019	.033	.017	.029	+.010	.020	−.003	.017	−.000	+.004	+.004
2 p. m.........	.025	.019	+.001	.036	.034	.041	.023	.035	+.028	.032	+.013	.017	.019
3 p. m.........	.034	.025	.018	.030	.036	.041	.033	.043	.041	.041	.024	.027	.033
4 p. m.........	.036	.029	.025	.024	.035	.035	.043	.035	.075	.043	.034	.033	.043
5 p. m.........	.030	.029	.031	.028	.026	.019	.040	.028	.086	.039	.030	.038	.050
6 p. m.........	.026	.026	.032	.019	.014	.009	.037	.025	.084	.030	.028	.033	.052
7 p. m.........	.012	.019	.031	.020	.008	+.001	.033	.014	.077	.013	.023	.023	.044
8 p. m.........	+.000	.011	.028	+.010	+.003	−.005	.021	.009	.062	.010	.009	.009	.035
9 p. m.........	−.008	+.003	.020	−.002	−.003	.010	+.004	+.008	+.038	+.001	+.005	.005	.020
10 p. m.........	.014	−.003	.015	.010	.003	.013	−.002	−.002	....	....	....	+.003	+.008
11 p. m.........	.014	.006	.014	.009	.004	.015	−.000	.011	....	....	....	−.001	−.001
12 p. m.........	.007	.006	.005	.008	.006	−.008	+.003	.017	....	....	....	.002	.004
1 a. m.........	−.005	.003	.005	.010	.005	+.003	+.005	.016	....	....	....	.000	.008
2 a. m.........	+.002	−.002	.003	.006	.006	.008	−.003	.015	....	....	....	.003	.002
3 a. m.........	.003	+.002	.001	.008	.008	+.007	.011	.016	....	....	....	.004	.007
4 a. m.........	+.005	−.001	.005	.007	.012	−.011	.014	.011	....	....	....	.007	.016
5 a. m.........	−.007	.005	+.001	−.014	−.014	−.018	−.017	−.012	....	....	....	.012	.031
6 a. m.........	.017	−.021	−.008	+.027	+.017	+.022	+.020	+.019	....	....	....	−.020	−.042

Horary table, for reducing observed temperature to daily mean.

Station.	Georgetown, Colo.	Green River, Wyo.	Los Angeles, Cal.	Santa Fé, N. Mex.	Colorado Springs, Colo.	Salt Lake City, Utah.	Hughes, Colo.	Camp Independence, Cal.	Beaver, Utah.	Labran, Colo.	Cottonwood Springs, Nev.
Latitude......	39° 42′	41° 31′	34° 03′	35° 41′	38° 49′	40° 47′	39° 59′	36° 50′	38° 16′	38° 23′	36° 03′
Altitude (feet)	8,587	6,006	325	7,044	6,030	4,339	5,021	3,956	5,915	5,217	3,449
Month........	June.	June.	June.	June.	July, Aug.	July.	July.	July.	Aug.	Sept.	Sept.
7 a. m	+11.7	+ 2.6	+ 2.4	− 6.0	+ 0.6	− 0.3	+ 7.9	+ 5.3	+ 5.7	+ 2.0	+ 3.9
8 a. m	+ 2.0	− 1.4	− 1.5	9.0	− 5.7	4.1	− 1.2	+ 1.3	+ 1.1	− 4.4	− 2.3
9 a. m	− 4.4	7.4	5.2	12.4	8.5	6.3	8.7	− 3.7	− 4.6	9.9	4.9
10 a. m	10.9	14.0	8.9	13.4	12.9	10.3	15.5	7.7	8.1	15.5	7.9
11 a. m	13.8	16.3	10.4	13.6	13.3	11.4	17.6	10.7	10.7	20.4	11.9
12 m...........	14.3	17.1	11.9	13.9	13.3	14.4	20.0	12.2	12.3	21.0	12.3
1 p. m	14.3	16.8	11.1	14.1	13.4	15.1	22.2	13.7	13.3	19.3	13.3
2 p. m	15.5	16.0	7.9	14.2	9.9	15.7	22.1	14.5	14.2	17.5	13.2
3 p. m	14.3	15.0	7.1	14.3	8.6	15.2	20.1	14.0	14.4	14.3	13.2
4 p. m	12.7	12.9	6.4	10.8	7.0	15.7	15.1	13.1	13.2	10.6	11.4
5 p. m	11.1	11.8	5.4	8.8	5.4	12.6	10.8	10.3	10.8	6.9	10.0
6 p. m	3.8	9.9	− 3.6	− 4.2	− 2.2	− 7.1	8.4	− 4.7	8.3	− 0.9	− 3.5
7 p. m	− 0.3	− 5.6	+ 1.5	+ 2.1	+ 1.6	+ 0.4	− 1.8	+ 0.9	− 2.1	+ 4.8	+ 0.8
8 p. m	+ 3.3	+ 2.0	5.1	5.2	3.5	6.0	+ 6.4	3.2	+ 2.5	6.0	2.9
9 p. m	4.8	5.6	0.7	7.6	4.8	8.0	8.7	5.0	4.3	9.3	3.9
10 p. m	7.9	8.7	6.6	9.9	5.7	8.8	11.1	6.4	5.7	11.1	5.9
11 p. m	8.0	10.9	7.4	10.4	8.2	11.3	11.6	7.0	6.4	11.3	7.3
12 p. m	9.3	12.9	7.6	11.6	10.1	13.0	13.7	8.3	7.5	12.2	9.3
1 a. m	10.1	15.2	7.7	13.3	10.8	13.3	15.1	9.7	10.2	13.1	9.6
2 a. m	11.5	17.5	7.7	15.0	10.9	13.3	16.6	10.7	12.2	14.1	10.7
3 a. m	12.1	18.8	7.9	16.1	11.9	15.1	17.6	11.7	13.4	14.8	11.5
4 a. m	13.2	21.0	8.0	17.2	12.5	17.2	19.0	12.9	15.4	15.3	12.3
5 a. m	14.0	20.1	7.6	17.4	12.7	17.9	21.3	13.2	13.8	16.5	14.4
6 a. m	+13.2	+ 9.7	+ 5.4	+ 5.2	+ 9.1	+ 7.2	+16.8	+ 9.0	+12.1	+11.2	+11.0
Range of temperature ...	29.5	38.1	19.9	31.7	26.1	33.6	43.5	27.7	29.8	37.5	27.7

Horary table, for reducing observed temperature to daily mean—Continued.

Station.	Beaver, Utah.	Trinidad, Colo.	Cheyenne, Wyo.	Pioche, Nev.	Ogden, Utah.	Truxton Springs, Ariz.	Fort Steele, Wyo.	Prescott, Ariz.	Gunnison, Utah.	Laramie, Wyo.
Latitude......	38° 16′	37° 10′	41° 08′	37° 55′	41° 13′	35° 25′	41° 47′	34° 33′	39° 10′	41° 19′
Altitude (feet)	5, 915	5, 989	6, 041	5, 942	4, 374	3, 885	6, 840	5, 318	5, 145	7, 123
Month........	Sept.	Sept.	Oct.	Oct.	Sept., Oct.	Oct.	Nov.	Nov.	Nov.	Dec.
7 a. m	+ 4.2	+ 5.1	+12.3	+ 7.1	+15.4	+ 2.5	+ 4.5	+ 4.4	+12.9	+ 7.9
8 a. m	− 0.4	− 2.2	− 0.1	+ 3.3	+ 1.7	− 5.5	+ 2.3	− 6.9	+ 6.4	+ 4.4
9 a. m	3.8	7.5	8.8	− 1.7	− 6.1	10.0	− 0.9	11.0	− 1.9	− 2.6
10 a. m	7.2	12.8	13.4	6.4	11.8	16.6	4.7	12.7	8.2	9.7
11 a. m	8.3	14.7	15.7	8.7	16.1	17.1	6.0	14.4	12.7	15.6
12 m..........	10.1	16.6	17.8	10.7	19.0	17.7	6.3	16.1	16.3	16.6
1 p. m	10.6	16.5	19.2	11.3	20.9	18.7	6.6	22.8	18.4	18.3
2 p. m	11.0	14.5	19.8	13.2	21.0	19.1	7.3	20.9	19.9	19.0
3 p. m	10.8	12.1	19.4	12.1	21.2	15.7	7.1	15.7	16.2	15.3
4 p. m	10.6	11.2	17.4	10.9	20.6	4.6	5.0	10.1	12.5	11.5
5 p. m	8.6	6.9	11.5	4.5	15.0	1.6	2.6	− 3.4	8.9	− 3.2
6 p. m	5.2	− 1.0	− 2.9	2.5	− 6.8	− 0.6	− 1.0	+ 0.3	− 2.5	+ 1.0
7 p. m	− 0.7	+ 1.9	+ 2.0	− 0.5	+ 4.2	+ 0.9	+ 0.3	2.7	+ 0.2	2.5
8 p. m	+ 1.1	4.5	3.1	+ 0.7	7.1	2.0	0.6	5.4	2.0	4.0
9 p. m	3.4	0.6	7.9	2.5	8.7	7.0	1.3	6.8	3.7	4.8
10 p. m	5.2	7.5	9.3	3.3	10.1	9.4	2.1	7.9	5.5	7.5
11 p. m	6.5	8.1	11.6	5.4	9.7	10.8	2.8	9.6	7.4	8.6
12 p. m	7.8	9.0	13.0	7.4	11.0	12.1	2.8	11.3	8.3	9.4
1 a. m	8.6	9.9	13.8	8.0	11.9	13.7	3.4	11.4	10.0	9.6
2 a. m	9.3	11.4	14.5	9.0	13.1	13.5	3.9	13.0	11.5	9.2
3 a. m	10.5	12.9	15.3	9.4	14.4	13.5	4.4	14.1	13.1	10.0
4 a. m	10.9	14.0	15.1	9.9	16.2	14.3	5.5	15.2	13.9	10.8
5 a. m	11.6	15.7	15.3	10.2	16.8	14.4	5.8	16.3	14.7	11.9
6 a. m	+ 9.8	+12.5	+15.0	+ 9.3	17.2	+14.5	+ 6.7	+13.4	+13.9	+11.2
Range of temperature...	22.6	32.3	35.1	23.4	38.4	33.6	14.0	39.1	34.6	30.9

NOTE.—Take the difference between maximum and minimum for daily mean and select corresponding tables. If maximum is not observed, select highest observed temperature during March in connection with minimum. Difference for several camps will give a range which, with the month, will decide the tables to be used for all observation in vicinity.

TABLE OF ALTITUDES DETERMINED FROM SIMULTANEOUS CISTERN-BAROMETER OBSERVATIONS AT TWO OR MORE STATIONS.

NOTE.—This table contains only the altitudes of important peaks or points of local notoriety in the section embraced. Less than one-third of the altitudes determined by the cistern-barometer are included.

With the aneroid determinations the list of computed barometric altitudes will exceed eleven thousand in number. To render this data useful otherwise than in the delineation of the topography of the country on the atlas map of the survey, it is contemplated, as already set forth, to publish at intervals "Tables of positions, distances, and altitudes." These tables, with descriptive notes, it is hoped will prove of considerable practical advantage to the departments of the government operating in the more remote Western regions, to actual settlers, and to those who may hereafter occupy some portion of this territory.

Table of altitudes determined from simultaneous cistern-barometer observations at two or more stations.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
1	Abiquiu	New Mexico	69*d*	5,930.1
2	Abiquiu Peak	do	69*d*	11,240.7
3	Acoma	do	77*d*	6,422.8
4	Adobe Station	California	73*a*	282.2
5	Agency Knob	Colorado	61*b*	12,273.5
6	Agua Azul (northeast on Mesa)	New Mexico	77*d*	7,928.0
7	Agua Azul, or Blue Water	do	77*d*	6,682.8
8	Agua Caliente	California	80*b*	724.8
9	Agua Fria	New Mexico	77*a*	6,486.2
10	Agua Negra	do	70*e*	8,193.9
11	Aguajes de Los Guajolotes	do	78*a*	6,202.4
12	Albuquerque	do	77*b*	4,918.7
13	Algodones	do	77*b*	5,104.3
14	Altar Peak	Colorado	61*c*	13,254.0
15	Animas City, Old	do	61*c*	6,662.3
16	Antelope Ranch	California	72*b*	358.7
17	Antelope Spring	Arizona	75	8,065.1
18	do	Utah	59	6,701.7
19	Antelope Spring, Upper	do	50	7,143.7
20	Antelope Spring	New Mexico	77*b*	6,290.7
21	Anton Chico	do	78*d*	5,381.5
22	Antoro Peak	Colorado	61*c*	13,496.8
23	Anvil Rock	Arizona	75	5,354.1
24	Apache Camp	do	83	5,000.9
25	Arab Spring	California	65	5,697.3
26	Argentine Pass	Colorado	52*d*	13,286.1
27	Arkansas Pass	do	52*d*	11,445.3
28	Austin	Nevada	48*d*	6,593.9
29	Bacon Springs, main divide, northeast of	New Mexico	77	8,814.9
30	Bacon Springs	do	77*d*	7,189.0
31	Badito	Colorado	62*c*	6,386.5
32	Bah-li-vah Spring	California	65*b*	6,284.1
33	Bakersfield	do	73*a*	465.3
34	Baldy Peak (east of Fort Cameron)	Utah	59	11,730.2
35	Baldy (Elizabeth) Peak	New Mexico	70*a*	12,491.3
36	Baldy (Santa Fé) Peak	do	69*d*	12,661.2
37	Banded Peak	do	69*b*	12,824.4
38	Bare Mountain	California	65*c*	6,038.9
39	Bayard, Fort	New Mexico	84	6,318.5
40	Beaver	Utah	59	5,915.7
41	Bear Peak	New Mexico	83	8,081.1
42	Bear Creek Pass	Colorado	61*c*	11,605.7
43	Belmont	Nevada	57	8,091.9
44	Belknap Peak	Utah	59	11,894.3
45	Belleview Peak	Colorado	61*d*	12,673.1
46	Bernalillo	New Mexico	77*b*	5,083.7
47	Berry's Springs	Utah	67	2,809.6
48	Bernal Hill	New Mexico	78*d*	7,029.0
49	Big Lake (San Luis Valley)	Colorado	61*d*	7,477.6
50	Blanco and Largo Cañons, junction of	New Mexico	69*a*	5,738.2
51	Blue Spring	Arizona	76	7,795.8
52	Blue Water Spring	New Mexico	77	6,774.1
53	Bold's Ranch	California	80*d*	141.2
54	Boston Peak	do	73*a*	6,519.3
55	Boulder Peak	Colorado	61*d*	12,416.9
56	Bowers's Ranch	Arizona	75	4,411.8
57	Bowie, Camp	do	89	4,871.6
58	Bozeman's Ranch	California	73*d*	3,157.2
59	Bozeman	Montana	23*b*	4,838.6
60	Breckenridge Mountain	California	73*a*	7,417.6
61	Breckenridge Pass	Colorado	52*d*	11,503.3
62	Brown's Peak	California	65*d*	5,392.3
63	Buckhorn Ranch (or Warren's Station)	do	73*c*	693.1

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
64	Bueno Caballo	New Mexico	77	6,947.6
65	Buffalo Peak	Colorado	52*d*	13,328.6
66	Bullion City	Nevada	49	6,386.4
67	Bull Run Mountain	....do	40	9,040.7
68	*Bennett's Wells, Death Valley	California	65*d*	—5.8
69	Burguin, Camp	New Mexico	69*d*	7,277.4
70	Butte Valley post-office	Colorado	62*c*	5,894.2
71	Butte near Cubero	New Mexico	77*d*	6,820.2
72	Cady, Camp	California	73*d*	1,893.8
73	Cajon Pass Divide	....do	73*d*	4,195.4
74	Caliente	....do	73*d*	1,314.1
75	Caliente Springs	....do	73*a*	3,687.7
76	Callville	Nevada	66	944.6
77	Camulos Ranch	California	73*c*	799.0
78	Canby Peak	Colorado	61c	13,356.0
79	Cañoncito	New Mexico	77*b*	7,023.0
80	Cañon City	Colorado	62*a*	5,395.5
81	Cañon Springs	Arizona	83	5,497.7
82	Cañon Spring	California	81*d*	1,238.5
83	Cañon Station	....do	65*d*	2,650.0
84	Carrizo Spring	New Mexico	76	7,477.0
85	Carrizo Peak	....do	68*b*	9,390.4
86	Carlin, camp near	Nevada	40	4,849.4
87	Carr's Cabin, Antelope Park	Colorado	61c	9,988.7
88	Carthage, on Owen's Lake	California	65*c*	3,589.0
89	Cave Spring	Arizona	76	6,031.2
90	Ciboletta	New Mexico	77*a*	6,410.7
91	Cement and Eureka Creeks, divide between	Colorado	61c	12,786.5
92	Cerro Blanco	New Mexico	62c	14,269.0
93	Cerro Gordo Landing, Colorado River	California	65*d*	3,656.1
94	Cerro Gordo Pass	....do	65*b*	8,873.5
95	Chamisal	New Mexico	69*d*	7,527.6
96	Cheyenne	Wyoming	44c	6,041.0
97	Chicoso	Colorado	70*a*	6,076.3
98	Chloride	Arizona	74*b*	4,201.4
99	Chuckawalla	California	81*d*	2,095.2
100	Cienega de San Simon	Arizona	89	3,854.8
101	Cimmaron	New Mexico	70*a*	6,384.5
102	Circleville	Utah	59	5,624.8
103	Ciruela	New Mexico	70*c*	6,743.9
104	Clear Creek and Platte Divide	Colorado	52*d*	11,416.1
105	Coal-mines near Cañon City	....do	62*a*	5,440.9
106	Cochetopa, or Los Pinos Agency	....do	61*b*	9,088.0
107	Cochetopa Pass	....do	61*b*	10,032.3
108	Cochetopa and Saguache Divide, near head	....do	61*d*	11,234.3
109	Colfax	....do	62*c*	8,599.4
110	Colonas Ferry, Rio Grande	New Mexico	69*b*	7,442.7
111	Colorado Creek and Rio Grande Junction	....do	69*b*	6,386.4
112	Colorado Springs (astronomical station)	Colorado	62*a*	6,009.7
113	Conejos	....do	69*b*	7,434.9
114	Conejos Peak	California	73*c*	2,564.9
115	Conejos and San Juan, divide between	Colorado	61*d*	12,302.1
116	Cooley's Ranch	Arizona	83	5,366.8
117	Coombs Station	California	73*d*	2,885.5
118	Corinne (C. P. R. R. track by level)	Utah	41	4,233.0
119	Corrales	New Mexico	77*b*	5,090.9
120	Costilla	Colorado	69*b*	7,750.7
121	Costilla Peak	New Mexico	70*a*	12,615.3
122	Cottage, Camp	Nevada	40	6,437.2
123	Cottonwood Spring	....do	66	3,449.5
124	Cottonwood Station	California	73*d*	2,487.8
125	Cow Spring	....do	65	3,875.5

* Below the level of the sea.

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
126	Cow Spring	New Mexico	84	4,954.1
127	Coyote Spring	Nevada	58	3,674.4
128	......do	New Mexico	76	7,201.8
129	Coyote Water-holes	....do	84	6,774.8
130	Craig, Fort	....do	84	4,447.5
131	Cross Spring	....do	*77d*	6,264.6
132	Crossman's Spring	Nevada	*74a*	4,390.7
133	Crystal Spring	....do	66	5,782.0
134	Cubero	New Mexico	*77a*	6,121.9
135	Cucamonga	California	*73d*	1,327.8
136	Cucamonga Peak	....do	*73d*	8,529.4
137	Cucharas Pass	Colorado	*70d*	9,994.2
138	Cucharas and Trinchera, divide between	....do	*62c*	10,955.2
139	Cuchillo	New Mexico	*77b*	5,195.4
140	Cuddy's Ranch	California	*73c*	5,277.9
141	Cuerno Verde Peak	Colorado	*62c*	12,340.6
142	Culebra Church	....do	*69b*	8,009.7
143	Culebra Peak	New Mexico	*70a*	14,049.3
144	Cummings, Fort	....do	84	4,777.7
145	Currant Creek Pass	Colorado	*61b*	9,653.6
146	Dawe's Ranch	California	*73a*	451.1
147	Darwin Cañon	....do	*65d*	3,143.1
148	Dayton	Colorado	*52d*	9,333.3
149	Death Valley, barometer-station I	California	*65d*	*— 69.2
150	Death Valley, barometer-station II	....do	*65d*	+ 57.1
151	Death Valley, barometer-station III	....do	*65d*	+ 7.3
152	Death Valley, barometer-station IV	....do	*65d*	— 45.3
153	Death Valley, barometer-station V	....do	*65d*	— 62.4
154	Death Valley, barometer-station VI	....do	*65d*	—110.0
155	Death Valley, barometer-station VII	....do	*65d*	— 63.9
156	Del Norte	Colorado	*61d*	7,742.7
157	Deep Spring	California	*65a*	4,957.1
158	Deer Spring	Arizona	76	5,981.9
159	Defiance, Fort	New Mexico	68	7,041.7
160	Del Norte Knob	Colorado	*61d*	8,218.3
161	Del Norte Peak	....do	*61d*	13,084.1
162	Denver (K. P. R. R. track by level)	....do	53c	5,196.6
163	Deseret City	Utah	50	4,642.2
164	Desert Spring	....do	58	5,886.8
165	Desert Tanks	Arizona	76	5,192.1
166	Desert Wells	....do	82	2,135.2
167	Desert Springs	California	*73a*	1,989.0
168	Desert Wells	Nevada	57	4,696.3
169	Diamond City	Utah	50	6,369.9
170	Disappointment Spring	Nevada	66	4,834.8
171	Dos Palmas	California	*81d*	102.8
172	Dotson's Ranch	Colorado	*62c*	6,379.1
173	Douglas Camp (astronomical monument by level)	Utah	41	4,905.0
174	Dunn's Peak	Colorada	61c	13,502.4
175	Dutch Henry's Ranch	California	73c	1,195.1
176	Edgar's Spring	....do	65	4,060.8
177	Ehrenberg, camp opposite	....do	*81b*	408.0
178	Eighteen-Mile Mountain	Colorado	*61c*	12,277.8
179	Eldorado Mill	California	*66d*	863.0
180	Elizabethtown	New Mexico	*70a*	8,464.7
181	Elizabeth Lake	California	*73c*	3,317.5
182	El Monte	....do	*73c*	328.5
183	El Paso Mines (tunnel)	....do	*73b*	4,112.6
184	El Puerto de la Laguna	New Mexico	*69b*	7,187.1
185	El Rito	....do	*69d*	6,792.0

* The altitudes in Death Valley marked with a minus-sign (—) indicate that that station in the valley is so many feet below the level of the sea.

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
186	El Rito	New Mexico	77*d*	5,649.7
187	El Vado de los Padres (Colorado River)	Utah	67	3,193.9
188	Engineer Peak	Colorado	61*c*	13,277.4
189	Ephraim City	Utah	50	5,633.4
190	Escudilla Mountain	Arizona	83	10,691.3
191	Embudo	New Mexico	69*d*	5,891.0
192	Eureka	Nevada	49	5,905.6
193	Eureka Springs	New Mexico	83	4,239.2
194	Evans Mountain (timber-line)	Colorado	52*d*	11,722.6
195	Evans Mountain	do	52*d*	14,321.0
196	Fairplay	do	52*d*	10,075.9
197	Faust's Station	Utah	50	5,296.1
198	Fear's Station	California	73*d*	3,393.0
199	Fillmore	Utah	59	6,025.7
200	Fish Lake	Nevada	57	4,745.0
201	do	Utah	59	8,763.2
202	do	Nevada	58	6,866.0
203	Floyd Camp (now Fairfield)	Utah	50	4,866.5
204	Forks of road, Sunset crossing to (Apache)	Arizona	76	7,839.6
205	Fountain Green	Utah	50	5,873.8
206	France's Springs	California	74*d*	4,219.8
207	French Pass	Colorado	52	12,043.5
208	Furnace Creek	California	65*d*	405.1
209	Furnace Spring	do	65*d*	336.9
210	Galena	Nevada	48	5,649.8
211	Galisteo	New Mexico	77*b*	6,116.6
212	Gallinas Park	do	69*d*	9,798.3
213	Gardner's post-office	Colorado	62*c*	6,956.2
214	Garland, Fort (Camp near)	do	62*c*	7,849.4
215	Georgetown (astronomical station)	do	52*d*	8,587.2
216	Georgia Pass	do	52*d*	11,770.2
217	Gila Cañon (Hot Springs)	New Mexico	84	5,905.4
218	Gila Cañon, mouth of	do	83	4,917.8
219	Gila River Junction, Big and Little	do	84	5,743.4
220	Glacier Peak	Colorado	61*c*	14,243.0
221	Glenville	California	65*c*	3,094.3
222	Glencove	Utah	59	5,220.9
223	Goodwin, Old Camp, post-office	Arizona	83	2,816.3
224	Gordon's Ranch	California	73*c*	736.8
225	Gorman's Ranch	do	73*c*	3,838.1
226	Goshen	Utah	50	4,482.5
227	Gould's Ranch	do	67	4,052.5
228	Graham Mountain	Arizona	83	10,516.2
229	Granite Wells	California	73*b*	2,080.1
230	Granite Springs	do	73*b*	4,015.2
231	Grant, post-office	Colorado	52*d*	8,497.3
232	Grant, Old Camp	Arizona	83	2,118.5
233	Grant, New Camp, post-office	do	83	4,833.1
234	Grape Vine Peak	California	65*c*	8,527.9
235	Grape Vine Spring	do	65*c*	2,431.8
236	Grape Vine Ranch	do	73*d*	2,246.8
237	Gray's Peak, north	Colorado	52*d*	14,380.3
238	Gray's Peak, south	do	52*d*	14,410.7
239	Gray's Peak, north and south, divide between	do	52*d*	13,929.3
240	Green River (astronomical station)	Wyoming	42	6,096.9
241	Griffith Peak	Colorado	52*d*	11,588.8
242	Grizzly Peak	California	73*d*	11,723.4
243	Guadalupita	New Mexico	70*c*	7,676.9
244	Gunnison	Utah	50	5,144.6
245	Guy Fawkes	New Mexico	84	6,700.0
246	Half-Moon Creek, A. and P. divide, head of	Colorado	52*d*	12,968.6
247	Half-Moon Creek, timber-line, head of	do	52*d*	11,668.5
248	Half-Moon Creek Peak, south of	do	52*d*	13,552.3

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
249	Halloran Springs	California	74a	3,271.7
250	Hall's Gulch Summit	Colorado	52d	12,670.8
251	Hall's Ranch	....do	61b	7,839.8
252	Hall's Works	....do	52d	9,916.5
253	Hamilton's Ranch	....do	62c	7,226.7
254	Handie's Peak	....do	61c	14,149.0
255	Hand-cart Pass	....do	52d	12,263.0
256	Hartsell's Ranch (new)	....do	61b	8,828.0
257	Harvard, Mount	....do	61b	14,151.6
258	Hayden Creek Pass	....do	61b	10,780.4
259	Hebron	Utah	58	5,474.8
260	Hedionda Lake	New Mexico	69b	7,149.0
261	Hell Cañon, western entrance of	....do	77b	5,991.5
262	Henson Creek and Animas River, divide between	Colorado	61c	12,876.7
263	Henson and Cebolla Creeks, divide between	....do	61c	13,002.9
264	Hoosier Pass	....do	52d	11,627.1
265	Horse Springs	New Mexico	84	7,044.7
266	Hot Springs, Diamond Creek	....do	84	5,544.7
267	Hot Springs	Nevada	48	4,730.8
268	Hot Springs and Thunder Creek, divide between	Colorado	61c	11,643.8
269	Howardsville	....do	61c	9,545.2
270	Hualapais	Arizona	75	5,321.9
271	Huerfano	Colorado	62c	4,714.5
272	Hughes (astronomical station)	....do	53	5,021.0
273	Humphreys Peak	Arizona	75	12,561.8
274	Hunchback Peak (Oso)	Colorado	61c	13,755.5
275	Hunter's Ranch	California	65c	6,274.7
276	Huntington, Mohave River	....do	73d	2,898.6
277	Hunt's Peak	Colorado	61b	14,054.6
278	Hurricane Peak	....do	61c	13,565.2
279	Idaho Springs	....do	53c	7,284.0
280	Independence Camp	California	65a	3,956.5
281	Indian Spring	Utah	50	5,283.5
282	Indian Wells	California	73a, 73b, 65d, 65c	2,607.6
283	Ivanpah	....do	74d	4,238.1
284	Jaycock's Ranch	Arizona	75	6,814.1
285	Jefferson	Colorado	52d	9,862.5
286	Jemez Mountain (△ station XX)	New Mexico	69d	9,533.7
287	Jemez Peak	....do	77b	8,568.9
288	Joe's Peak	California	65c	9,712.2
289	Johnson's Ranch	....do	65a	3,459.5
290	......do	....do	65d	5,015.3
291	Kerber and Poncho Creeks, divide between	Colorado	61b	11,129.7
292	Kernville	California	65c	2,550.7
293	Kincaid's Ranch	....do	73d	1,771.0
294	King's Springs, Death Valley	....do	65	— 225.1
295	Kneeling Jesus Bluff	New Mexico	84	7,902.8
296	Kozlowski's Ranch	....do	77b	6,905.3
297	La Bajada	....do	77	5,514.5
298	La Bayonne	California	80a	15.7
299	Labran	Colorado	62a	5,217.8
300	Lachusca	New Mexico	68	6,702.8
301	La Glorieta	....do	77b	7,047.7
302	Laguna Los Griegos	....do	78a	6,655.5
303	Laguna	....do	77a	6,266.0
304	La Junta	Colorado	52d	6,612.0
305	Lake City	....do	61c	8,753.4
306	Lake Creek, at fall	....do	52d	9,384.2
307	Lake Creek Pass	....do	61b	12,226.3
308	Lake City, Antelope Park, divide between	....do	61c	11,777.7

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
309	Lake Peak	New Mexico	69*d*	12,405.3
310	La Laguna Ranch	California	73*c*	129.2
311	La Monica Springs	New Mexico	84	7,735.3
312	Lane's Crossing, Mojave River	California	73*d*	2,819.1
313	Lane's Ranch	Colorado	61*b*	6,380.1
314	La Placita or Placitas	New Mexico	77*b*	5,129.3
315	La Plata Peak	Colorado	61*c*	13,316.0
316	La Veta	New Mexico	77*a*	6,266.0
317	Laramie	Wyoming	43*d*	7,123.0
318	Las Animas, west	Colorado	62*b*	3,885.7
319	Las Tapiacitas	New Mexico	69*a*	8,810.0
320	Las Vegas	Nevada	66	2,074.0
321	Las Lunitas	New Mexico	77	4,805.5
322	Laughlin's Peak	do	70*d*	8,949.9
323	La Veta Peak	Colorado	62*c*	11,653.9
324	Leaches Point	California	73*b*	3,613.7
325	Lee's Springs in Fremont Pass	Utah	59	6,883.1
326	Lehigh	do	50	4,596.1
327	Leonard's Ranch, Arkansas River	Colorado	61*b*	8,335.4
328	Liedendorf's Wells	New Mexico	89	4,601.3
329	Lime and Cascade Creeks, divide between	Colorado	61*c*	10,703.4
330	Lime or White Earth Creek Pass	do	61*c*	11,313.7
331	Lincoln, Mount	do	52*d*	14,375.3
332	Little Cottonwood	Utah	50	4,359.0
333	Little Yosemite	California	65*c*	6,442.1
334	Liverpool Landing, Colorado River	do	74*d*	606.3
335	Lone Pine	do	65*b*	3,810.1
336	Lookout Hill	do	65*d*	4,214.2
337	Lopez Ranch	do	73*c*	3,248.3
338	Los Angeles	do	73*c*	325.6
339	Los Brazos (river bottom)	New Mexico	69*b*	7,321.2
340	Los Cerntos del Aquila	do	69*b*	7,942.6
341	Los Chavez	do	77*d*	4,775.0
342	Los Encinos Ranch	California	73*c*	774.1
343	Los Lunas	New Mexico	77*d*	4,805.5
344	Los Machos	do	69*d*	7,289.8
345	Los Ojos, Chama River	do	69*b*	7,272.7
346	Los Pinos and Piedra Rivers, divide between	Colorado	61*c*	10,[illegible]77.7
347	Los Pinos and Rio Grande, divide between	do	61*c*	10,736.9
348	Los Quelites	New Mexico	77	5,133.6
349	Los Toros	California	81*a*	202.7
350	Los Tusos	New Mexico	77	7,537.3
351	Luceros	do	69*b*	7,941.2
352	Luera Springs	do	84	7,649.6
353	Lyons Ranch	California	73*c*	1,396.6
354	Macomb's Peak	Colorado	61*c*	13,154.2
355	Malaga Peak	California	73*c*	2,319.6
356	Malaga Ranch	do	73*c*	4.5
357	Mammoth Mills	Utah	58	6,947.3
358	M[illegible]ngos Spring	New Mexico	83	4,798.6
359	Marshall Pass	Colorado	61*b*	10,851.7
360	Martinez Mesa	New Mexico	78*d*	6,820.1
361	Martin's Ranch	California	73*d*	2,055.1
362	McCarthy's Ranch	New Mexico	77*a*	6,039.4
363	McClellan's Peak	Colorado	52*d*	13,841.8
364	McClure's Ranch	do	62*d*	5,318.4
365	McLaughlin's Ranch	do	52*d*	9,671.5
366	Meadow Mountain	California	65*c*	11,734.2
367	Mears Peak	Colorado	61*c*	13,007.9
368	Meigs Peak	do	61*d*	13,393.5
369	Mill Station	Utah	59	6,504.2
370	Mimbres Mountains (△ station XXXIX, 1873)	New Mexico	84	10,061.1
371	Mineral City	Colorado	61*c*	11,473.7

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
372	Mineral Spring	Arizona	76	6,670.3
373	Mogollon Mesa	do	76	7.535.3
374	Mojave, Camp	do	74*b*	755.0
375	Morey	Nevada	58	7,383.6
376	Morton or Silver Heels Mountain	Colorado	52*d*	10,107.1
377	Mosca Pass	do	62*c*	9,849.1
378	Mosquito	do	52*d*	10,445.6
379	Mosquito Pass	do	52*d*	13,308.4
380	Mosquito Spring	California	73*b*	2,009.8
381	Mount Pleasant	Utah	50	5,875.0
382	Mountain Meadows	do	59	5,741.8
383	Mountain Spring	Nevada	66	5,500.8
384	Mule Spring	New Mexico	84	5,231.8
385	Murderer's Mesa, Calva Plateau	Colorado	61*c*	12,309.7
386	Nacimiento Peak	New Mexico	69*d*	10,044.8
387	Nacimiento	do	69*c*	7,300.0
388	Nambe Pueblo	do	69*d*	6,045.1
389	Navajo Spring	Arizona	67	4,101.2
390	Nebo Peak	Utah	50	11,992.0
391	Nelson's Tank	Arizona	75	6,216.5
392	Newberry Peak	California	74*c*	3,375.4
393	Nichols Point	do	73*a*	6,262.7
394	Nobman's Spring	do	74*d*	3,734.7
395	Nordhoff	do	73*c*	818.8
396	Nutria	New Mexico	76	6,901.4
397	Nutria Spring	do	76	6,934.0
398	Nutritas Plaza	do	69*b*	7,454.9
399	Oak Spring	do	76	7,946.4
400	Ocate Crater	do	70*c*	8,902.8
401	Ogden (astronomical observatory)	Utah	41	4,374.0
402	Ogden Junction Railroad (by level)	do	41	4,299.6
403	Ojitos-de-las Cuevas, or Two-Cave Spring	New Mexico	77*a*	5,901.8
404	Ojo Amarillo	do	69*c*	6,384.1
405	Ojo Caliente	do	76	6,291.6
406	Ojos Calientes	do	68*a*	5,594.2
407	Ojo Datil	do	77	7,419.2
408	Ojo del Indio	do	77*a*	9,289.3
409	Ojo de los Cazos	do	77*b*	7,615.1
410	Ojo del Oso	do	76	5,902.1
411	Ojo de los Valles	do	77*b*	6,978.9
412	Ojo de Nuestra Señora	do	69*c*	6,605.8
413	Ojo do Vaca	do	77*b*	6,863.6
414	Ojo Gallo	do	77*a*	7,942.7
415	Olancha Peak	California	65*c*	12,250.8
416	Old Bony Mountain	do	73*c*	1,892.4
417	O'Neil's Ranch	Nevada	49	5,581.2
418	Ord Peak	New Mexico	76	10,093.5
419	Oro City	Colorado	52	10,088.1
420	Owen's River Bridge	California	65*a*	3,618.0
421	Owyhee	Nevada	40	5,392.3
422	Pagosa Hot Springs	Colorado	69*a*	7,057.3
423	Pagosa Peak	do	61*c*	12,675.8
424	Pah-ghun-pah-ghun Spring	Nevada	66	2,281.9
425	Pah-Ute Mines	California	73*a*	6,607.6
426	Pah-Ute Peak	do	73*a*	8,342.0
427	Pah-Ute Spring	do	74	2,849.3
428	Painted Cañon, entrance	Arizona	74	745.8
429	Paleta Peak	California	72*b*	4,567.5
430	Panamint	do	65*d*	6,604.9
431	Panamint Station	do	73*a*	3,548.6
432	Panquitch	Utah	59	6,273.3
433	Paragoonah	do	59	6,222.7
434	Paria	do	67	4,562.1

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
435	Paria Cañon, mouth of	Arizona	67	3,017.6
436	Paria River and Birch Creek, divide between	Utah	59	7,591.3
437	Pass Peak	Colorado	61*c*	13,091.8
438	Peach Orchard Spring	Arizona	68*c*	6,272.7
439	Pelado	New Mexico	69*d*	11,260.4
440	Peñasco	....do	69*d*	7,452.0
441	Pennoyer Springs	Nevada	58	6,651.7
442	Pescado Spring	New Mexico	76	6,546.2
443	Picacho Station	Arizona	82	1,750.2
444	Picket Post	....do	82	2,669.6
445	Pilot Knob	California	73*b*	5,525.1
446	Pioche	Nevada	58	5,942.3
447	Pipe Springs	Arizona	67	5,397.2
448	Placer Mountain	New Mexico	77*b*	8,826.5
449	Plaza del Alcalde	....do	69	5,601.2
450	Pleasant Valley	Utah	50	7,539.0
451	Point of Rocks	California	73*d*	2,541.6
452	Pole Creek, A. and P. divide between Pole Creek and Maggie Gulch.	Colorado	61*c*	12,296.3
453	Puncho Pass	....do	61*b*	8,945.5
454	Prescott	Arizona	75	5,316.0
455	Prospect Peak	Colorado	69*b*	9,908.9
456	Provo	Utah	50	4,567.3
457	Provo Peak	....do	50	11,066.2
458	Pueblo Colorado	New Mexico	68*c*	6,367.6
459	Pueblo. R. R. levels; track at Depot	Colorado	62*a*	4,669.0
460	Pueblo Jemez	New Mexico	77*b*	5,479.0
461	Pueblo Pintado	....do	69*c*	6,505.7
462	Pueblo Springs	....do	77	6,362.7
463	Pueblo Viejo, or Safford post-office	....do	83	2,711.5
464	Puertocito Spring	....do	84	6,499.3
465	Purgatoire and Vermejo divide (Vermejo or Francisco Pass).	....do	70*a*	9,173.1
466	Quinn Cañon	Nevada	58	6,255.7
467	Ralston	New Mexico	89	4,487.7
468	Raton Pass	Colorado	70*a*	7,893.2
469	Real Dolores	New Mexico	77	6,801.9
470	Red Cloud Peak	Colorado	61*c*	14,092.6
471	Red Mountain	....do	61*b*	13,332.7
472	Red Mountain (timber-line)	....do	61*b*	11,745.7
473	Red Rock Station	California	73*a*	2,394.1
474	Reily's Station	....do	73*c*	1,477.5
475	Rio Grande and Culebra Junction	Colorado	69*b*	7,086.7
476	Rio Grande, Crossing at Embudo Creek	New Mexico	69*d*	5,829.6
477	Rio Grande, Crossing at La Joya	....do	69*d*	5,651.0
478	Rio Grande, Crossing at Honda Creek	....do	69*b*	6,357.9
479	Rio Grande, at Peña Blanca	....do	77*b*	5,255.8
480	Rito Embargo Creek	Colorado	61*d*	8,099.5
481	Ritger's Ranch	California	65*a*	4,345.3
482	Rock Cliff, post-office	Colorado	61*d*	8,270.7
483	Rock Spring	Arizona	76	6,849.3
484	Rosalie Peak	Colorado	52*d*	14,236.1
485	Rose Springs	California	65*c*	3,544.9
486	Rosita (sun-dial)	Colorado	62*c*	8,736.0
487	Round Peak	....do	61*c*	12,946.1
488	Sabinal	New Mexico	77*d*	5,087.3
489	Saguache	Colorado	61*d*	7,620.4
490	Saguache Creek, (camp 16, 1875)	....do	61*d*	9,450.3
491	Salt Lake City (Temple pier by level)	Utah	41	4,330.4
492	Santa Ana	New Mexico	77*b*	5,345.7
493	San Antonio	Nevada	57	5,280.5
494	San Antonio Valley	New Mexico	69*b*	8,366.9
495	San Antonio Peak	California	73*d*	10,191.0

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
496	San Antonio Mountain	New Mexico	69*b*	10,912.0
497	San Antonio	....do	84	4,958.2
498	San Antonio and El Brazos, divide between	....do	69*b*	9,887.4
499	Santa Buena Ventura	California	60*d*	145.8
500	San Carlos Agency	Arizona	83	2,558.7
501	Sanchez Ranch	New Mexico	77*a*	7,298.0
502	San Christobal crossing, Rio Grande, water edge	....do	69*b*	6,422.9
503	San Christobal crossing, high bank west side of river	....do	69*b*	7,192.5
504	San Daño	....do	69*d*	8,366.2
505	Sandia Mountains	....do	77*b*	10,608.8
506	San Emigdio Store	California	73*a*	788.3
507	San Felipe	New Mexico	77*b*	5,007.4
508	San Fernando	California	73*c*	1,034.0
509	San Fernando Peak	....do	73*c*	3,792.8
510	San Gabriel	....do	73*c*	418.9
511	San Gabriel Church	....do	73*c*	480.7
512	San Gabriel Peak	....do	73*c*	6,293.2
513	San Gorgonio Pass	....do	80*b*	2,745.7
514	Sangre del Cristo Pass	Colorado	62*c*	9,577.9
515	San Francisco Spring	Utah	59	6,527.1
516	San Francisquito Cañon	California	73*c*	2,381.6
517	San Francisco Mountain (edge of crater)	Arizona	75	10,121.8
518	San Francisco Mountain (timber-line)	....do	75	11,467.6
519	San Ildefonso	New Mexico	69*d*	5,457.8
520	San Ignatio	....do	77*a*	5,515.0
521	San Isidro	....do	77*b*	5,459.9
522	San Juan City	Colorado	61*c*	8,900.8
523	San Juan River, junction with Navajo Creek	New Mexico	69*a*	6,268.2
524	San Juan, or Hamilton Pass, head of Rio Grande	Colorado	61*c*	12,413.0
525	San Juan River, mouth of Rio Mancos	New Mexico	68*b*	4,692.1
526	San Juan and Old Animas City, pass between	Colorado	61*c*	11,595.9
527	San Juan River and South Fork Rio Grande, A. and P. divide, on trail from Del Norte to Pagosa Spring.	....do	61*d*	10,853.6
528	San Juan, fork of Upper	....do	61*c*	7,776.9
529	San Luis Lake	....do	61*d*	7,535.0
530	San Luis de Culebra	....do	70*a*	7,596.3
531	San Lorenzo	New Mexico	69*d*	6,107.0
532	San Mateo	....do	77*a*	7,323.0
533	San Mateo Peak	....do	84	10,336.5
534	Santo Nino del Rincon	....do	70*c*	7,418.3
535	San Rafael	....do	77	6,509.1
536	Santa Cruz	....do	69*d*	5,590.0
537	Santa Monica	California	73*c*	81.7
538	Santa Fé	New Mexico	69*d*	7,044.2
539	Santa Paula	California	73*c*	384.0
540	Sapello	New Mexico	70	6,876.0
541	Saratoga Springs	Nevada	66	263.6
542	Sayer's Ranch	New Mexico	70*a*	6,693.5
543	Say-qui-to Spring	California	65	5,553.2
544	Sevier Pass (west side)	Utah	50	4,767.5
545	Sevier Lake Desert	....do	50	4,873.8
546	Sevier River Bridge	....do	59	5,282.6
547	Shoonesburg	....do	67	3,920.5
548	Shungo-pah-we	Arizona	68	6,031.9
549	Signal Peak, Carrizo Mountains	....do	69*c*	9,330.2
550	Silla	New Mexico	77*b*	6,676.8
551	Silver City	....do	83	5,946.0
552	Silver Peak Mines	Nevada	57	4,256.6
553	Silver Spring	California	65	4,000.2
554	......do	Arizona	76	6,169.1
555	Simpson's	Colorado	61*c*	14,055.9
556	S'kumpah	Utah	67	5,999.6
557	Slate Ranch	Colorado	52*d*	9,257.2
558	Smith's Ranch, Arkansas River	....do	62*d*	4,797.5

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
559	Snake River, mouth of Chihuahua Gulch	Colorado	52*d*	11,757.9
560	Snyder's Ranch	....do	61*a*	8,127.1
561	Soda Lake	California	74*a*	1,127.9
562	Soledad City	....do	73c	2,513.0
563	Spadra	....do	73*d*	802.4
564	Spanish Peak, west	Colorado	70*a*	13,717.9
565	Spear's Ranch	Arizona	74*b*	680.6
566	Spring Valley Spring	Nevada	49	7,768.1
567	Saint Clair's Ranch	California	80*b*	1,961.2
568	Steele, Fort	Wyomi g	43	6,850.0
569	Stern's Store	Colorado	62*c*	9,067.7
570	Stewart's Peak	....do	61c	14,032.1
571	Stinking Springs	New Mexico	76	6,690.4
572	......do	....do	77*b*	6,248.8
573	Stone Cabin	Nevada	57	6,390.3
574	Stone's Ferry	....do	66*b*	1,107.9
575	Saint Mary's (post-office)	Colorado	62*c*	6,167.1
576	Stump's Ranch	Nevada	49	4,748.9
577	Summit Springs	Arizona	76	7,867.2
578	Summit Mines, general level	Colorado	61*d*	11,089.2
579	Sunday Peak	California	65c	8,334.8
580	....do	New Mexico	84	6,030.3
581	Sunset Crossing	Arizona	76	4 891.0
582	Sunset Gap	....do	76	5,754.8
583	Sunset Tanks	....do	76	5,797.2
584	Surveyors Wells	California	73*b*	3,567.1
585	Tanks between Camp Apache and Camp Grant	Arizona	83	5,717.0
586	Taos Peak	New Mexico	70*a*	13,145.0
587	Taos Plaza	....do	69*d*	6,949.4
588	Taos Pueblos	....do	69*d*	7,014.6
589	Taylor, Mount	....do	77*a*	11,391.2
590	Taylor's Ranch	....do	78*a*	5,830.9
591	Tegua (Moqui)	Arizona	68*c*	6,298.8
592	Tehachapai	California	73*a*	3,830.6
593	Tehachapai Pass	....do	73*a*	3,831.9
594	TehachapaiPeak	....do	73*a*	8,263.1
595	Tejon, Old Fort	....do	73*a*	3,245.7
596	Ten Mile and Eagle Creek, divide between	Colorado	52*d*	10,756.1
597	Tennessee Pass	....do	52*d*	10,701.9
598	Tetilla Peak	New Mexico	77*b*	7,060.0
599	Thomas Ranch	California	73c	3,771.6
600	Thunder Peak	....do	65	9,121.7
601	Tierra Amarilla	New Mexico	69*b*	7,499.8
602	Tijeras	....do	77*b*	6,213.7
603	Tim-pa-ute, or Maguinta Spring	Nevada	58	6,891.7
604	Tinnah-kah Springs	....do	66	4,079.9
605	Tipton Peak	Arizona	74*a*	7,364.4
606	Toas Kete	New Mexico	68	6,505.8
607	Too-lee-cha Peak	California	65	7,021.8
608	Tres Hermanos	New Mexico	77	7,151.1
609	Trinchera Peak	Colorado	70*a*	13,680.7
610	Trinidad (astronomical monument)	....do	70*a*	5,989.9
611	Triplets	New Mexico	83	4,346.6
612	Trout Creek Pass	Colorado	61*b*	9,612.7
613	Trout Lake	....do	61*c*	9,700.2
614	Truxton Springs	Arizona	75	3,885.5
615	Tucson	....do	89	2,537.7
616	Tule Spring	....do	76	5,924.7
617	Tulerosa, Old Fort	New Mexico	83	6,740.4
618	Tunicha Mesa	....do	68*d*	5,510.0
619	Twin Creek Pass	Colorado	62*d*	8,568.1
620	Uncompahgre Creek and Animas, divide between	....do	61*c*	11,928.0
621	Uncompahgre Peak	....do	61*c*	14,408.4

Table of altitudes—Continued.

No.	Locality.	State or Territory.	Atlas-sheet.	Altitude above the sea (feet).
622	Union, Fort	New Mexico	70c	6,744.1
623	Union Park	Colorado	61*b*	9,654.8
624	Union Pass	Arizona	74*b*	3,600.0
625	United States Mountain	New Mexico	69*d*	10,734.3
626	Ute Peak	....do	69*b*	10,152.3
627	Venable's Ranch	Colorado	61*d*	7,628.1
628	Venado Spring	New Mexico	76	5,981.9
629	Verde, Camp	Arizona	75	3,159.7
630	Vergenes Ranch	California	73c	940.0
631	Volunteer Spring	New Mexico	75	7,106.4
632	Wah Wah, or Ha-wa-wah Spring	Utah	59	5,545.9
633	Wancoba Peak	California	65*a*	11.261.1
634	Warm Spring	Utah	67	3,806.9
635	Washington	....do	67	2,906.0
636	Washington, Mount	California	73*d*	10,801.9
637	Washington Pass	Arizona	68*d*	8,825.5
638	Welden	California	65c	2,716.9
639	Weston's Pass	Colorado	52*d*	12,108.8
640	West's Ranch	California	74*a*	595.6
641	White Bluff Spring	Nevada	66	5,019.8
642	White Granite Mountain	California	73c	7,045.0
643	White River Junction, North and South Forks	Utah	51	7,088.0
644	White Rock Spring	Arizona	68c	6,301.2
645	White's Ranch, Huerfano Valley	Colorado	62c	7,469.0
646	Whitney's Meadows	California	65c	9,371.4
647	Whitney's Peak (called also Fisherman's Peak)	....do	65*a*	14,448.4
648	Whitlock's Cienega	Arizona	83	3,579.5
649	Wilcox Ranch, Antelope Park	Colorado	61c	9,600.1
650	Wild Rose Spring	California	65*d*	4,683.4
651	Willow Spring	Arizona	76	7,294.8
652	......do	California	73*a*	2,530.8
653	......do	....do	81*b*	420.0
654	......do	New Mexico	77*a*	6,676.6
655	......do	Utah	50	4,421.6
656	Willow Tree Spring	California	73*b*	2,500.0
657	Wingate, Old Fort	New Mexico	77*a*	6,507.3
658	Wingate, Fort	....do	76	7,037.7
659	Winnemucca (Signal Office)	Nevada	39*d*	4,355.0
660	Workman's Ranch	California	73c	361.6
661	Yellow Peak	Colorado	61c	13,618.0
662	Young's Ranch	Utah	49	5,642.2
663	Yucca, Camp	New Mexico	89	4,373.9
664	Zuni, near	....do	76	6,391.8

PLATE VII.

Showing diurnal barometric oscillation.

FIG. 1. *Georgetown, Colo.* Lat. 39° 42′. Altitude above sea 8587.8 feet; range of diurnal temperature 29°.5. Results from hourly observations taken from June 16 to July 5, 1873.

FIG. 2. *Green River Station, Wyo.* Lat. 41° 31′. Altitude 6096.9 feet; range of diurnal temderature 38°.1. Results from hourly observations taken from June 5 to June 29, 1873.

FIG. 3. *Salt Lake City, Utah.* Lat. 40° 47′. Altitude 4330.4 feet; range of dinrual temperature 33°.6. Results from hourly observations taken from July 13 to August 1, 1872.

FIG. 4. *Colorado Springs, Colo.* Lat. 38° 49′. Altitude 6030.4 feet; range of diurnal temperature 26°.1. Results from hourly observations taken from July 24 to August 10, 1873.

FIG. 5. *Los Angeles, Cal.* Lat. 34° 03′. Altitude 325 feet; range of diurnal temperature 19°.9. Results from hourly observations taken from June 11 to June 28, 1875.

FIG. 6. *Santa Fé, N. Mex.* Lat. 35° 41′. Altitude 7044.2 feet; range of diurnal temperature 31°.7. Results from hourly observations taken from June 11 to June 20, 1873.

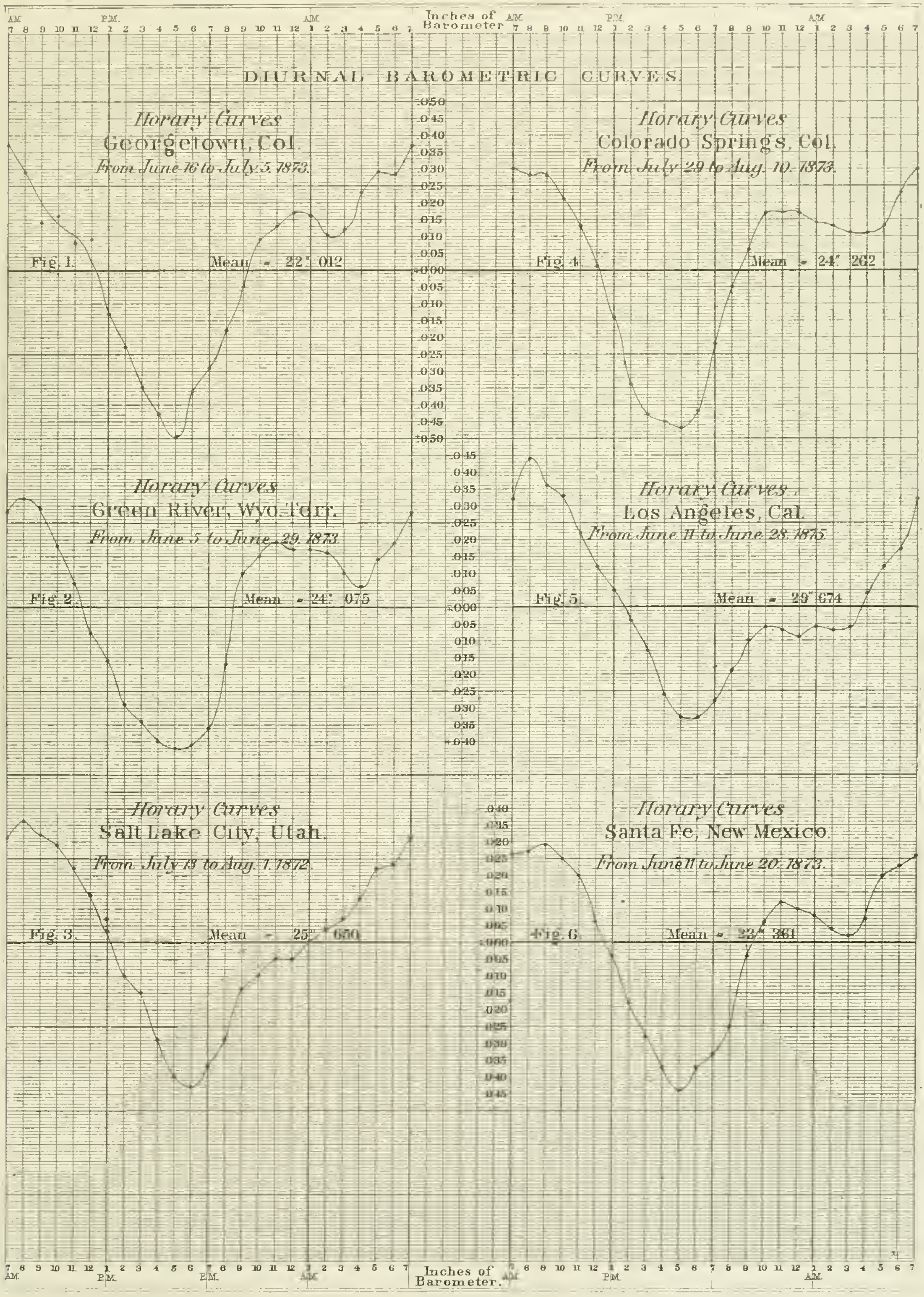

DIURNAL BAROMETRIC CURVES.
Inches of Barometer
Horary Curves
Georgetown, Col.
From June 16 to July 5. 1873.
Fig. 1.
Mean = 22" 012
Horary Curves
Colorado Springs, Col.
From July 29 to Aug. 10. 1873.
Fig. 4.
Mean = 24" 262
Horary Curves
Green River, Wyo. Terr.
From June 5 to June 29. 1873.
Fig. 2.
Mean = 24" 075
Horary Curves
Los Angeles, Cal.
From June 11 to June 28. 1875.
Fig. 5.
Mean = 29" 674
Horary Curves
Salt Lake City, Utah.
From July 13 to Aug. 1. 1872.
Fig. 3.
Mean = 25" 650
Horary Curves
Santa Fe, New Mexico.
From June 11 to June 20. 1873.
Fig. 6.
Mean = 23" 361
Inches of Barometer.

PLATE VIII.

Showing diurnal barometric oscillation.

FIG. 7. *Hughes, Colo.* Lat. 39° 59′. Altitude 5021.6 feet; range of diurnal temperature 43°.5. Results from hourly observations taken from July 12 to July 23, 1873.

FIG. 8. *Camp Independence, Cal.* Lat. 36° 50′. Altitude 3956.5 feet; range of diurnal temperature 27°.7. Results from hourly observations taken from July 19 to August 9, 1871.

FIG. 9. *Beaver, Utah.* Lat. 38° 16′. Altitude 5915.6 feet; range of diurnal temperature 29°.8. Results from hourly observations taken from August 8 to August 25, 1872.

FIG. 10. *Labran, Colo.* Lat. 38° 23′. Altitude 5217.8 feet; range of diurnal temperature 37°.5. Results from hourly observations taken from August 12 to August 27, 1873.

FIG. 11. *Cottonwood Springs, Nev.* Lat. 36° 03′. Altitude 3449 feet; range of diurnal temperature 27°.7. Results from hourly observations taken from August 31 to September 14, 1871.

FIG. 12. *Beaver, Utah.* Lat. 38° 16′. Altitude 5915.6 feet; range of diurnal temperature 22°.6. Results from hourly observations taken from August 30 to September 7, 1872.

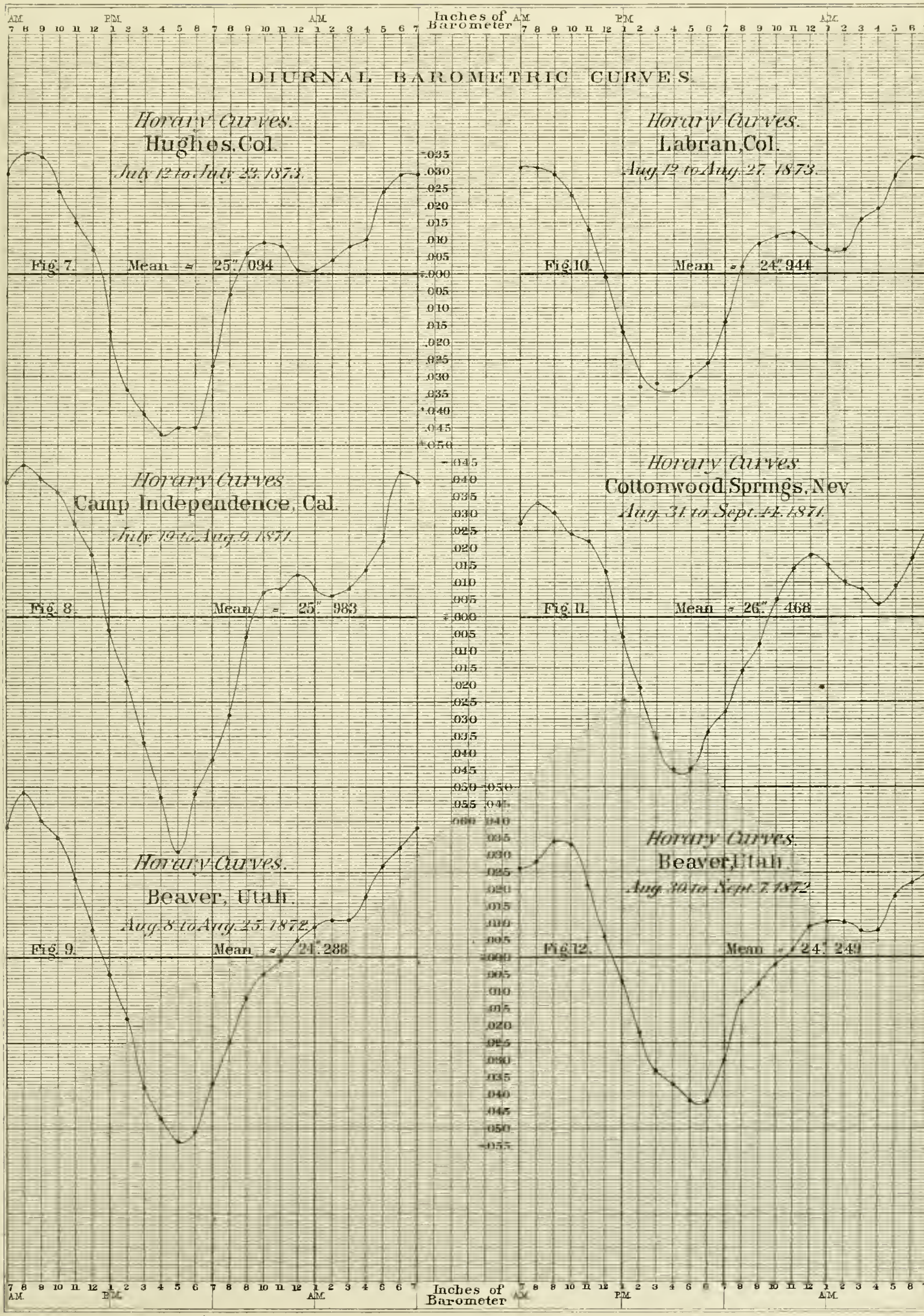

DIURNAL BAROMETRIC CURVES.
Inches of Barometer
Horary Curves.
Hughes, Col.
July 12 to July 23. 1873.
Fig. 7.
Mean = 25." 094
Horary Curves.
Labran, Col.
Aug. 12 to Aug. 27. 1873.
Fig. 10.
Mean = 24." 944
Horary Curves
Camp Independence, Cal.
July 19 to Aug. 9. 1871.
Fig. 8.
Mean = 25." 983
Horary Curves
Cottonwood Springs, Nev.
Aug. 31 to Sept. 11. 1871.
Fig. 11.
Mean = 26." 468
Horary Curves.
Beaver, Utah.
Aug. 8 to Aug. 25. 1872.
Fig. 9.
Mean = 24." 288
Horary Curves.
Beaver, Utah.
Aug. 30 to Sept. 7. 1872.
Fig. 12.
Mean = 24." 249
Inches of Barometer

PLATE IX.

Showing diurnal barometric oscillation.

FIG. 13. *Trinidad, Colo.* Lat. 37° 10′. Altitude 5989.9 feet; range of diurnal temperature 32°3. Results from hourly observations taken from September 4 to September 19, 1873.

FIG. 14. *Cheyenne, Wyo.* Lat. 41° 08′. Altitude 6041 feet; range of diurnal temperature 35°.1. Results from hourly observations taken from September 15 to October 21, 1872.

FIG. 15. *Pioche, Nev.* Lat. 37° 55′. Altitude 5942.3 feet; range of diurnal temperature 23°.4. Results from hourly observations taken from September 27 to October 14, 1872.

FIG. 16. *Ogden, Utah.* Lat. 41° 13′. Altitude 4374.0 feet; range of diurnal temperature 38°.4. Results from hourly observations taken from September 26 to October 3, 1873.

FIG. 17. *Truxton Springs, Ariz.* Lat. 35° 25′. Altitude 3885.5 feet; range of diurnal temperature 33°.6. Results from hourly observations taken from October 23 to October 25, 1871.

FIG. 18. *Fort Fred. Steele, Wyo.* Lat. 41° 47′. Altitude 6840 feet; range of diurnal temperature 14°. Results from hourly observations taken from October 30 to November 27, 1872.


DIURNAL BAROMETRIC CURVES
Inches of Barometer.
Trinidad, Col.
Sept. 1 to Sept. 19, 1873.
Fig. 13.
Mean = 24."256
Ogden, Utah
Sept. 26 to Oct. 3. 1873.
Fig. 16.
Mean = 25." 525
Cheyenne, Wyo. Terr.
Sept. 15 to Oct. 21, 1872.
Fig. 14.
Mean = 24." 101
Truxton Springs Ariz.
Oct. 23 to Oct. 25, 1871
Fig. 17.
Mean = 26." 051
Pioche, Nev.
Sept. 27 to Oct. 14, 1872.
Fig. 15.
Mean = 24." 233
Ft. Fred Steele, Wyo. Terr.
Oct. 30 to Nov. 27, 1872.
Fig. 18.
Mean = 23." 572
Inches of Barometer.

PLATE X.

Showing diurnal barometric oscillation.

FIG. 19. *Fort Prescott, Ariz.* Lat. 34° 33′. Altitude 5318 feet; range of diurnal temperature 38°. Results from hourly observations taken from November 1 to November 8, 1871.

FIG. 20. *Gunnison, Utah.* Lat. 39° 10′. Altitude 5144.6 feet; range of diurnal temperature 34°.6. Results from hourly observations taken from November 1 to December 1, 1872.

FIG. 21. *Laramie, Wyo.* Lat. 41° 19′. Altitude 7123 feet; range of diurnal temperature 30°.9. Results from hourly observations taken from December 6 to December 30, 1872.

FIG. 22. *Winnemucca, Nev.* Lat. 40° 58′. Altitude 4355 feet; range of diurnal temperature 35°.5. Results from hourly observations taken from July 23 to July 28, 1873.

FIG. 23. *Virginia City, Nev.* Lat. 39° 17′. Altitude 6339 feet; range of diurnal temperature 17°.4. Results from hourly observations taken from August 5 to August 31, 1873.

FIG. 24. *Bozeman, Mont.* Lat. 45° 41′. Altitude 4838.6 feet; range of diurnal temperature 16°.1. Results from hourly observations taken from September 11 to September 31, 1873.

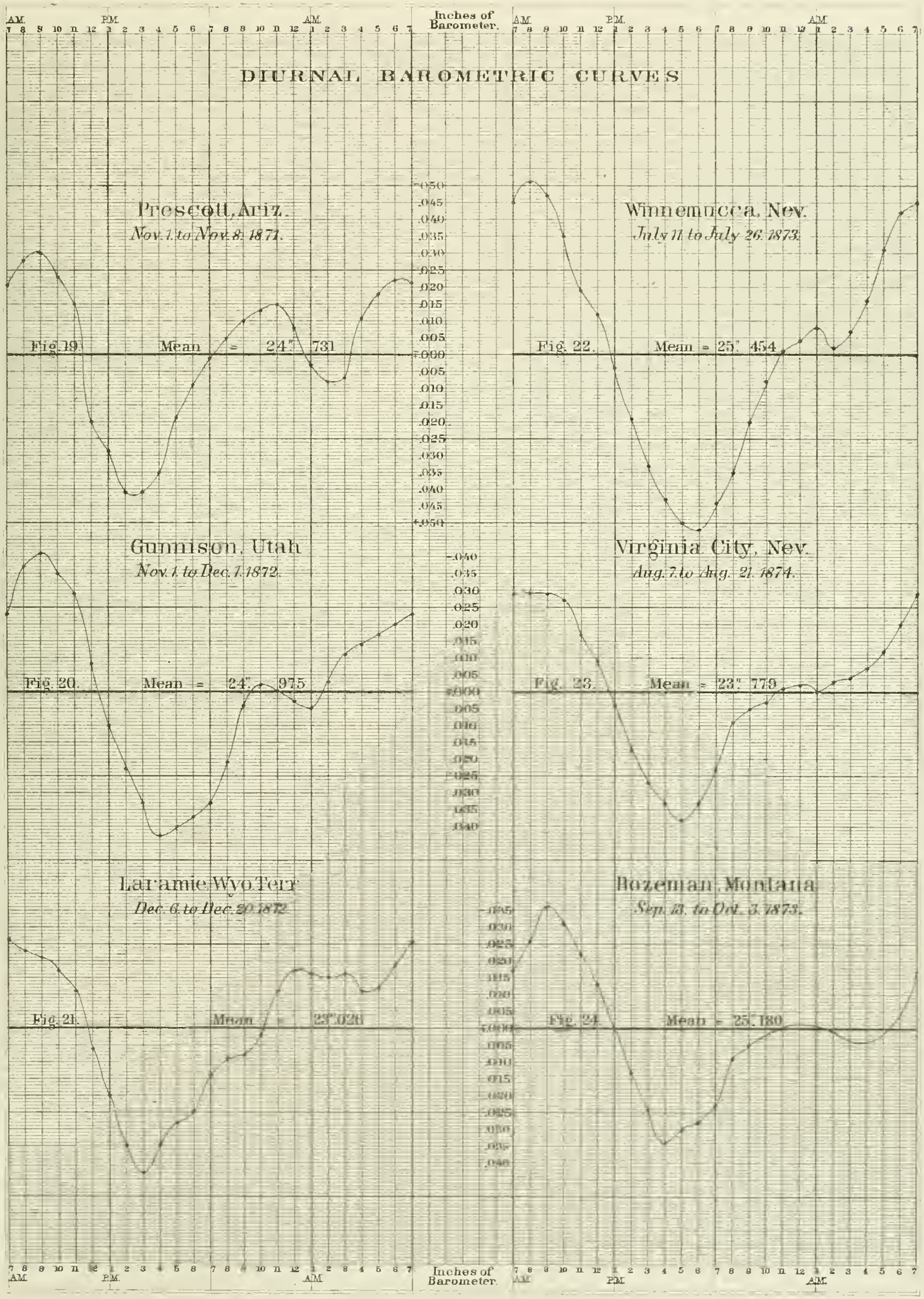

DIURNAL BAROMETRIC CURVES
Inches of Barometer.
Prescott, Ariz.
Nov. 1. to Nov. 8. 1871.
Fig. 19.
Mean = 24." 731
Winnemucca, Nev.
July 11. to July 26. 1873.
Fig. 22.
Mean = 25." 454
Gunnison, Utah
Nov. 1. to Dec. 1. 1872.
Fig. 20.
Mean = 24." 975
Virginia City, Nev.
Aug. 7. to Aug. 21. 1874.
Fig. 23.
Mean = 23." 779
Laramie Wyo. Terr.
Dec. 6. to Dec. 20. 1872.
Fig. 21.
Mean = 23." 026
Bozeman, Montana.
Sep. 13. to Oct. 3. 1873.
Fig. 24.
Mean = 25." 180
Inches of Barometer.

PLATE XI.

Showing diurnal temperature oscillation.

FIG. 25. *Georgetown, Colo.* Results from observations taken hourly from June 16 to July 5, 1873.
FIG. 26. *Green River Station, Wyo.* Results from observations taken hourly from June 5 to June 29, 1873.
FIG. 27. *Los Angeles, Cal.* Results from observations taken hourly from June 11 to June 28, 1875.
FIG. 28. *Salt Lake City, Utah.* Results from observations taken hourly from July 13 to August 1, 1872.
FIG. 29. *Santa Fé, N. Mex.* Results from observations taken hourly from June 11 to June 20, 1873.
FIG. 30. *Colorado Springs, Colo.* Results from observations taken hourly from July 29 to August 10, 1873.

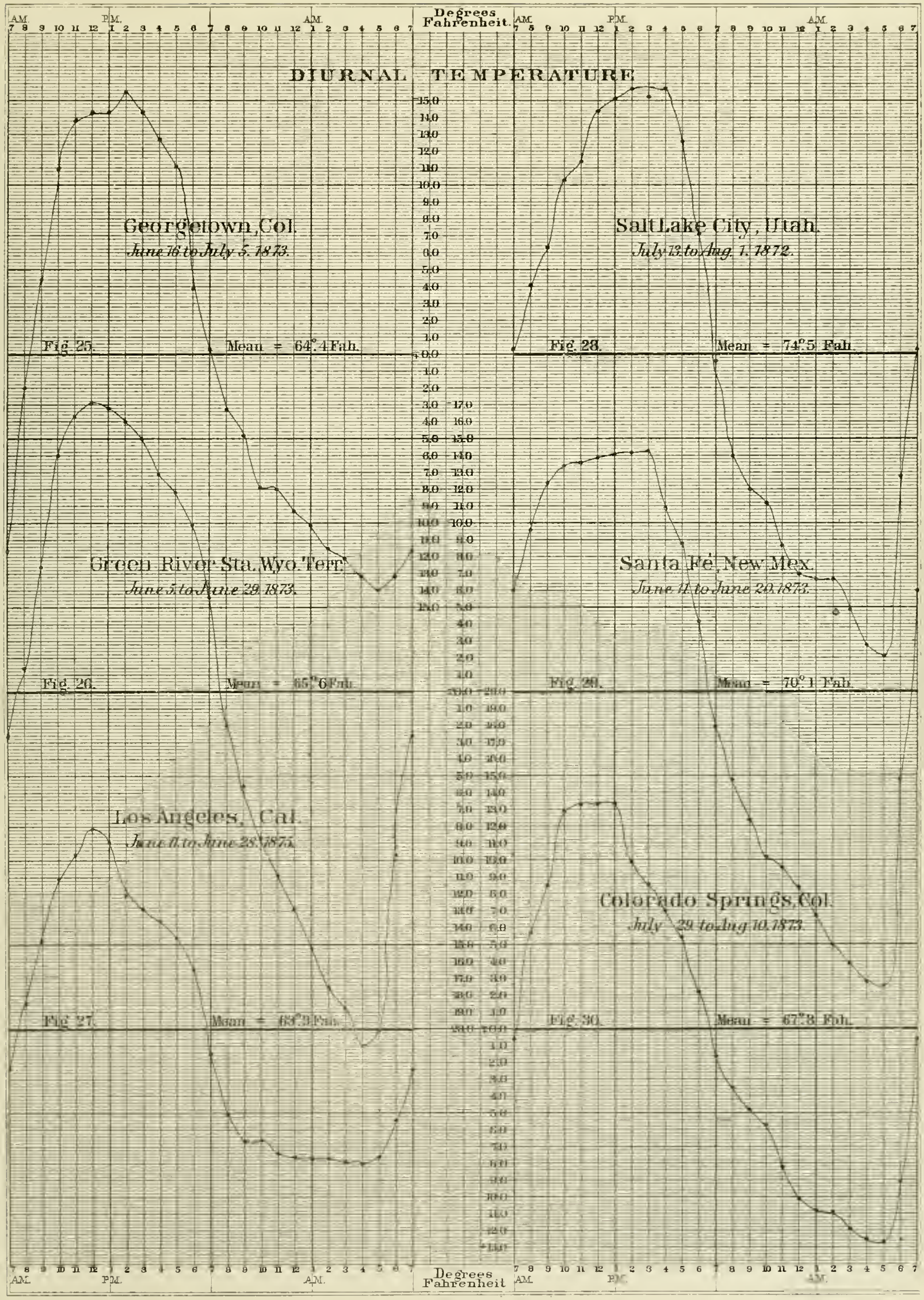

DIURNAL TEMPERATURE
Degrees Fahrenheit.
Georgetown, Col.
June 16 to July 5. 1873.
Fig. 25.
Mean = 64°.4 Fah.
Salt Lake City, Utah.
July 13 to Aug. 1. 1872.
Fig. 28.
Mean = 74°.5 Fah.
Green River Sta. Wyo. Terr.
June 5 to June 29. 1873.
Fig. 26.
Mean = 65°.6 Fah.
Santa Fé, New Mex.
June 11 to June 20. 1873.
Fig. 29.
Mean = 70°.1 Fah.
Los Angeles, Cal.
June 11 to June 28. 1875.
Fig. 27.
Mean = 63°.3 Fah.
Colorado Springs, Col.
July 29 to Aug 10. 1873.
Fig. 30.
Mean = 67°.8 Fah.
A.M.
P.M.
Degrees Fahrenheit

PLATE XII.

Showing diurnal temperature oscillation.

FIG. 31. *Beaver, Utah.* Results from observations taken hourly from August 8 to August 25, 1872.
FIG. 32. *Labran, Colo.* Results from observations taken hourly from August 12 to August 27, 1873.
FIG. 33. *Beaver, Utah.* Results from observations taken hourly from August 30 to September 7, 1872.
FIG. 34. *Camp Independence, Cal.* Results from observations taken hourly from July 19 to August 9, 1871.
FIG. 35. *Hughes, Colo.* Results from observations taken hourly from July 12 to July 23, 1873.
FIG. 36. *Cottonwood Springs, Nev.* Results from observations taken hourly from August 31 to September 14, 1871.

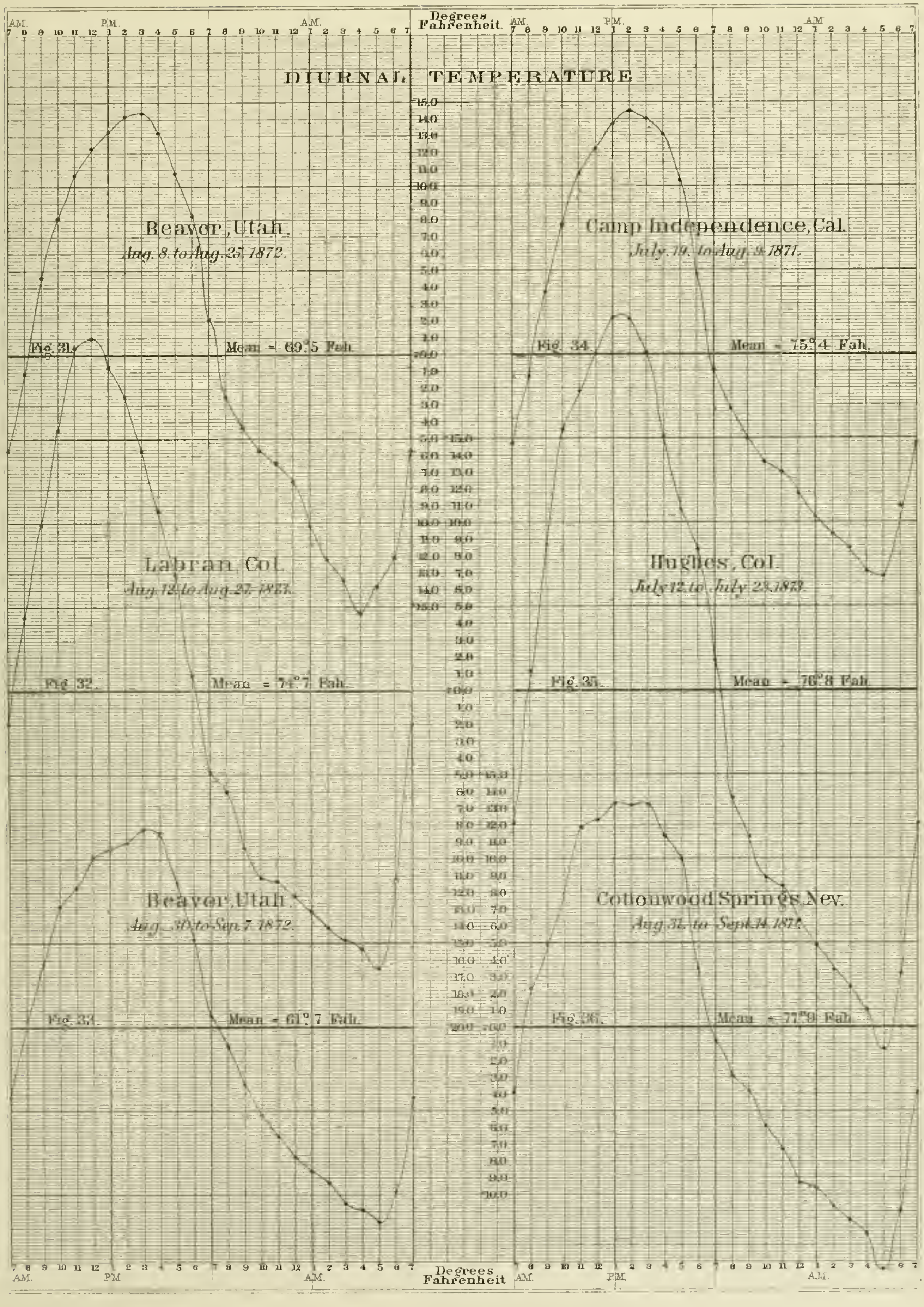

DIURNAL TEMPERATURE
Degrees Fahrenheit.
Beaver, Utah.
Aug. 8. to Aug. 25. 1872.
Fig. 31.
Mean = 69°.5 Fah.
Camp Independence, Cal.
July 19. to Aug. 9. 1871.
Fig. 34.
Mean = 75°.4 Fah.
Labran, Col.
Aug. 12. to Aug. 27. 1873.
Fig. 32.
Mean = 74°.7 Fah.
Hughes, Col.
July 12. to July 23. 1873.
Fig. 35.
Mean = 76°.8 Fah.
Beaver, Utah.
Aug. 30. to Sep. 7. 1872.
Fig. 33.
Mean = 61°.7 Fah.
Cottonwood Springs, Nev.
Aug. 31. to Sept. 14. 1871.
Fig. 36.
Mean = 77°.9 Fah.
A.M.
P.M.
Degrees Fahrenheit

PLATE XIII.

Showing diurnal temperature oscillation.

FIG. 37. *Trinidad, Colo.* Results from observations taken hourly from September 4 to September 19, 1873.
FIG. 38. *Cheyenne, Wyo.* Results from observations taken hourly from September 15 to October 31, 1872.
FIG. 39. *Ogden, Utah.* Results from observations taken hourly from September 26 to October 3, 1873.
FIG. 40. *Prescott, Ariz.* Results from observations taken hourly from November 1 to November 8, 1871.
FIG. 41. *Pioche, Nev.* Results from observations taken hourly from September 27 to October 14, 1872.
FIG. 42. *Fort Fred. Steele, Wyo.* Results from observations taken hourly from October 30 to November 27, 1872.

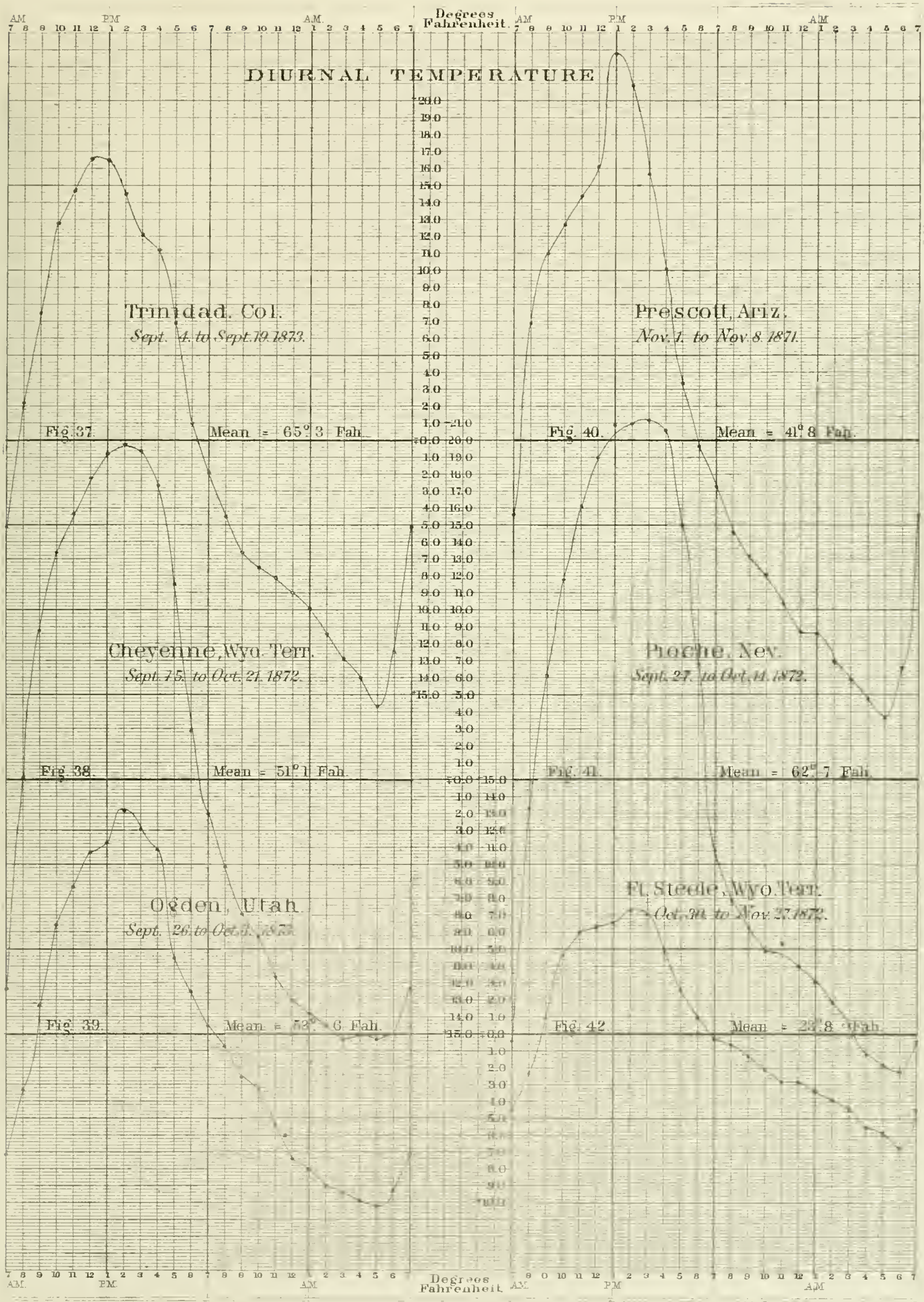

DIURNAL TEMPERATURE
Degrees Fahrenheit.
Trinidad, Col.
Sept. 4. to Sept. 19. 1873.
Fig. 37.
Mean = 65°.3 Fah.
Prescott, Ariz.
Nov. 1. to Nov. 8. 1871.
Fig. 40.
Mean = 41°.8 Fah.
Cheyenne, Wyo. Terr.
Sept. 15. to Oct. 21. 1872.
Fig. 38.
Mean = 51°.1 Fah.
Pioche, Nev.
Sept. 27. to Oct. 14. 1872.
Fig. 41.
Mean = 62°.7 Fah.
Ogden, Utah.
Fig. 39.
Ft. Steele, Wyo. Terr.
Fig. 42.
Mean = 23°.8 Fah.
Degrees Fahrenheit.

PLATE XIV.

Showing mean difference wet and dry thermometers.

FIG. 43. *Georgetown, Colo.* Results from observations taken hourly from June 16 to July 5, 1873.
FIG. 44. *Green River Station, Wyo.* Results from observations taken hourly from June 5 to June 29, 1873.
FIG. 45. *Los Angeles, Cal.* Results from observations taken hourly from June 11 to June 28, 1875.
FIG. 46. *Salt Lake City, Utah.* Results from observations taken hourly from July 13 to August 1, 1872.
FIG. 47. *Santa Fé, N. Mex.* Results from observations taken hourly from June 11 to June 20, 1873.
FIG. 48. *Colorado Springs, Colo.* Results from observations taken hourly from July 29 to August 10, 1873.

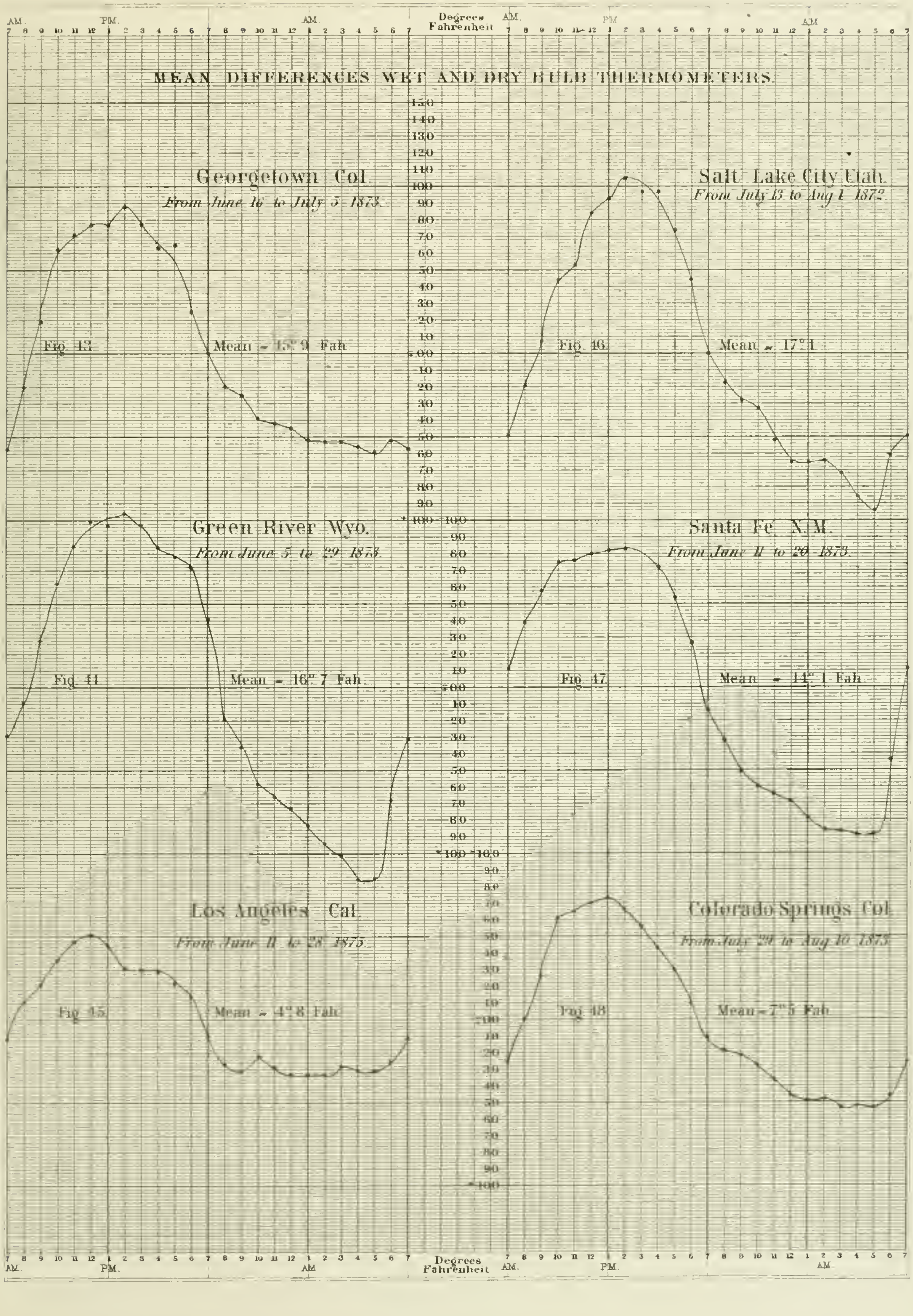

MEAN DIFFERENCES WET AND DRY BULB THERMOMETERS.
Degrees Fahrenheit
Georgetown Col.
From June 16 to July 5 1873.
Fig. 43
Mean = 15°.9 Fah.
Salt Lake City Utah.
From July 13 to Aug 1 1872.
Fig. 46
Mean = 17°.1
Green River Wyo.
From June 5 to 29 1873.
Fig. 44
Mean = 16°.7 Fah.
Santa Fe N.M.
From June 11 to 20 1873.
Fig. 47
Mean = 14°.1 Fah.
Los Angeles Cal.
From June 11 to 28 1875.
Fig. 45
Mean = 4°.8 Fah.
Colorado Springs Col.
From July 29 to Aug 10 1873.
Fig. 48
Mean = 7°.5 Fah.
AM. PM. AM.
Degrees Fahrenheit

PLATE XV.

Showing mean difference—wet and dry thermometers.

FIG. 49. *Beaver, Utah.* Results from observations taken hourly from August 8 to August 25, 1872.
FIG. 50. *Labran, Colo.* Results from observations taken hourly from August 12 to August 27, 1873.
FIG. 51. *Beaver, Utah.* Results from observations taken hourly from August 30 to September 7, 1872.
FIG. 52. *Camp Independence, Cal.* Results from observations taken hourly from July 19 to August 9, 1871.
FIG. 53. *Hughes, Colo.* Results from observations taken hourly from July 12 to July 23, 1873.
FIG. 54. *Cottonwood Springs, Nev.* Results from observations taken hourly from August 31 to September 14, 1871.

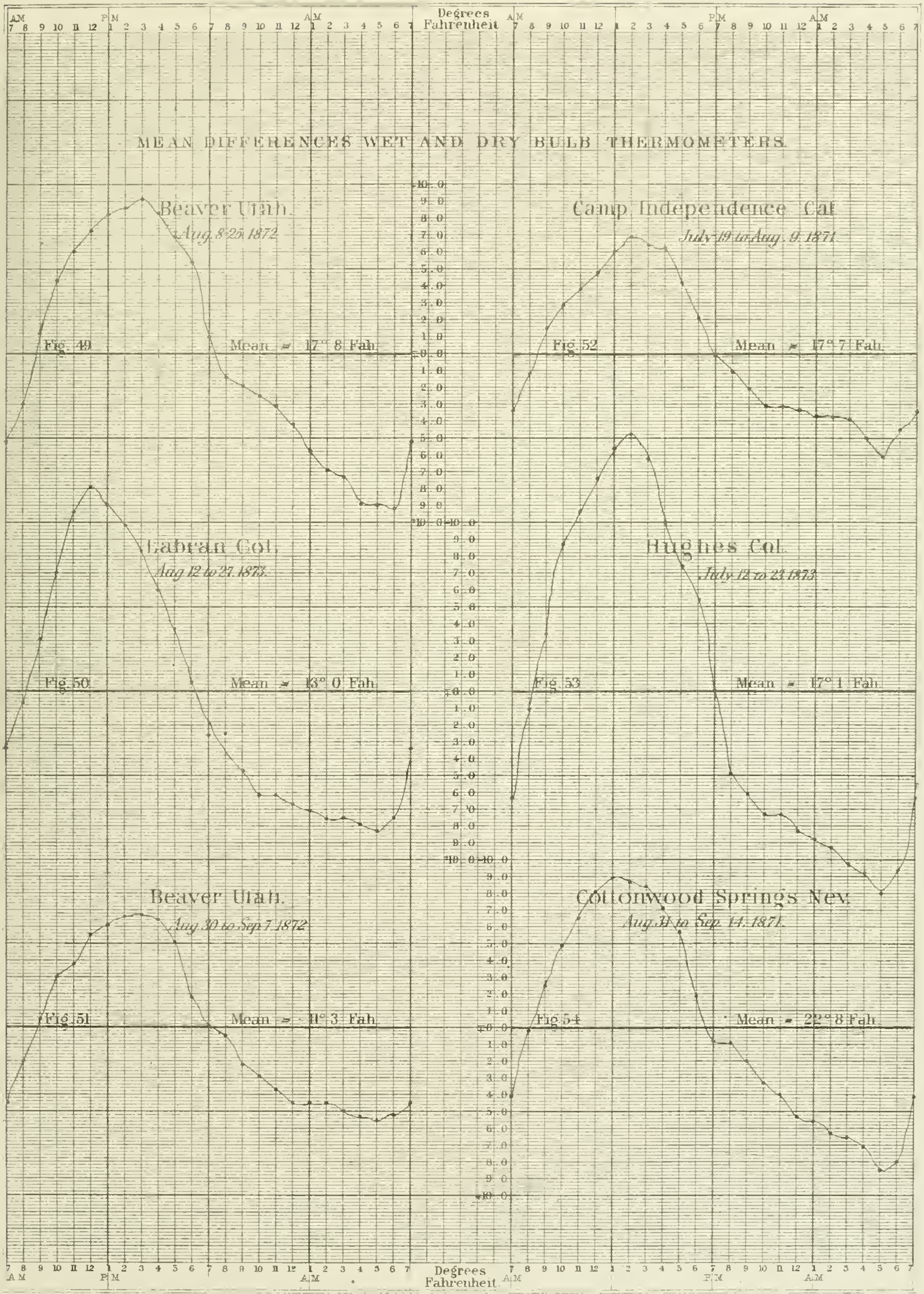

MEAN DIFFERENCES WET AND DRY BULB THERMOMETERS
Degrees Fahrenheit
Beaver Utah.
Aug. 8-25. 1872.
Fig. 49
Mean = 17° 8 Fah.
Camp Independence Cal.
July 19 to Aug. 9. 1871.
Fig. 52
Mean = 17° 7 Fah.
Labran Col.
Aug 12 to 27. 1873.
Fig. 50
Mean = 13° 0 Fah.
Hughes Col.
July 12 to 23 1873.
Fig. 53
Mean = 17° 1 Fah.
Beaver Utah.
Aug. 30 to Sep. 7. 1872.
Fig. 51
Mean = 11° 3 Fah.
Cottonwood Springs Nev.
Aug. 31 to Sep. 14. 1871.
Fig. 54
Mean = 22° 8 Fah.
A.M.
P.M.
Degrees Fahrenheit

PLATE XVI.

Showing mean difference wet and dry thermometers.

FIG. 55. *Trinidad, Colo.* Results from observations taken hourly from September 4 to September 19, 1873.
FIG. 56. *Cheyenne, Wyo.* Results from observations taken hourly from September 15 to October 21, 1872.
FIG. 57. *Ogden, Utah.* Results from observations taken hourly from September 26 to October 3, 1873.
FIG. 58. *Prescott, Ariz.* Results from observations taken hourly from November 1 to November 8, 1871.
FIG. 59. *Pioche, Nev.* Results from observations taken hourly from September 27 to October 14, 1872.
FIG. 60. *Fort Fred. Steele, Wyo.* Results from observations taken hourly from October 30 to November 27, 1872.

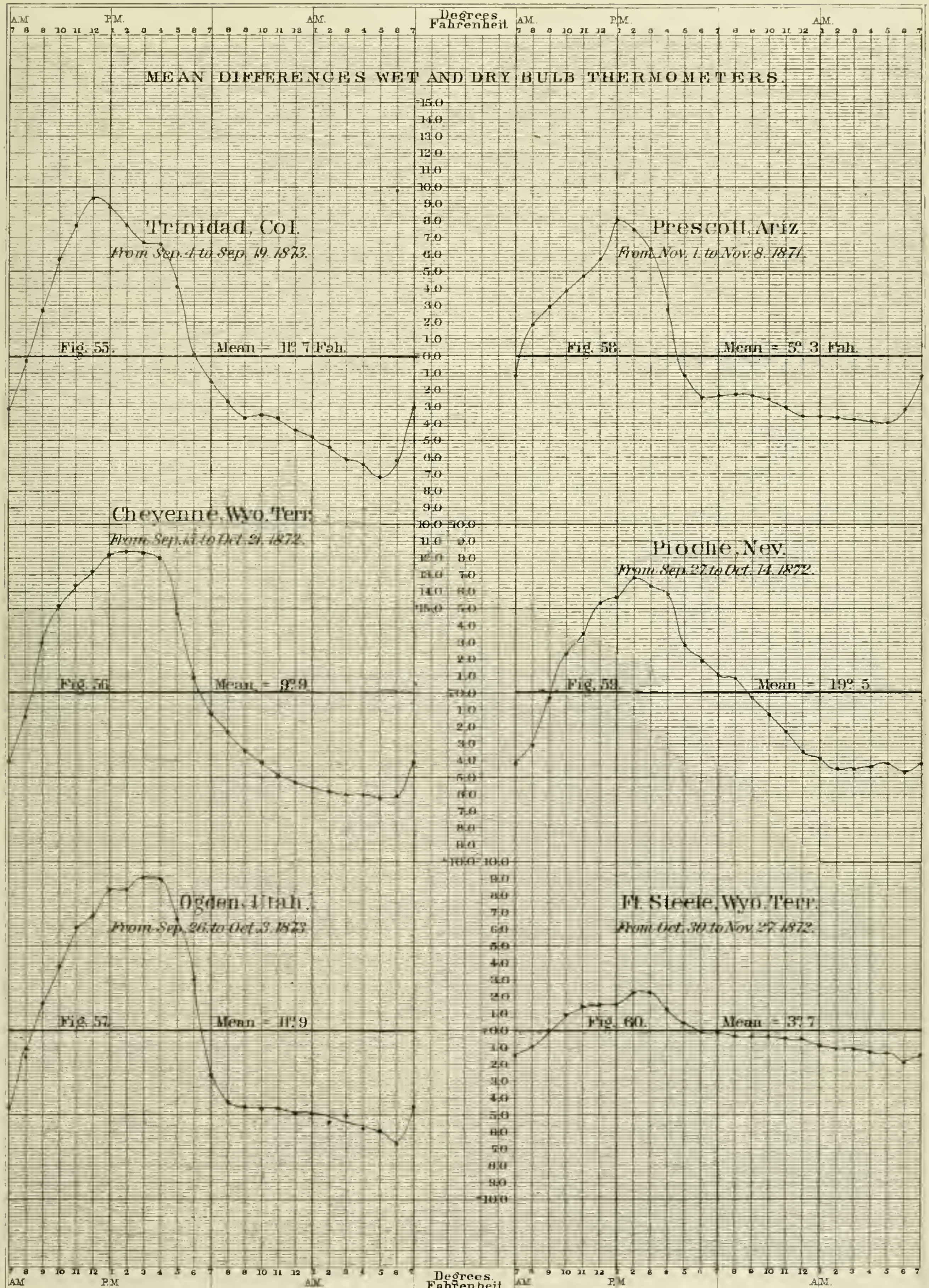

MEAN DIFFERENCES WET AND DRY BULB THERMOMETERS.
Degrees Fahrenheit
Trinidad, Col.
From Sep. 4 to Sep. 19. 1873.
Fig. 55.
Mean = 11° 7 Fah.
Prescott, Ariz.
From Nov. 1 to Nov. 8. 1871.
Fig. 58.
Mean = 5° 3 Fah.
Cheyenne, Wyo. Terr.
From Sep. 15 to Oct. 21. 1872.
Fig. 56.
Mean = 9° 9
Pioche, Nev.
From Sep. 27 to Oct. 14. 1872.
Fig. 59.
Mean = 19° 5
Ogden, Utah.
From Sep. 26 to Oct. 3. 1873.
Fig. 57.
Mean = 11° 9
Ft. Steele, Wyo. Terr.
From Oct. 30 to Nov. 27. 1872.
Fig. 60.
Mean = 3° 7
A.M.
P.M.
Degrees Fahrenheit

PLATE XVII.

Showing diurnal force of vapor.

FIG. 61. *Colorado Springs, Colo.* Results from observations taken hourly from July 29 to August 10, 1873.
FIG. 62. *Los Angeles, Cal.* Results from observations taken hourly from June 11 to June 28, 1875.
FIG. 63. *Georgetown, Colo.* Results from observations taken hourly from June 16 to July 5, 1873.
FIG. 64. *Salt Lake City, Utah.* Results from observations taken hourly from July 13 to August 1, 1873.
FIG. 65. *Santa Fé, N. Mex.* Results from observations taken hourly from June 11 to June 20, 1873.
FIG. 66. *Green River, Wyo.* Results from observations taken hourly from June 5 to June 29, 1873.

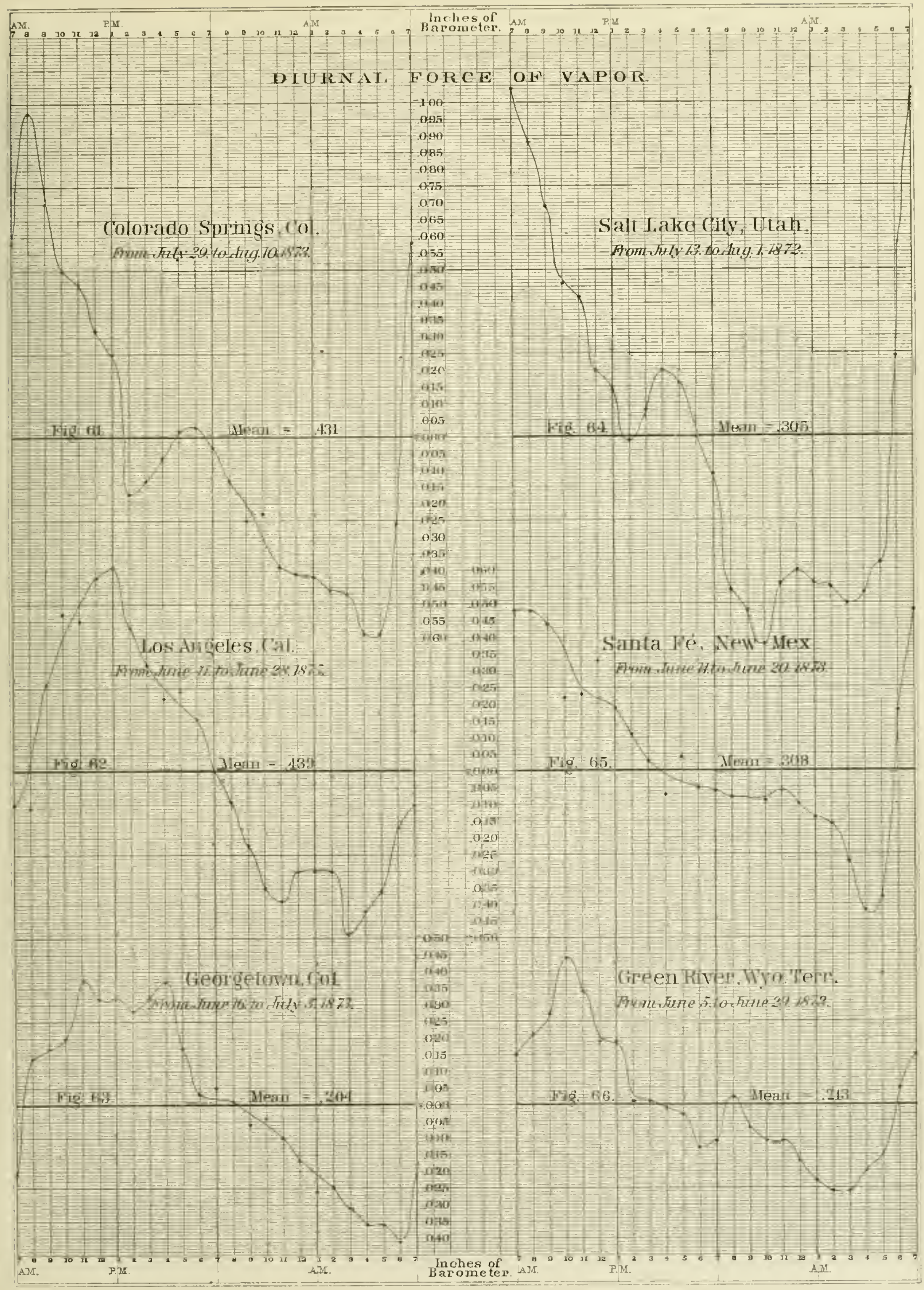

DIURNAL FORCE OF VAPOR.
Inches of Barometer.
Colorado Springs, Col.
From July 29 to Aug. 10 1873.
Fig. 61. Mean = .431
Salt Lake City, Utah.
From July 13 to Aug. 1 1872.
Fig. 64. Mean = .305
Los Angeles, Cal.
Fig. 62. Mean = .439
Santa Fé, New-Mex.
Fig. 65. Mean = .308
Georgetown, Col.
From June 16 to July 3 1873.
Fig. 63. Mean = .204
Green River, Wyo. Terr.
From June 5 to June 29 1873.
Fig. 66. Mean = .213
A.M. P.M. A.M.
Inches of Barometer.

PLATE XVIII.

Showing diurnal force of vapor.

FIG. 67. *Beaver, Utah.* Results from observations taken hourly from August 8 to August 25, 1872.

FIG. 68. *Cottonwood Springs, Nev.* Results from observations taken hourly from August 31 to September 14, 1871.

FIG. 69. *Labran, Colo.* Results from observations taken hourly from August 12 to August 27, 1873.

FIG. 70. *Beaver, Utah.* Results from observations taken hourly from August 30 to September 7, 1872.

FIG. 71. *Hughes, Colo.* Results from observations taken hourly from July 12 to July 23, 1873.

FIG. 72. *Camp Independence, Cal.* Results from observations taken hourly from July 19 to August 9, 1871.

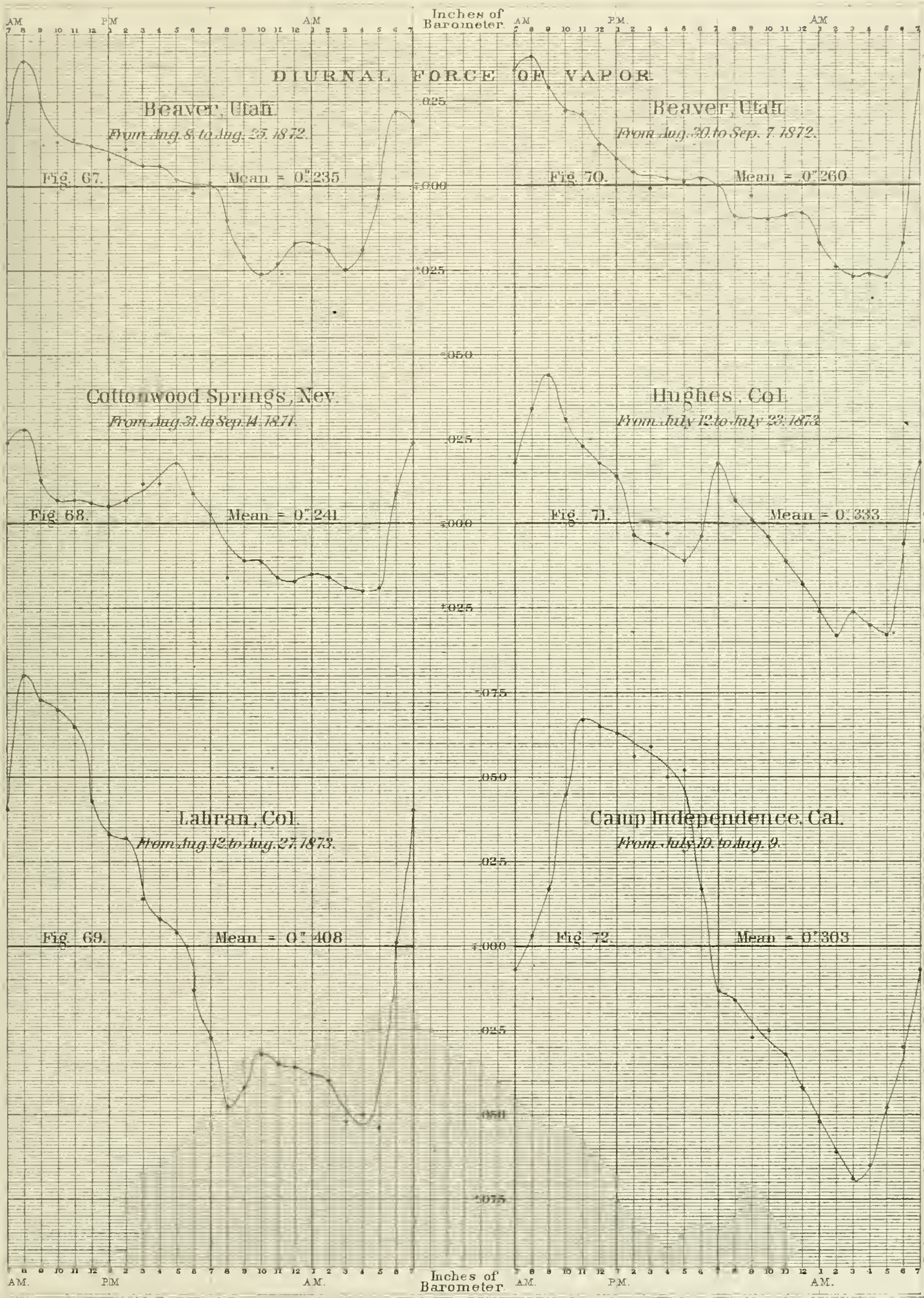

DIURNAL FORCE OF VAPOR
Inches of Barometer.
Beaver, Utah.
From Aug. 8. to Aug. 25. 1872.
Fig. 67.
Mean = 0."235
Beaver, Utah.
From Aug. 30. to Sep. 7. 1872.
Fig. 70.
Mean = 0."260
Cottonwood Springs, Nev.
From Aug. 31. to Sep. 14. 1871.
Fig. 68.
Mean = 0."241
Hughes, Col.
From July 12. to July 23. 1873.
Fig. 71.
Mean = 0."333
Labran, Col.
From Aug. 12. to Aug. 27. 1873.
Fig. 69.
Mean = 0."408
Camp Independence, Cal.
From July 19. to Aug. 9.
Fig. 72.
Mean = 0."303
.025
.000
.025
.050
.075
AM.
PM.
Inches of Barometer.

PLATE XIX.

Showing diurnal force of vapor.

FIG. 73. *Pioche, Nev.* Results from observations taken hourly from September 27 to October 14, 1872.
FIG. 74. *Prescott, Ariz.* Results from observations taken hourly from November 1 to November 8, 1871.
FIG. 75. *Trinidad, Colo.* Results from observations taken hourly from September 14 to September 19, 1873.
FIG. 76. *Fort Fred. Steele, Wyo.* Results from observations taken hourly from October 30 to November 27, 1872.
FIG. 77. *Ogden, Utah.* Results from observations taken hourly from September 26 to October 3, 1873.
FIG. 78. *Cheyenne, Wyo.* Results from observations taken hourly from September 15 to October 21, 1872

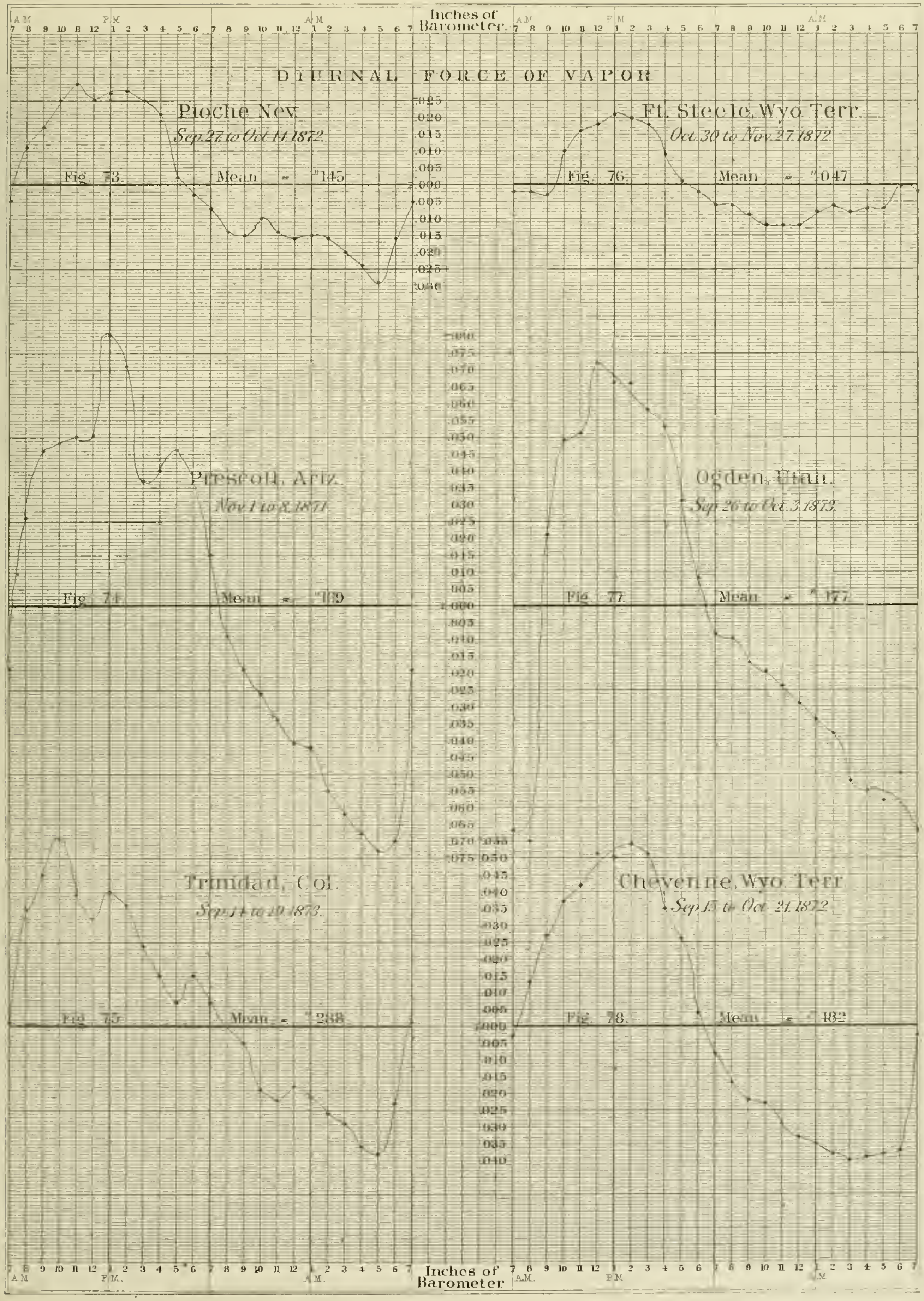

DIURNAL FORCE OF VAPOR
Inches of Barometer.
Pioche Nev.
Sep. 27 to Oct. 14. 1872.
Fig. 73.
Mean = ".145
Ft. Steele, Wyo. Terr.
Oct. 30 to Nov. 27. 1872.
Fig. 76.
Mean = ".047
Prescott, Ariz.
Nov. 1 to 8. 1871.
Fig. 74.
Mean = ".169
Ogden, Utah.
Sep. 26 to Oct. 3. 1873.
Fig. 77.
Mean = ".177
Trinidad, Col.
Sep. 14 to 19. 1873.
Fig. 75.
Mean = ".288
Cheyenne, Wyo. Terr.
Sep. 15 to Oct. 21. 1872.
Fig. 78.
Mean = ".182
Inches of Barometer

PLATE XX.

Showing relative humidity.

FIG. 79. *Georgetown, Colo.* Results from observations taken hourly from June 16 to July 5, 1873.
FIG. 80. *Colorado Springs, Colo.* Results from observations taken hourly from July 29 to August 10, 1873.
FIG. 81. *Santa Fé, N. Mex.* Results from observations taken hourly from June 11 to June 20, 1873.
FIG. 82. *Los Angeles, Cal.* Results from observations taken hourly from June 11 to June 28, 1875.
FIG. 83. *Salt Lake City, Utah.* Results from observations taken hourly from July 13 to August 1, 1872.
FIG. 84. *Green River Station, Wyo.* Results from observations taken hourly from June 5 to June 29, 1873.

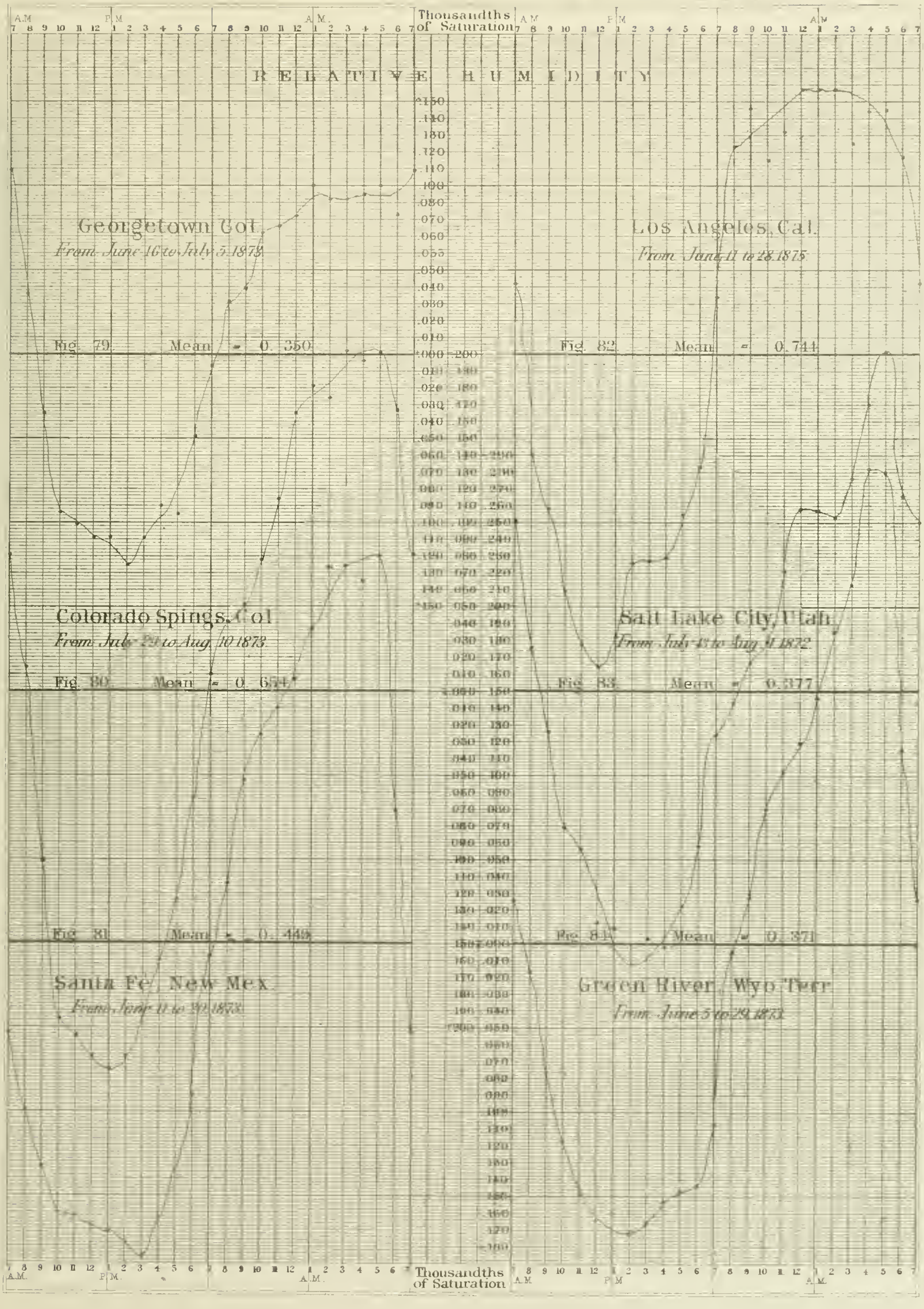

RELATIVE HUMIDITY
Thousandths of Saturation
Georgetown, Col.
From June 16 to July 5 1873.
Fig. 79. Mean = 0.350
Colorado Springs, Col.
From July 29 to Aug. 10 1873.
Fig. 80. Mean = 0.654
Santa Fe, New Mex.
From June 11 to 30 1873.
Fig. 81. Mean = 0.443
Los Angeles, Cal.
From June 11 to 28 1875.
Fig. 82. Mean = 0.744
Salt Lake City, Utah.
From July 4 to Aug. 9 1872.
Fig. 83. Mean = 0.377
Green River, Wyo. Terr.
From June 5 to 29 1873.
Fig. 84. Mean = 0.371
Thousandths of Saturation

PLATE XXI.

Showing relative humidity.

FIG. 85. *Camp Independence, Cal.* Results from observations taken hourly from July 19 to August 9, 1871.
FIG. 86. *Beaver, Utah.* Results from observations taken hourly from August 8 to August 25, 1872.
FIG. 87. *Hughes, Colo.* Results from observations taken hourly from July 12 to July 23, 1873.
FIG. 88. *Cottonwood Springs, Nev.* Results from observations taken hourly from August 31 to September 14, 1871.
FIG. 89. *Beaver, Utah.* Results from observations taken hourly from August 30 to September 7, 1872.
FIG. 90. *Labran, Colo.* Results from observations taken hourly from August 12 to August 27, 1873.

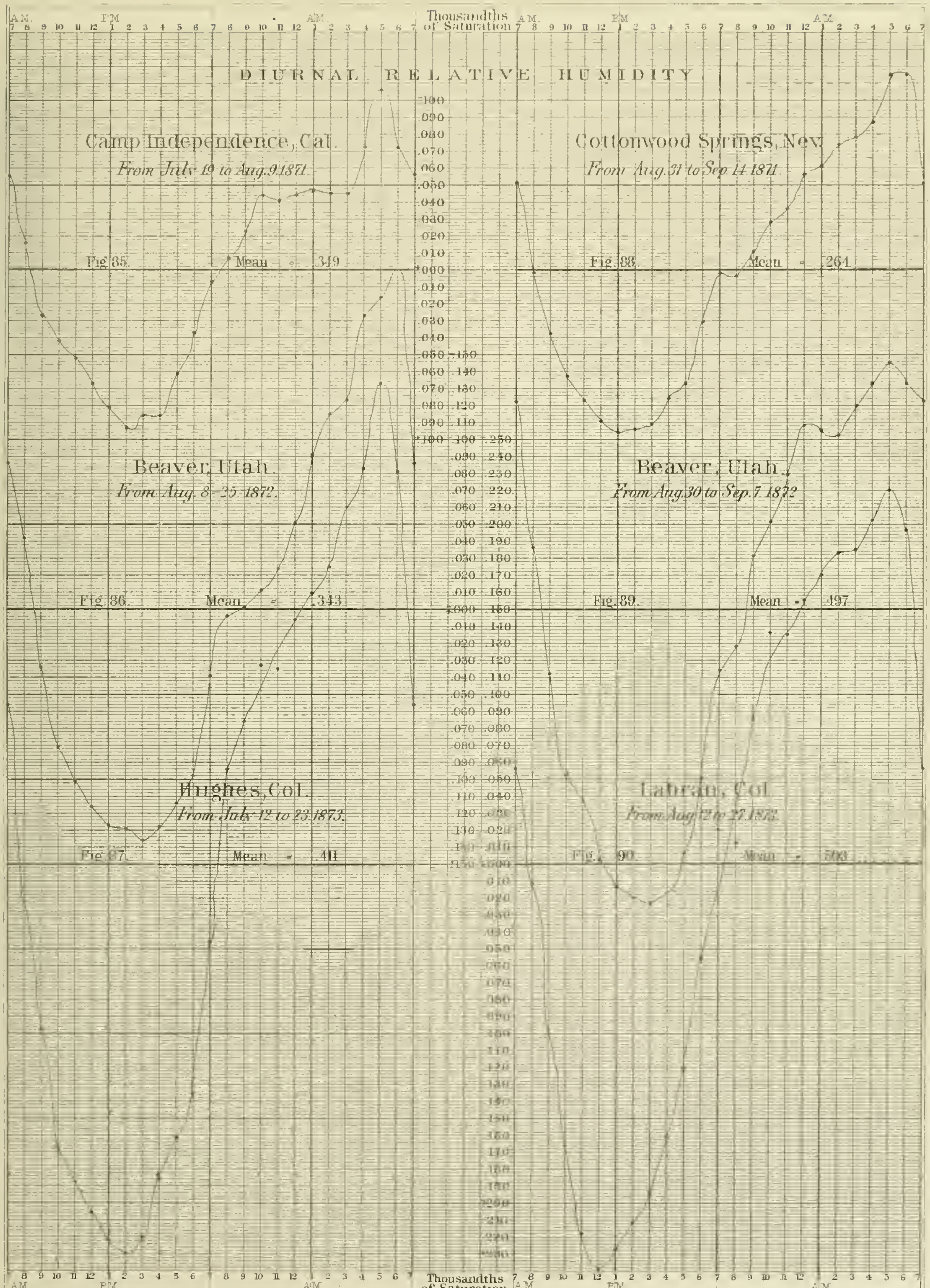
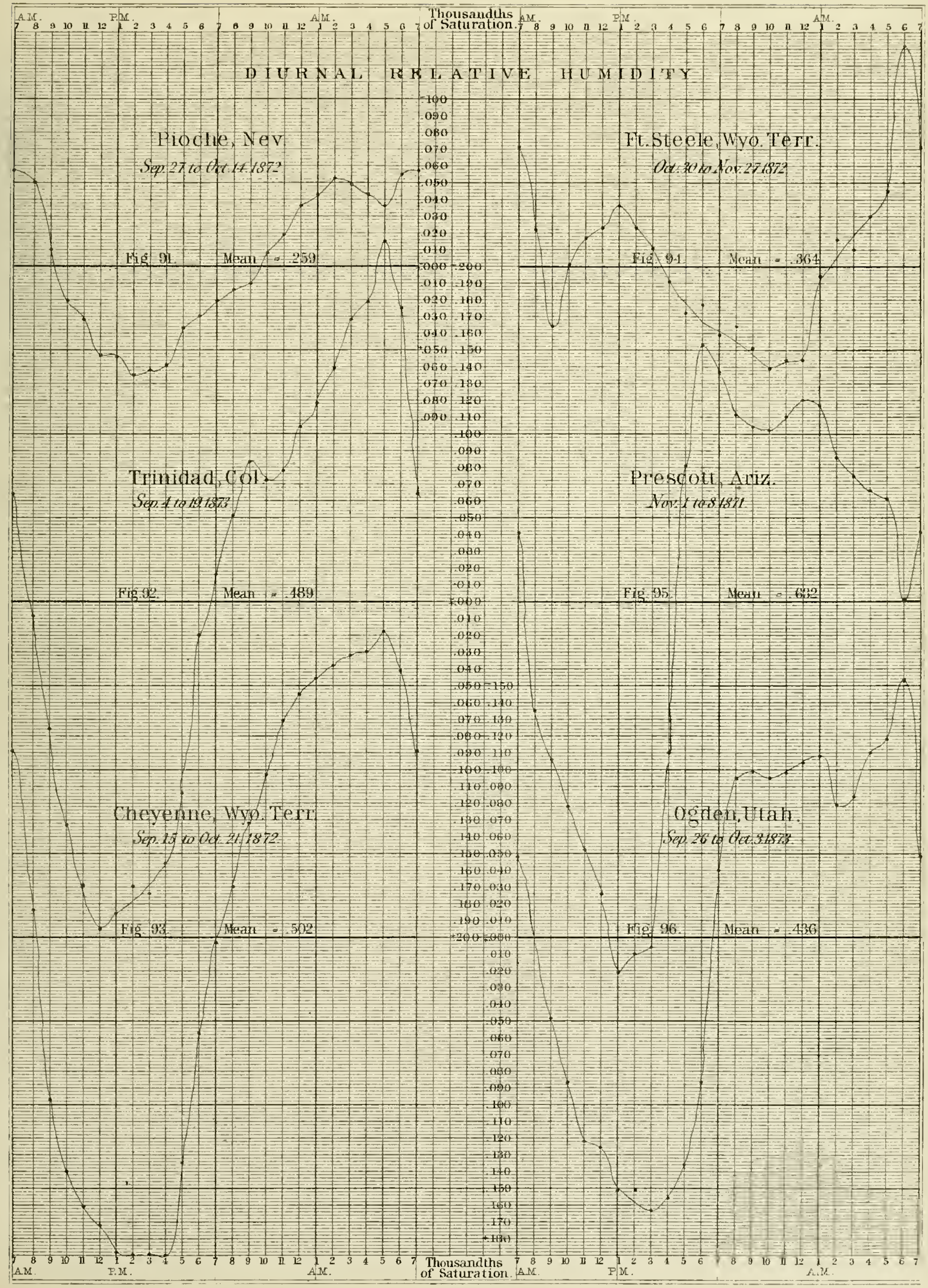

DIURNAL RELATIVE HUMIDITY
Thousandths of Saturation
Camp Independence, Cal.
From July 19 to Aug. 9 1871.
Fig. 35.
Mean .349
Cottonwood Springs, Nev.
From Aug. 31 to Sep. 14 1871.
Fig. 88.
Mean .264
Beaver, Utah.
From Aug. 8–25 1872.
Fig. 36.
Mean .343
Beaver, Utah.
From Aug. 30 to Sep. 7 1872.
Fig. 89.
Mean .497
Hughes, Col.
From July 12 to 23 1873.
Fig. 37.
Mean .411
Labran, Col.
Fig. 90.
Mean .503

PLATE XXII.

Showing relative humidity.

FIG. 91. *Pioche, Nev.* Results from observations taken hourly from September 27 to October 14, 1872.
FIG. 92. *Trinidad, Colo.* Results from observations taken hourly from September 4 to September 19, 1873.
FIG. 93. *Cheyenne, Wyo.* Results from observations taken hourly from September 15 to October 21, 1872.
FIG. 94. *Fort Fred. Steele, Wyo.* Results from observations taken hourly from October 30 to November 15, 1872.
FIG. 95. *Prescott, Ariz.* Results from observations taken hourly from November 1 to November 8, 1871.
FIG. 96. *Ogden, Utah.* Results from observations taken hourly from September 26 to October 3, 1873.


DIURNAL RELATIVE HUMIDITY
Thousandths of Saturation.
Pioche, Nev.
Sep. 27 to Oct. 14. 1872.
Fig. 91. Mean = .259
Ft. Steele, Wyo. Terr.
Oct. 30 to Nov. 27 1872.
Fig. 94. Mean = .364
Trinidad, Col.
Sep. 4 to 19 1873.
Fig. 92. Mean = .489
Prescott, Ariz.
Nov. 1 to 8 1871.
Fig. 95. Mean = .662
Cheyenne, Wyo. Terr.
Sep. 15 to Oct. 21 1872.
Fig. 93. Mean = .502
Ogden, Utah.
Sep. 26 to Oct. 3 1873.
Fig. 96. Mean = .436
A.M.
P.M.

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