US Army Corps
of Engineers

TECHNICAL REPORT CERC-86-9

ANNUAL DATA SUMMARY FOR 1983
CERC FIELD RESEARCH FACILITY

by

Herman C. Miller, William E. Grogg, Jr., Michael W. Leffler,
C. Ray Townsend III, Stephen C. Wheeler

Coastal Engineering Research Center

DEPARTMENT OF THE ARMY
Waterways Experiment Station, Corps of Engineers
PO Box 631, Vicksburg, Mississippi 39180-0631

September 1986
Final Report

Approved For Public Release; Distribution Unlimited

Prepared for DEPARTMENT OF THE ARMY
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This report provides basic data and summaries for the measurements made during 1983 at the US Army Engineer Waterways Experiment Station (WES) Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) in Duck, N. C. The report includes comparisons of the present years' data to prior years, and cumulative statistics from 1980 to the present.

Summarized in this report are meteorological and oceanographic data, monthly bathymetric survey results, samples of quarterly aerial photography, and descriptions and hourly data for the storms that occurred during the year. Wave conditions were the highest since measurements began at the FRF. The year was highlighted by 24 storms that included the close passage of Tropical Storm Dean in September.

This report is the fifth in a series of annual summaries of data collected at
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the FRF; the first, which summarized data collected during 1977-1979, was published as CERC Miscellaneous Report 82-16; the second, which summarized data collected during 1980, was published as CERC Technical Report 84-1; the third, which summarized data collected during 1981, was published as CERC Technical Report 85-3; and the fourth, which summarized data collected during 1982, was published as CERC Technical Report 86-5. These reports are available from the WES Technical Report Distribution Section of the Technical Information Division, Vicksburg, Miss.

PREFACE

Data and data summaries presented herein were collected during 1983 and compiled at the US Army Engineer Waterways Experiment Station (WES) Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) in Duck, North Carolina. This report is the fifth of a series of annual FRF data summaries carried out under CERC's Waves and Coastal Flooding Program.

The report was prepared by Herman C. Miller, Oceanographer, under the supervision of Curtis Mason, Chief, FRF Group, Engineering Development Division. Michael W. Leffler, Computer Programmer Analyst, assisted with data collection and analysis; William E. Grogg, Jr., Electronics Technician, assisted with instrumentation; and Stephen C. Wheeler, Computer Specialist, and C. Ray Townsend III, Amphibious Vehicle Operator, assisted with data collection. Dr. James R. Houston, Chief, CERC; Mr. Charles C. Calhoun, Jr., Assistant Chief, CERC; Dr. William L. Wood, former Chief, Engineering Development Division; and Mr. Thomas W. Richardson, Chief, Engineering Development Division, provided general guidance. Technical Monitor for the Program was Mr. John H. Lockhart, Jr., Office, Chief of Engineers.

The National Oceanic and Atmospheric Administration/National Ocean Service maintained the tide gage and provided statistics for summarization. In addition, a special thank you is extended to William A. Birkemeier, Hydraulic Engineer, for his supervision of the FRF surveying program and preparation of the Interactive Survey Reduction Program software for reducing the survey data.

COL Allen F. Grum, USA, was the previous Director of WES. COL Dwayne G. Lee, CE, is the present Commander and Director. Technical Director is Dr. Robert W. Whalin.

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CONVERSION FACTORS, NON-SI TO SI (METRIC) UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
acres	4,046.873	square metres
feet	0.3048	metres
millibars	100.0	pascals
miles (US statute)	1.609347	kilometres

ANNUAL DATA SUMMARY FOR 1983
CERC FIELD RESEARCH FACILITY

PART I: INTRODUCTION

1. The US Army Engineer Waterways Experiment Station (WES) Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF), located on 176 acres* at Duck, N. C. (Figure 1), consists of a 561-m-long research pier, an accompanying office, and field support buildings. The FRF is near the middle of Currituck Spit along a 100-km unbroken stretch of shoreline extending south from Rudee Inlet, Va., to Oregon Inlet, N. C. It is bordered by the Atlantic Ocean to the east and Currituck Sound to the west. The Facility is designed to (a) provide a rigid platform from which waves, currents, water levels, and bottom elevations can be measured, especially during severe storms; (b) provide CERC with field experience and data to complement laboratory and analytical studies and numerical models; (c) provide a manned field facility for testing new instrumentation; and (d) serve as a permanent field base of operations for physical and biological studies of the site and its adjacent region.

2. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The piles are embedded approximately 20 m below the ocean bottom. The pier deck is 6.1 m wide and extends from behind the dune line to about the 6-m water depth contour at a height of 7.8 m above mean sea level. The pilings are protected against sand abrasion by concrete erosion collars and against corrosion by a cathodic system.

3. An FRF Measurements and Analysis (FRFMA) program has been established to collect basic oceanographic and meteorological data at the site, reduce and analyze these data, and publish the results.

4. This report is the fifth in a series of annual reports and summarizes the data collected during 1983. Data for previous years are summarized by Miller (1982 and 1984) and Miller et al. (1985 and 1986).

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 9.

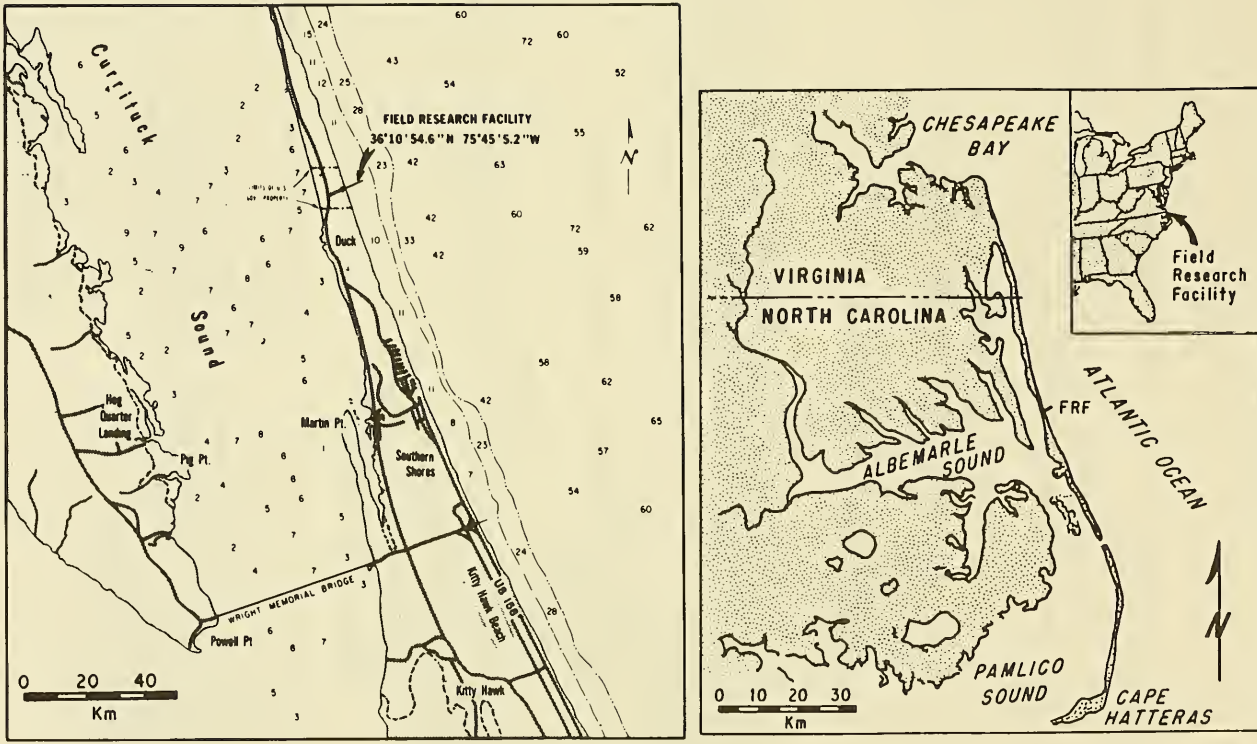


Figure 1. Location of Field Research Facility

Descriptions of the instrumentation, including sensor calibration and maintenance (Part III), and data collection and analysis procedures (Part IV), precede reporting of the data (Parts V and VI). Although this is intended to be a self-contained document, details for some procedures and instrumentation are given in the references.

5. Future annual reports will be of approximately the same format as this report; reader's comments on the format and usefulness of the data presented are encouraged.

6. In addition to the annual reports, monthly data reports summarizing the same types of data shortly after the data are collected are available from the following address:

WES/CERC Field Research Facility
SR Box 271
Kitty Hawk, N. C. 27949

7. The WES/CERC Coastal Engineering Information Analysis Center (CEIAC) is responsible for storing and disseminating most of the data presented or alluded to in this report. All data requests should be submitted in writing and addressed to:

Commander and Director
US Army Engineer Waterways Experiment Station
ATTN: CEIAC
PO Box 631
Vicksburg, Miss. 39180-0631

Tidal data other than the summaries in this report should be obtained directly from the following address:

NOAA/National Ocean Service
ATTN: Tide Analysis Branch
Rockville, Md. 20852

A complete explanation of the exact data desired for specific dates and times will expedite filling any request; an explanation of how the data will be used will help CEIAC or National Ocean Service (NOS) determine if other relevant data are available. For information regarding the availability of data, contact CEIAC at (601) 634-2017. Costs for collecting, copying, and mailing will be borne by the requester.

PART II: CLIMATOLOGICAL SUMMARY

Climate

8. The FRF enjoys a typical marine climate which moderates the extremes of both summer and winter. During the warmest month, July, the daily high air temperature averages 30° C. Correspondingly, ocean water surface temperatures tend to be highest during July through September, averaging over 20° C. Lowest air and water temperatures occur during February, averaging less than 7° C and 5° C, respectively.

9. Precipitation is generally well distributed throughout the year, averaging 1,071 mm annually. Frontal precipitation from midlatitude cyclones predominates in the winter, and local convection (thunderstorms) accounts for most of the summer rainfall.

10. Winds at the FRF are dominated by tropical air masses which create low to moderate warm southern breezes, Arctic air masses which produce cold winds from northerly directions, and smaller scale cyclonic low pressure systems which originate either in the tropics (and move north along the coast) or originate inland (and move eastward offshore). The dominant wind direction changes with the season, being generally from northern directions in the fall and winter and from southern directions in the spring and summer. The annual resultant wind direction is from the north-northwest. It is common for fall and winter storms (northeasters) to produce winds with average speeds in excess of 15 m/sec. Although the portion of the North Carolina coast in the vicinity of the FRF experiences a fairly low frequency of occurrence of direct hurricane strikes (on the average of once every 42 years), more frequent near-misses can cause high wave conditions at the FRF.

Waves

11. Wave directions at the FRF, as with winds, are seasonally distributed. Waves tend to approach most frequently from north of the pier in the fall and winter and south of the pier in the summer, but on an annual basis they are approximately evenly distributed between north and south (resultant wave direction is almost shore-normal). However, storm waves approach twice as frequently from north of the pier.

12. The annual mean wave height (measured at the seaward end of the FRF pier) is 0.9 m, with a standard deviation of 0.6 m. Wave heights in excess of 2 m can be expected to occur 7 percent of the time, or 600 hr per year.

13. Wave periods generally vary between 6 and 12 sec, with an annual mean peak spectral period of 8.8 sec and a standard deviation of 2.8 sec. Wave periods tend to be longest during the fall and shortest during the summer.

Nearshore Currents

14. Surface current speed and direction at the FRF are influenced by winds, waves, and, indirectly, by the bottom topography. The extent of the respective influence varies daily. However, winds tend to dominate the currents at the seaward end of the pier, while waves dominate within the surf zone. The effect of the bottom topography is such that, under certain conditions (e.g., near shore-normal wave angles), rip currents develop which interrupt the general flow of the alongshore current. A trough located under the seaward half of the pier is a preferred location for such currents. Currents tend to be southward during fall and winter and northward during spring and summer.

Tides and Water Levels

15. Ocean tides at the FRF are semidiurnal, with a mean range of 1.0 m. The highest water levels generally are associated with strong and persistent onshore winds and high waves. Storm surges have resulted in a maximum water level of 1.5 m above the National Geodetic Vertical Datum (NGVD). Water levels in Currituck Sound are wind-dominated rather than tidal, being low when winds are northerly and high during southerly winds.

Bathymetry

16. Nearshore bathymetry at the FRF is characterized by regular shore-parallel contours, a moderate slope, and a barred surf zone (usually an outer storm bar in water depths of about 4.5 m and an inner bar in water depths between 1.0 and 2.0 m). This pattern is interrupted in the immediate vicinity

of the pier where a trough runs under much of the pier's length, ending in a scour hole at the pier's seaward end where depths are up to 3.0 m greater than the adjacent bottom.

Sediment Size

17. On the dunes, sediments are generally medium size and moderate to well sorted. On the beach face and the beach step, size distribution is primarily bimodal, with a very coarse (1-2 mm) gravel intermixed with fine to moderate size sand. Offshore, sediments are well sorted, and size decreases with the distance offshore.

PART III: INSTRUMENTATION

18. This part identifies the instruments used for monitoring oceanographical and meteorological conditions and briefly describes their design, operation, and location. More detailed explanations of the instruments may be found in Miller (1980). Equipment used for other types of data collection, such as the surveying system, are not generally discussed; however, references are provided in Part IV.

Meteorological Instruments

Air temperature

19. A Yellow Springs Instrument Company, Inc. (YSI), Yellow Springs, Ohio, electronic temperature probe with analog output interfaced to the FRF's Data General NOVA-4 was operated beside the National Weather Service's (NWS's) instrument shelter located 43 m behind the dune (Figure 2). To ensure proper temperature readings, the probe was installed 3 m above ground inside a "coolie hat" to shade it from direct sun yet provide proper ventilation.

Maximum/minimum thermometers

20. Maximum and minimum thermometers housed in the shelter were used to determine the daily extreme air temperatures. The shelter was designed with louvered sides, a double roof, and a slatted bottom for housing instruments requiring protection from direct sunlight.

21. The actual temperature readings at the time the thermometers were read were compared to ensure accuracy of the maximum and minimum values. Maintenance consisted of the periodic removal and cleaning of the thermometers with soap and water and lubricating the Townsend support used to hold and reset the instruments.

Atmospheric pressure

22. Atmospheric pressure was measured with a YSI electronic sensor gage with analog output. The sensor was located in the laboratory building at 9 m above NGVD, and data were recorded on the FRF computer. Data from this gage were compared with a NWS aneroid barometer at least once a week to ensure proper operation of the instruments.

23. A recording aneroid sensor (microbarograph) located in the laboratory building was used to continuously record atmospheric pressure variation.

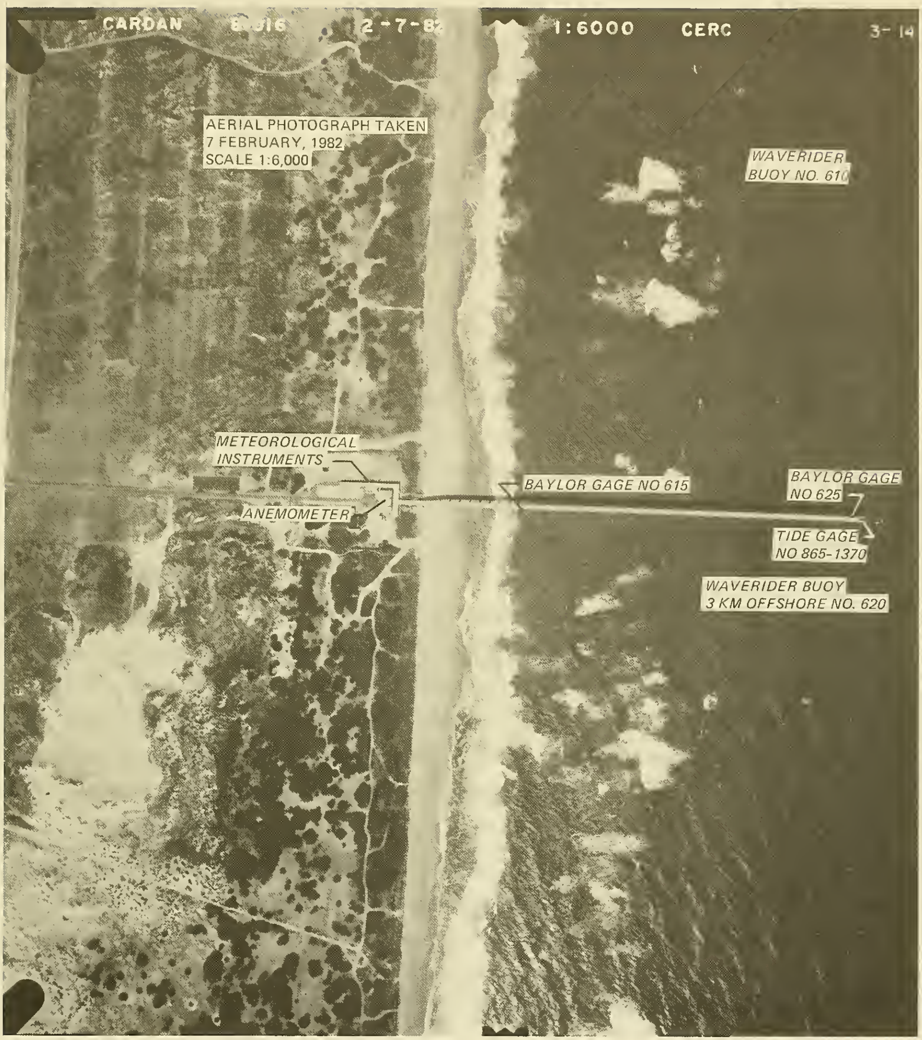


Figure 2. FRF gage locations

The microbarograph was manufactured by Weathertronics Incorporated, Sacramento, Calif.

24. The microbarograph was compared daily with the NWS's aneroid barometer, and adjustments were made as necessary. Maintenance of the microbarograph consisted of inking the pen, changing the chart paper, and winding the clock every 7 days. During the summer, a meteorologist from the NWS (Norfolk, Va.) checked and verified the operation of the NWS barometer.

Rain gage

25. A 30-cm weighing rain gage manufactured by the Belfort Instrument Company, Baltimore, Md., used to measure the daily amount of precipitation, was located near the instrument shelter, 46 m behind the dune. The manufacturer's specifications indicated that the instrument's accuracy was ±0.5 percent for precipitation amounts less than 15 cm and ±1.0 percent for amounts above 15 cm.

26. A 15-cm-capacity "true check" clear plastic rain gage with a 0.025-cm resolution, manufactured by the Edwards Manufacturing Company, Albert Lea, Minn., was used to monitor the performance of the weighing rain gage. This gage, located near the weighing gage, was checked daily; very few discrepancies were identified thoughout the year.

Wind speed and direction

27. Winds were measured from the top of the laboratory building at an elevation of 19.1 m (Figure 2) by using a Skyvane Model W102P anemometer manufactured by the Weather Measure Corporation, Sacramento, Calif. Wind speed and direction data were incorporated into the automated data collection and analysis program, and were also collected continuously on a strip-chart recorder. The Weather Measure Corporation specifies an accuracy of ±0.45 m/sec below 13 m/sec and ±3 percent at speeds above 13 m/sec, with a threshold of 0.9 m/sec. Wind direction accuracy is ±2 deg with a resolution of less than 1 deg. The anemometer was calibrated semiannually at the National Bureau of Standards in Gaithersburg, Md., and was within the manufacturer's specifications.

Wave Gages

Baylor wave staff gages

28. Two parallel cable inductance wave gages, manufactured by the Baylor Company, Houston, Tex., were mounted on the FRF pier: gage 615 at

sta 6+20 and gage 625 at 19+00 (Figure 2). These gages are rugged and reliable, and require little maintenance except to keep tension on the cables and to remove any material which may cause an electrical short between them. These gages were calibrated prior to installation by creating an electrical short between the two cables at known distances along the cables and recording the voltage output. Electronic signal conditioning amplifiers are used to ensure that the output signals from the gages are within a 0- to 5-V range. Gage accuracy is about 1 percent with a 0.1 percent full-scale resolution. These gages are susceptible to lightning damage, but protective measures have been taken to minimize such occurrences. A more complete description of the gage's operational characteristics is given by Grogg (1986).

Waverider buoy wave gages

29. A Waverider buoy gage (620) was positioned offshore 3 km from the monumentation baseline (Figure 2). This gage was manufactured by the Datawell Laboratory of Instrumentation, Haarlem, The Netherlands, and measures the vertical acceleration produced by the passage of a wave. The signal is double-integrated to produce a displacement signal, which is transmitted by radio to an onshore receiver. The manufacturer states that wave amplitudes are correct to within 3 percent of their actual value for wave frequencies between 0.065 and 0.5 Hz (15- to 2-sec wave periods). However, calibration curves for buoys used at the FRF prior to 1983 (see Miller 1984, Miller et al. 1985 and 1986) indicate that the wave heights for the combined data from 1980 through 1982, reported in Part V of this report, for wave periods less than 15 sec, average about 7 percent less than actual values. For wave periods greater than 15 sec this error increases with wave period. The manufacturer specifies the error can increase to 10 percent for wave periods greater than 20 sec. Calibration results show errors as large as 15 percent are possible for the very long wave periods. Calibrations of buoys used during 1983 are within the manufacturer's specifications. The buoys were calibrated without the use of the mooring system during deployment. This occurrence may introduce additional errors of an unknown magnitude. For most engineering applications, a 7 percent error is tolerable; however, a correction procedure is described in Appendix A, thus allowing the calibration error to be improved up to 4 percent.

Tide Gage

30. Water level data were obtained from a NOAA/NOS control tide station (No. 865-1370) located at the seaward end of the research pier (Figure 2), by using a digital tide gage manufactured by Leupold and Stevens, Inc., Beaverton, Oreg. The Leupold-Stevens' analog-to-digital recorder is a float-activated, negator-spring, counterpoised instrument that mechanically converts the vertical motion of a float into a coded, punched paper tape record. The below-deck installation at pier sta 19+60 consisted of a 30.5-cm-diam stilling well with a 2.5-cm orifice and a 21.6-cm-diam float.

31. This tide gage was checked daily for proper operation of the punch mechanism and for accuracy of the time and water level information. The accuracy was determined by comparing the gage level reading with a level read from a reference electric tape gage. Once a week, a heavy metal rod was lowered down the stilling well and through the orifice to ensure free flow of water into the well. During the summer months, when biological growth was most severe, divers inspected and cleaned the orifice opening as required.

32. Quarterly, a National Oceanic and Atmospheric Administration (NOAA)/NOS tide field group familiar with the installation and equipment inspected the tide station. The tide gage elevation was checked using existing NOS control positions, and the equipment was checked and adjusted as needed. NOS and FRF personnel also reviewed procedures for tending the gage and handling the data. Any specific comments on the previous months of data were discussed to ensure data accuracy.

PART IV: DATA COLLECTION AND ANALYSIS

Data Acquisition System/Digital Data Collection

33. The primary data acquisition system was a Data General Corporation, Westboro, Mass., NOVA-4 minicomputer located in the FRF laboratory building. The backup system consisted of a WICAT Systems Incorporated, Orem, Utah, 150 WS minicomputer. Signals from the air temperature and atmospheric pressure sensors, the anemometer, and wave gages were routinely sampled four times per second for 20 min every 6 hr beginning at or about 0100, 0700, 1300, and 1900 hours Eastern Standard Time (EST); these hours correspond to the time that the NWS creates daily synoptic weather maps. During storms, hourly data recordings were made. Prior to collection, each gage signal was first amplified and biased to ensure a 0- to 5-V range.

34. Data were recorded on nine-track magnetic tapes having the following format: first, two header records of information were written, which include (a) the sensor identification number; and (b) the date, time, calibration, and signal bias factors, followed by 13 records of data for each 20-min recording interval. Each data record contained 384 data values in a binary format, such that each value represented the computer units corresponding to the instantaneous voltage output of the sensor. The above sequence of 15 records per file was repeated for each sensor and recording interval until the data tape was filled, a total of 600 to 700 files per tape.

Meteorological Data Collection

Maximum and minimum thermometers

35. High and low temperature values were read daily directly from the instruments and represent the extreme temperature values since the last reading.

Microbarograph and rain gage

36. Each instrument used for monitoring the meteorological conditions at the FRF was read and inspected daily. For those instruments with analog chart recording capabilities, (a) the pen was zeroed (where applicable); (b) the chart time was checked and corrected, if necessary; (c) a daily reading was marked on the chart for reference; (d) the starting and ending chart

times were recorded, as necessary; and (e) new charts were installed when needed.

Meteorological Data Analysis

Air temperature

37. Mean air temperature was computed four times per day from 20-min digital data samples. From these data, monthly and annual means were determined.

38. Monthly and annual mean and extreme highest and lowest daily temperatures were determined from the daily maximum and minimum thermometer values.

Atmospheric pressure

39. Mean atmospheric pressure was computed four times per day from 20-min digital data samples. From these data, monthly and annual means were determined.

Wind data

40. Mean wind speed and direction were computed four times per day from 20-min digital data samples.

41. Annual, seasonal, and monthly joint probability distributions of wind speed versus direction were computed. Wind speeds were resolved into 1-m/sec intervals while the directions were at 22.5-deg intervals; i.e., 16-point-compass-direction specifications. These distributions are presented as wind "roses," such that the length of the petal represents the frequency of occurrence of wind blowing from the specified direction and the width of the petal is indicative of the speed in 3-m/sec intervals. Resultant directions and speeds were also determined by vector-averaging the data.

Wave Data

42. Thompson (1977) and Harris (1974) describe the procedure used for analyzing and summarizing the digital wave data contained in this report. The procedure is based on a Fast Fourier Transform (FFT) spectral analysis of 4,096 data values (1,024-sec recordings, sampled at 4 Hz) for each file processed.

43. The program computes the first five moments of the distribution of

sea-surface elevations, then edits the digital data file by checking for data points out of the 0- to 5-V range or "jumps" or "spikes." A jump is defined as a data value greater than 2.5 standard deviations from the previous data value, while a spike is a data value 5 standard deviations or more from the mean. If less than 5 jumps or spikes in a row are found, the program linearly interpolates between acceptable data and replaces the erroneous data values. If more than 4 jumps or spikes in a row or a total of 100 bad data points for the file are found, the program stops interpolating and editing. At this point, the program analyzes the data and prints a flag indicating there is a problem with the file. If the variance is less than 0.001 m^2, the record is not analyzed. After editing, the first five moments of the distribution of sea-surface elevations are again computed. A cosine bell data window is applied to increase the resolution for the energy spectrum of the file; use of the data window is discussed by Harris (1974). After application of the data window, the program computes the variance spectrum (energy spectrum) using the FFT procedure. After the data files are analyzed, the results are eliminated for files flagged as bad or appear inconsistent with simultaneous observations from nearby gage sites. Frequently, the spectrum and/or distribution function of sea-surface elevations are examined to determine if the data are acceptable. After the analysis results are edited, monthly summaries of wave heights and periods are generated for inclusion in summary reports.

44. Unless otherwise specified, "wave height" means the energy-based parameter H_{m_0} (defined as four times the standard deviation of the sea-surface elevations).

45. The wave period T_p is defined as the period associated with the maximum energy in the spectrum. This is resolved by partitioning the spectrum into frequency bands of equal width and determining the band with the maximum energy density. The period reported is the reciprocal of the center frequency (e.g., T_p = 1/frequency) of the spectral band. Since the spectral bands are equal frequency width, namely 0.010742 Hz (e.g., 11/1,024 sec), the analysis provides uniform resolution in frequency. However, the resolution in period is not uniform since the period intervals become larger for lower frequencies. Because of the convention of reporting the period at the center of the interval, only a discrete set of period values is possible (Table 1). The wave periods used in this report have been rounded to the nearest second before

Table 1

Spectral Band and Peak Period Specifications

Band Number	Upper Limit of Frequency Band, Hz	Corresponding Period, Lower Limit of Band, sec	Period Associated with Center Frequency of Band, sec	Periods Not Reported, sec
6	0.064	15.52	17	15, 16
7	0.075	13.30	14	13
8	0.086	11.64	12	0
9	0.097	10.34	11	↓
10	0.107	9.31	10	
11	0.118	8.46	9	
12	0.129	7.76	8	
13	0.140	7.16	7	
14	0.150	6.65	7	
15	0.161	6.21	6	
16	0.172	5.82	6	
17	0.183	5.48	6	
18	0.193	5.17	5	
19	0.204	4.90	5	
etc...				

summarization. Complete information about the energy contained in all frequency bands can be best obtained by inspecting the full spectrum, examples of which are included in Appendix B for gage 625 during storm wave conditions.

Water Level Data

Collection

46. The water level information was obtained from a NOS tide gage which produced a digital paper tape of instantaneous water levels sampled continuously at 6-min intervals. At the end of each month, the paper tape was removed from the recorder and mailed to NOS in Rockville, Md., for analysis.

Analysis

47. The digital paper tape records of tide heights taken every 6 min were analyzed by the Tides Analysis Branch of NOS. An interpreter created a digital magnetic computer tape from the punch paper tape, which was then processed on a large computer. First, a listing of the instantaneous tidal height values was created for visual inspection. If errors were encountered, a computer program was used to fill in or recreate bad or missing data by using correct values from the nearest NOS tide station and accounting for

known time lags and elevation anomalies. The data were plotted, and a new listing was generated and rechecked. When the validity of the data had been confirmed, monthly tabulations of daily highs and lows, hourly heights (instantaneous height selected on the hour), and various extreme and/or mean water level statistics were computed. The monthly or annual mean sea level (msl) reported is the average of the hourly heights, while the mean tide level (MTL) is midway between mean high water (MHW) and mean low water (MLW).

Visual Observations

48. Daily visual observations were made near 0700 hours to supplement instrumented data collection. These include observations of surface current speed and direction at (a) the seaward end of the pier, (b) the midsurf position on the pier, and (c) the beach 500 m updrift of the pier. Surface currents were determined by observing the movement of dye on the water surface. Surface current speed and direction at the FRF are influenced by winds, waves, tides, and indirectly by the bottom topography. The extent of the respective influence varies daily. However, winds tend to dominate the currents at the seaward end of the pier, whereas, the breaker angle and heights dominate within the surf zone. During extreme wave conditions the seaward end of the pier is within the breaker zone and, consequently, currents measured there are strongly influenced by waves. The effect of the bottom topography is such that under certain conditions rip currents develop which interrupt the general flow of the longshore current. The trough under the pier is a preferred location for such currents. This report concentrates on the longshore currents.

49. Also measured were wave approach angles at the seaward end of the pier, the breaker angle, and the breaker type nearshore. Wave direction was also determined using a Raytheon Mariner's Pathfinder radar, manufactured by the Raytheon Marine Company, Manchester, N. H., mounted on the roof of the FRF building; use of this system for measuring ocean waves is explained by Mattie and Harris (1978).

Bathymetric and Pier Surveys

Collection

50. Profiles were obtained monthly and after storms by using the Coastal Research Amphibious Buggy (CRAB), a 10.7-m-tall amphibious tripod, and

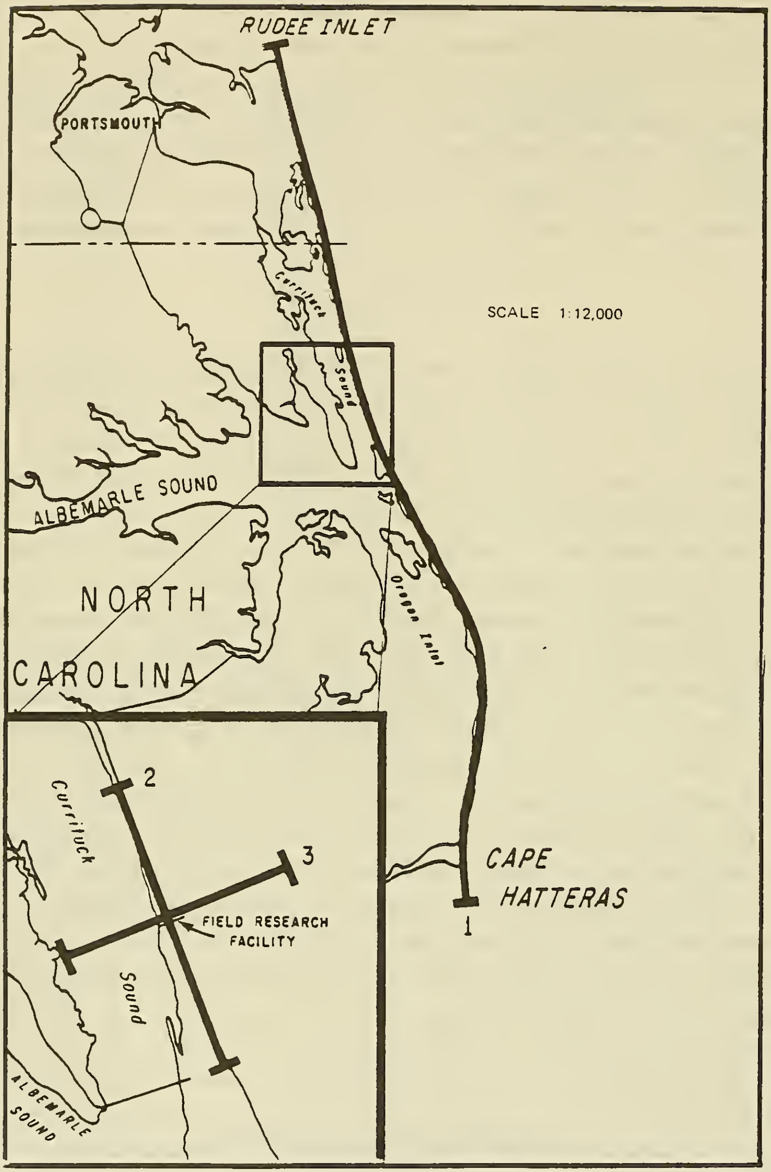


Figure 3. Aerial photography flight lines

a Zeiss Elta-2 total station surveying system described by Birkemeier and Mason (1984). Each profile estended seaward from the baseline behind the dune to a water depth of about 10 m, within 0.6 km north and south of the FRF pier. Their locations are shown in Figure C1 of Appendix C. The survey accuracy was about ±3 cm horizontally and vertically. Soundings along both sides of the FRF pier were included by the use of a technique which consisted of lowering a weighted measuring tape to the bottom, and then recording the distance below the established pier deck elevation. Measurements were made midway between the pier pilings to minimize errors caused by scour near the pilings.

Analysis

51. The pier, beach, nearshore, and offshore data were reduced to position (X,Y) and depth (Z) triplets relative to established monumentation and NGVD, respectively. The data were listed, and a display of the profiles (i.e., distance along the range versus elevation) was generated for visual inspection. After the data were edited, another set of routines was used to compute contour diagrams of the bottom topography and time sequences of bottom elevations at selected locations along the pier.

Photographic Data

Aerial photography

52. Quarterly aerial photographic missions were performed using a 9-in.-negative format mapping aerial camera that is capable of producing black/white and color photography. All coverage was at least 60 percent overlap, with flights flown as close as possible to low tide between 1000 and 1400 hours with less than 10 percent cloud cover.

53. The photographs obtained on 26 January, 27 April, and 3 October were concentrated near the FRF (Figure 3), while those obtained on 8 July also included coverage from Cape Henry, Va., to Cape Hatteras, N. C.

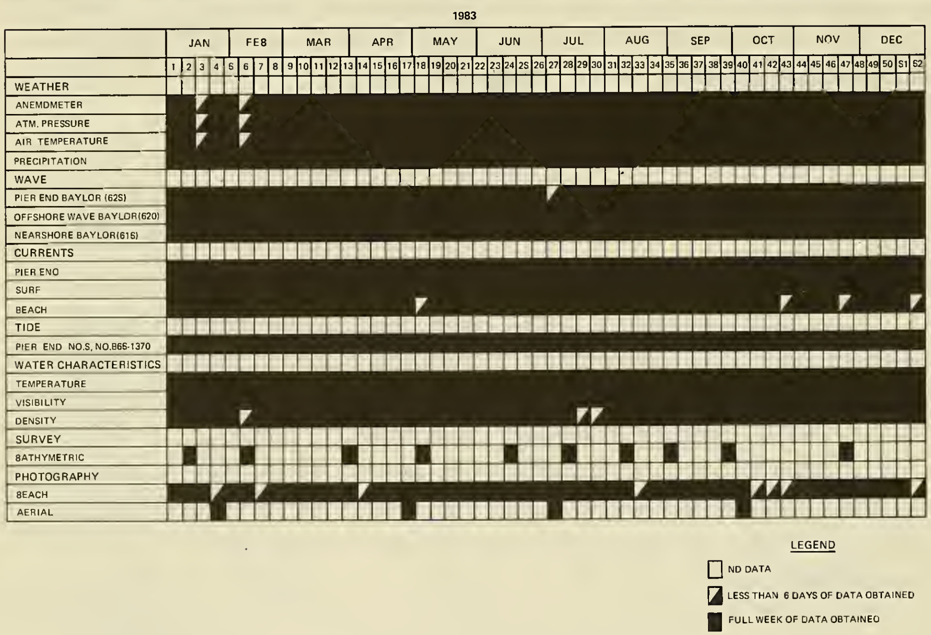
Beach photography

54. Daily color slides of the beach were taken using a 35mm camera from the same location on the pier, looking north and south. The location from which each picture was taken and the date, time, and a brief description of the picture were marked on the sides; and an inventory was maintained.

55. Table 2 is intended as a quick reference guide to show the dates for which various types of data are available. Wave gage histories which may explain major gaps in the data are provided in Appendix B. This part provides results of the weather, wave, surface currents, tidal, water characteristics, survey, and photographic measurements made during the year. Although this report is intended to provide basic data for analysis by users, many of the

Table 2

Reference Guide Showing Dates for Which Various Types of Data are Available



daily observations have been summarized by month, season, or year to aid in interpretation. If individual data are needed, the user can obtain the detailed information by following the procedures described in Part I (paragraphs 6 and 7).

Meteorology

56. This section summarizes the meteorological measurements made at the FRF in 1983. A discussion of the data and a comparison with previous years are also presented. Appendix D contains hourly wind speed and direction and atmospheric pressure values during storm conditions.

Air temperature

57. The marine climate at the FRF moderates the extremes of both summer and winter as shown in Figure 4. The 1983 annual mean temperature (based on four observations per day) was 15.9° C with a 3.6° C standard deviation. Daily high and low temperatures, summarized in Table 3, show large variations that are primarily caused by the effect of onshore/offshore winds and the temperature difference between the ocean and land. Although infrequent, freezing

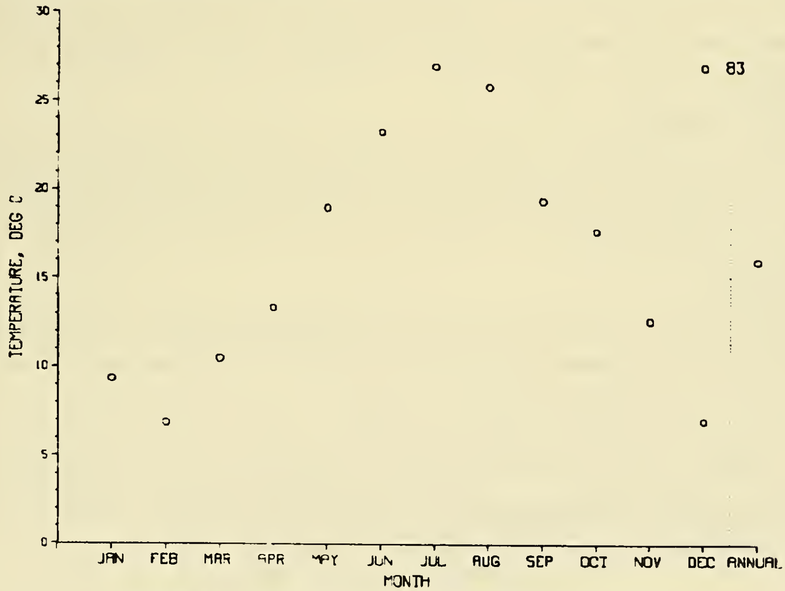


Figure 4. Mean monthly air temperatures, 1983

Table 3

Air Temperature Statistics, ° C

Month	Mean High 1983	Mean High 1980-1982	Maxima 1980-1983	Mean Low 1983	Mean Low 1980-1982	Minima 1980-1983
Jan	9.3	7.8	20	3.4	-0.3	-14
Feb	9.7	8.2	22	2.5	0.9	-11
Mar	15.0	12.5	24	5.8	4.1	-7(83)
Apr	17.7	19.4	30	8.0	10.4	-2
May	22.8	23.6	35	14.8	14.5	6
Jun	26.4	27.8	35	18.5	19.5	11
Jul	31.3	30.0	43	24.6	21.9	13
Aug	30.9	29.0	37	21.9	21.1	15(83)
Sep	27.8	27.0	34	20.5	19.5	10
Oct	22.9	20.7	30(83)	15.6	12.8	4
Nov	18.7	16.3	32(83)	8.3	8.1	-3
Dec	14.7	12.5	25	3.9	3.7	-14(83)
Annual	20.6	19.4		12.3	11.3	

temperatures can be expected at the FRF from December through February.

58. Since measurements every 6 hr were not made in years prior to 1983, only the daily high and low values (Table 3) can bé compared. This shows that throughout the year the high and low temperatures during 1983 were higher than mean values for 1980 through 1982.

Atmospheric pressure

59. The atmospheric pressure variation showed a tendency for low pressures to develop during March and April and for high pressures to develop from September through December (Figure 5). Data are not available from FRF for prior years for comparison.

Precipitation

60. During 1983, precipitation was generally high in the spring and fall and low in the summer (Figure 6). A total of 1,248 mm was received during the year for a monthly mean of 104 mm.

61. In prior years, the monthly mean was 86 mm (20 percent less than during 1983) and more evenly distributed throughout the year. Monthly maxima for all the years of measurements occurred in March, April, October, and December while minima occurred in July 1983 (Table 4).

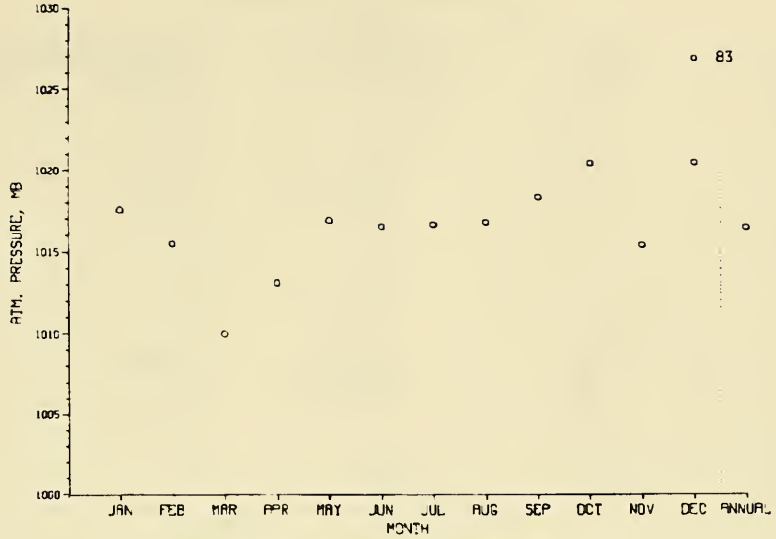


Figure 5. Atmospheric pressure, 1983

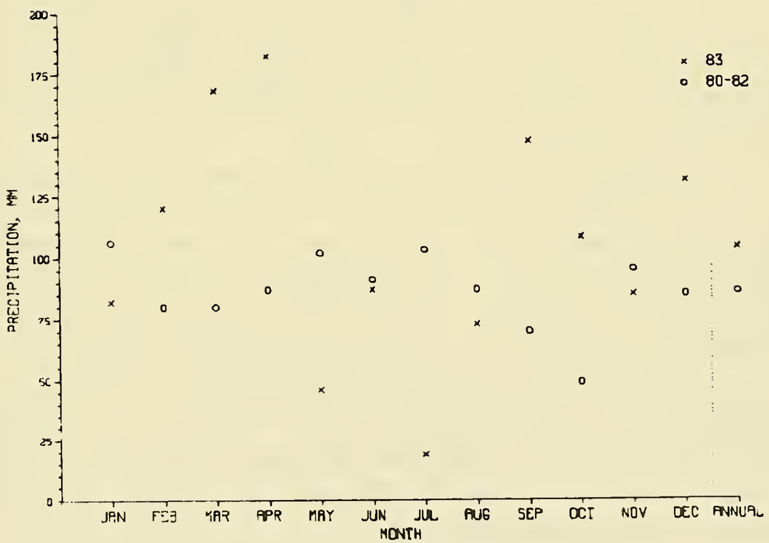


Figure 6. Precipitation, 1983

Table 4

Precipitation Statistics, mm

Month	Total 1983	Mean 1978-1982	1978-1983 Extreme Maxima	1978-1983 Extreme Minima
Jan	82	106	180	45
Feb	120	80	127	46
Mar	168	80	168(83)	48
Apr	182	87	182(83)	46
May	46	102	239	39
Jun	87	91	130	60
Jul	19	103	200	19(83)
Aug	73	87	220	36
Sep	147	70	160	5
Oct	108	49	108(83)	25
Nov	85	95	130	67
Dec	131	85	131(83)	47
Avg	104	86		
Annual	1,248	1,035		

Winds

62. Since local winds frequently control nearshore currents and wave conditions, an understanding of the wind and wave climate at any coastal location is important to most studies of hydrodynamic and sedimentary processes. In this section, wind characteristics at the FRF are discussed based on measurements made four times per day.

63. Present year. The distribution of winds during 1983 is shown in Figure 7. Winds blew from NNE through ENE directions 25.7 percent of the time, from SSW through WSW 25.6 percent, and 4 to 7 percent for each of all the other directions during the year. The resultant wind speed and direction was 0.6 m/sec from 28 deg east of true north (Table 5). When speeds exceeded 10 m/sec 82 percent of the time, the winds were from N through ESE.

64. Wind distributions changed with the season such that during January through March, 63.4 percent blew from northerly directions. The resultant magnitude and direction were 2.8 m/sec and 21 deg, respectively. For the 12 percent of the observations when the wind speed exceeded 10 m/sec, the wind was directed from N through ENE (Figure 8).

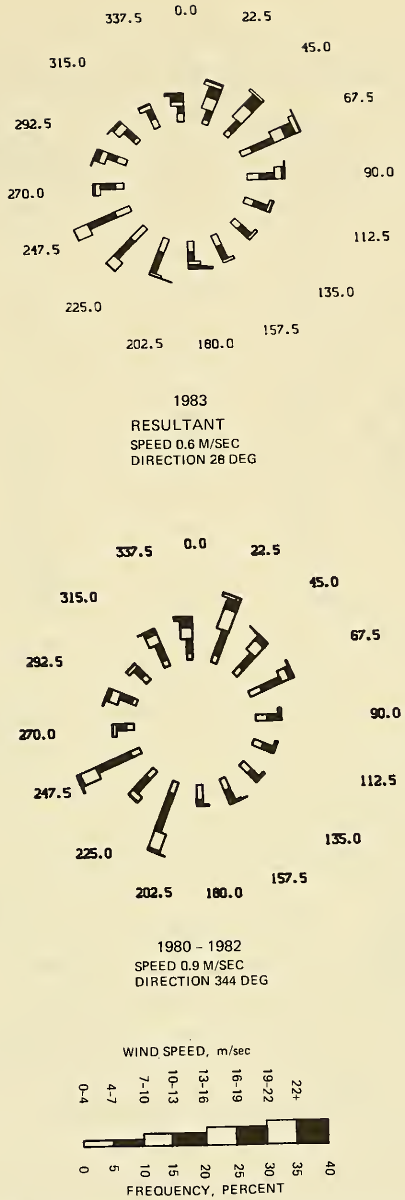


Figure 7. Comparison of annual wind roses for 1983 versus 1980-1982

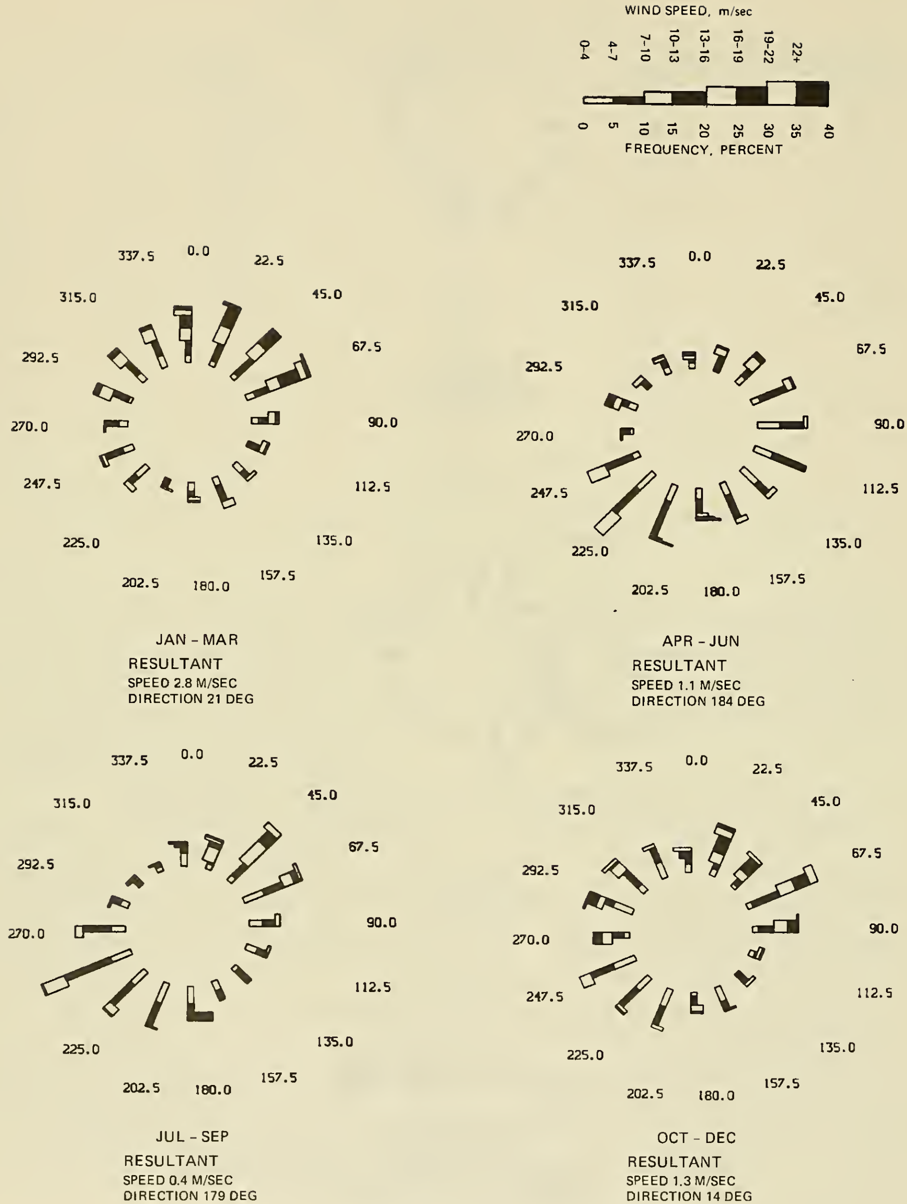


Figure 8. Seasonal wind roses for 1983

Table 5

Resultant Wind Speed and Direction

Season or Month	1983		1980-1982		1980-1983	
	Speed m/sec	Direction deg True N	Speed m/sec	Direction deg True N	Speed m/sec	Direction deg True N
Annual	0.6	28	0.9	344	0.8	353
Jan-Mar	2.8	21	1.9	338	2.0	352
Apr-Jun	1.1	184	0.8	202	0.9	195
Jul-Sep	0.4	179	0.1	155	0.1	172
Oct-Dec	1.3	14	2.2	0	2.0	3
Jan	3.1	19	2.2	320	2.3	344
Feb	4.2	23	1.8	347	2.3	2
Mar	1.3	19	1.6	342	1.5	350
Apr	1.9	222	0.8	216	1.1	219
May	1.5	187	0.5	192	0.8	189
Jun	1.3	106	1.0	196	0.8	171
Jul	2.9	205	1.2	218	1.6	121
Aug	0.3	258	0.3	23	0.2	4
Sep	2.2	45	0.8	54	1.2	50
Oct	3.0	60	2.1	21	2.2	34
Nov	2.0	272	2.4	35	1.8	340
Dec	2.2	5	2.5	34	2.4	349

65. During April through June, the winds were low and easterly through southwesterly. Under 3 percent of the speeds exceeded 10 m/sec; however, on two occasions speeds exceeded 25 m/sec from the south and SSW. The resultant speed was 1.1 m/sec and direction was 184 deg.

66. The winds during July through September were bidirectional, with 26.9 percent blowing from NNE and 41.2 percent from SSW through W. The resultant speed was low, 0.4 m/sec, showing the approximate balance between northerly and southerly winds while the resultant direction was 179 deg, indicating southerly winds occurred slightly more often. For 6.3 percent of the winds during this season, the speed exceeded 10 m/sec--again, primarily from the northeast quadrant.

67. The winds were mixed during October through December, with 33.5 percent blowing from NNE through E, and 6 to 10 percent from each of the westerly directions. The resultant wind speed and direction show the northeasterly dominance at 1.3 m/sec and 14 deg, respectively. Wind speeds

exceeded 10 m/sec 14.5 percent of the time, and these winds blew primarily from the northeast quadrant.

68. Present versus past years. There was a tendency for winds to blow more often from the northeasterly directions during 1983 (Figure 7). The distribution is similar to 1982, while during prior years there were more northwesterly winds. The more frequent northeasterly winds occurred during January through March and October through December, while seasonal distributions for April through September are very nearly the same as for prior years. Monthly differences between 1983 and prior years are emphasized in Table 5.

69. Combination of all years. Annual and seasonal distributions of winds for the combined years 1980 through 1983 are presented in Figure 9. Of the 5,250 observations, over 6 percent exceeded 10 m/sec. For those speeds in excess of 10 m/sec, 44 percent occurred during October through December and 32 percent during January through March.

Waves

70. This section presents summaries of wave data collected at the FRF. A review of the wave conditions during 1983 and a comparison with previous years is followed by a discussion of the wave climate for 1980 through 1983. Appendix B contains summaries for each gage which include height and period distributions, wave direction distributions, and persistence tables. A discussion of individual major storms is given in Part IV, and Appendix D contains hourly wave data for times when the heights H_{m_0} exceeded 2 m at the seaward end of the FRF pier.

Present data year, spatial variation

71. The distribution of wave heights for all three gages operated during the year is shown in Figure 10. For a given frequency of occurrence, wave heights were highest at the gage located 3 km from shore (gage 620), second at the pier end (gage 625), and lowest at the landward end of the pier (gage 615) This pattern of variation (decrease of wave height with depth) is consistent with previous years' data. Refraction, bottom friction, and wave breaking contribute to the observed differences in height. Wave height statistics for the staff gage (gage 615) located at the landward end of the pier in shallow water were considerably different than the other gages. In all but the very

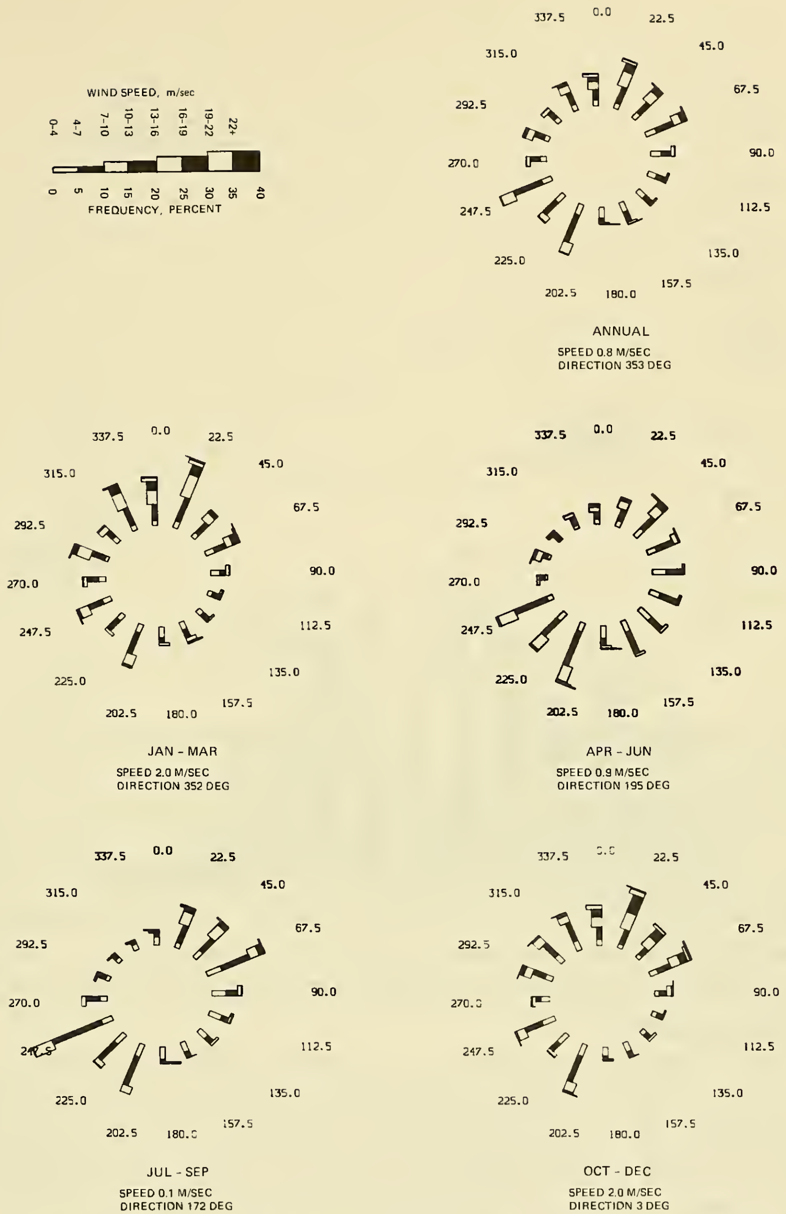


Figure 9. Annual and seasonal wind roses for 1980 through 1983

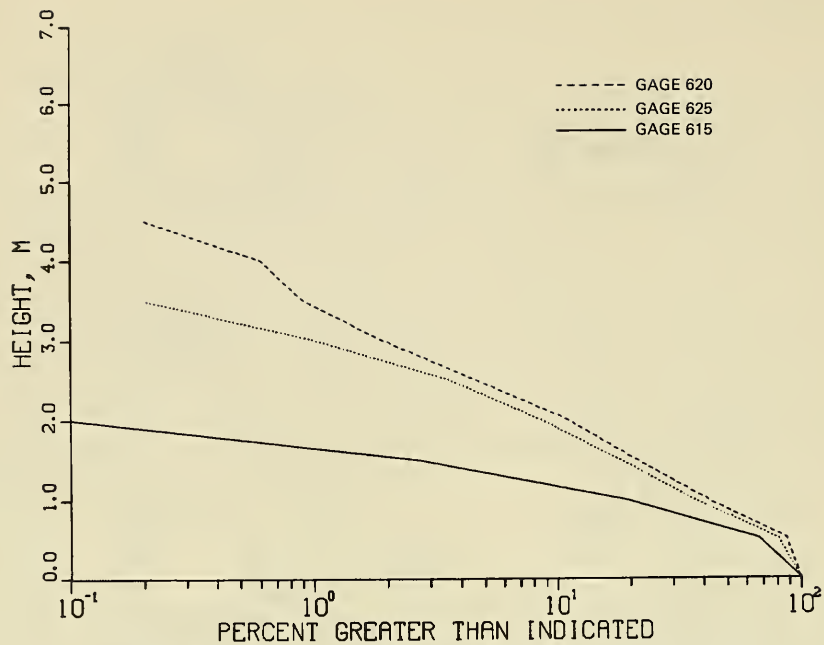


Figure 10. Annual wave height distributions for 1983

calmest conditions, this gage is within the breaker zone. Consequently, these statistics represent a lower energy wave climate in which the annual mean height is more than 20 percent less than at the seaward end of the pier.

72. The distributions of wave periods for all of the gages are shown in Figure 11. Although the distributions of wave periods for gages 620 and 625 were similar, gage 615 had a higher occurrence of wave periods 6 sec and less primarily due to waves frequently breaking seaward of the gage. This pattern of variation between gages is consistent with data from the previous year.

Temporal variation

73. Temporal height and period trends for gages 620 and 625 are shown in Figures 12 and 13, respectively, and are consistent with those for gage 615. Seasonal wave height distribution variations as shown in Figure 14 (gage 625) were similar for all gages; waves were most severe during January through March. Seasonal wave period distributions (Figure 15) (gage 625) were also similar for all gages. In general, the tendency was for the less severe wave conditions during April through September to frequently have wave periods of

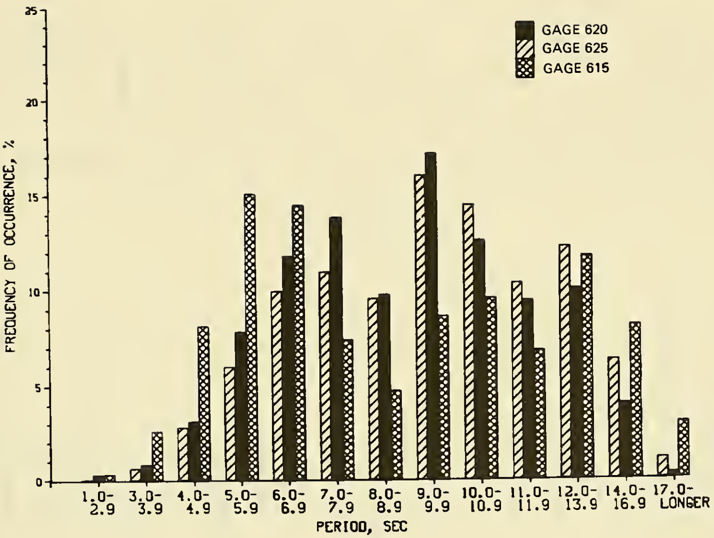
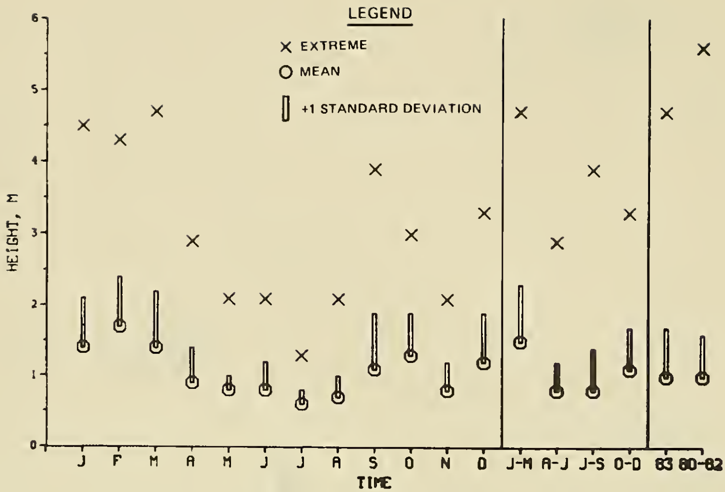
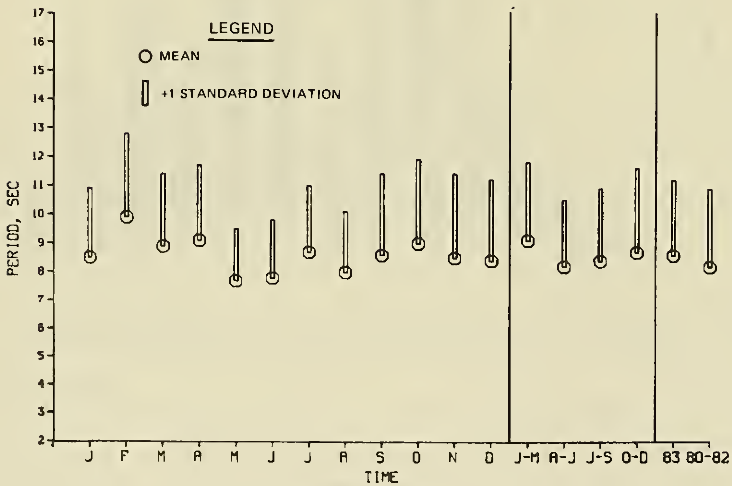


Figure 11. Annual wave period distributions for 1983

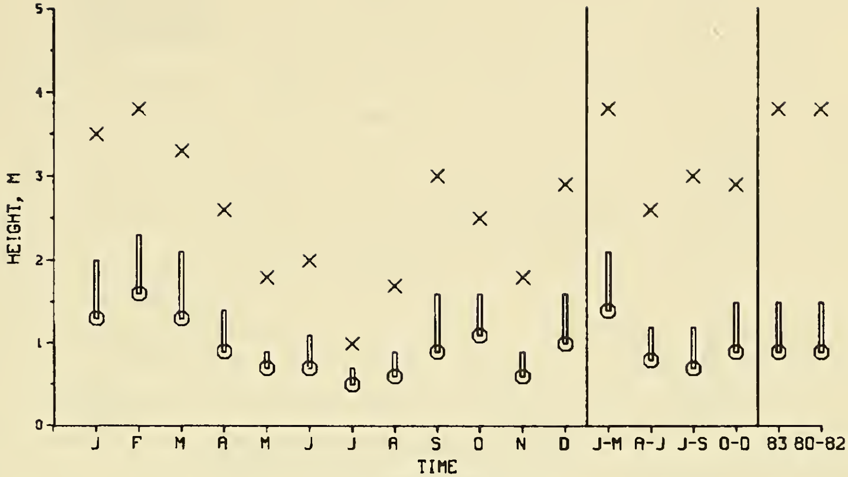


a. Wave height

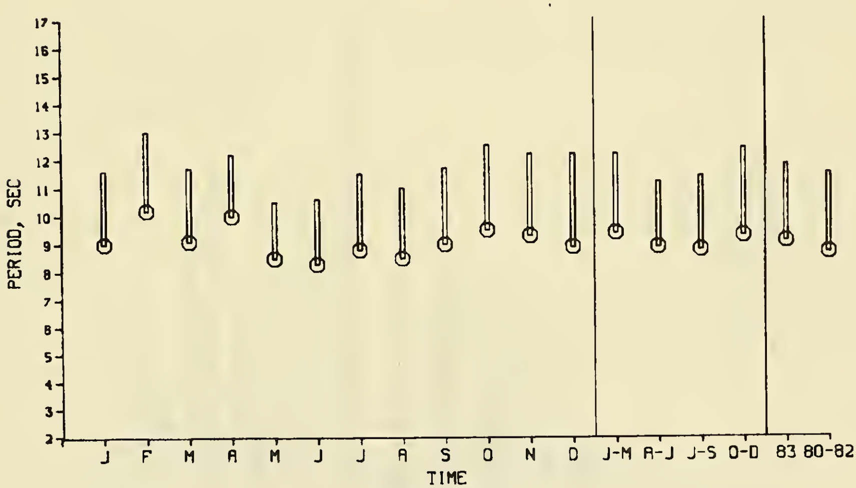


b. Wave period

Figure 12. 1983 wave statistics for gage 620



a. Wave height



b. Wave period

Figure 13. 1983 wave statistics for gage 625

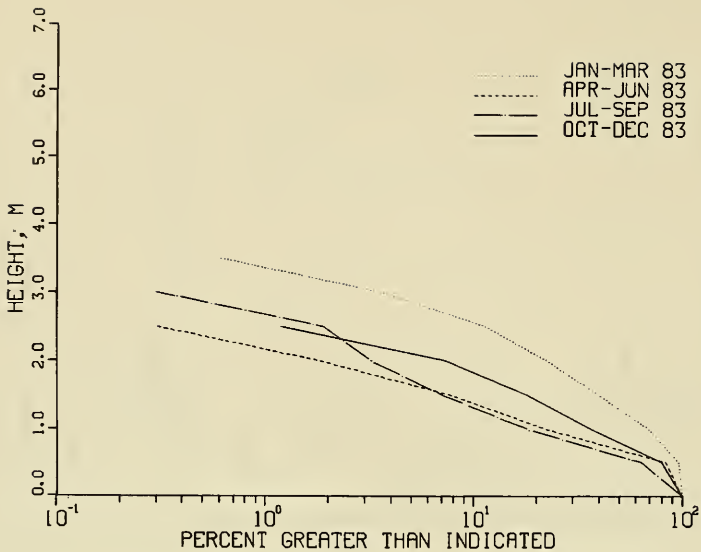


Figure 14. 1983 seasonal wave height distributions for gage 625

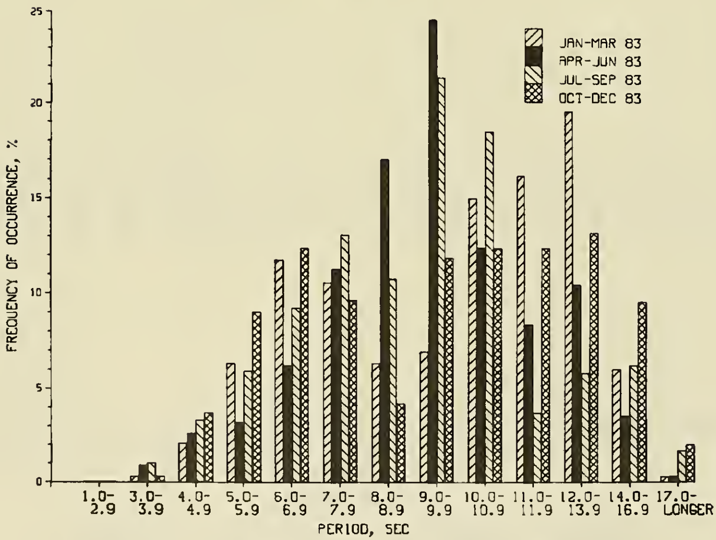


Figure 15. 1983 seasonal wave period distributions for gage 625

8 and 9 sec while more severe fall and winter wave conditions showed a higher proportion of longer period waves.

74. The distribution of wave directions for the year, based on visual observations (Figure 16), revealed that waves approached the north side of the pier 41 percent of the time, the southside 49 percent, and approximately shore-normal 10 percent. However, when wave heights exceeded 2 m at the seaward end of the pier, the waves approached 47 percent of the time from the north, 40 percent from the south, and 13 percent normal to shore.

75. Seasonal variation of wave direction is shown in Figure 17. The northerly tendency during winter and fall and the southerly tendency during spring and summer are consistent with wind distributions discussed previously.

Present versus past years

76. Wave height and period distributions for 1983 were similar to the combined 1980 through 1982 distributions. Figure 18 compares the heights and Figure 19 compares the periods for gage 625. There was a tendency for wave periods of 9 sec or longer to occur more often during the year. Seasonal distributions of wave heights showed that a relatively severe January through March was offset by a mild October through December.

77. Wave direction distribution for 1983 was similar to prior years, as can be seen in Figure 16b. Resultant wave height and direction values in Table 6 show that monthly consistency is lower than seasonal and annual.

All years combined

78. The 4-year data set between 1980 and 1983 provides the most complete description of the wave climate at the FRF. Figure 20 indicates that for the lower 97 percent of the wave heights for gages 620 and 625, the distributions are approximately the same. However, for wave heights greater than approximately 2.5 m, the Waverider shows a greater proportion of higher waves. Figure 21 indicates that spatial differences in wave period were small, except that there was a higher percentage of 5- to 6-sec waves at the nearshore Baylor than at both other sites.

79. The joint distributions of wave height versus period for gages 620 and 625 are shown in Tables 7 and 8. The distributions are based on over 4,670 observations, and the values presented can be converted to percent by dividing by 10. Higher waves are generally associated with longer wave periods.

80. Seasonal distributions of wave height and period for gage 625 are shown in Figures 22 and 23, respectively. Both heights and periods vary with

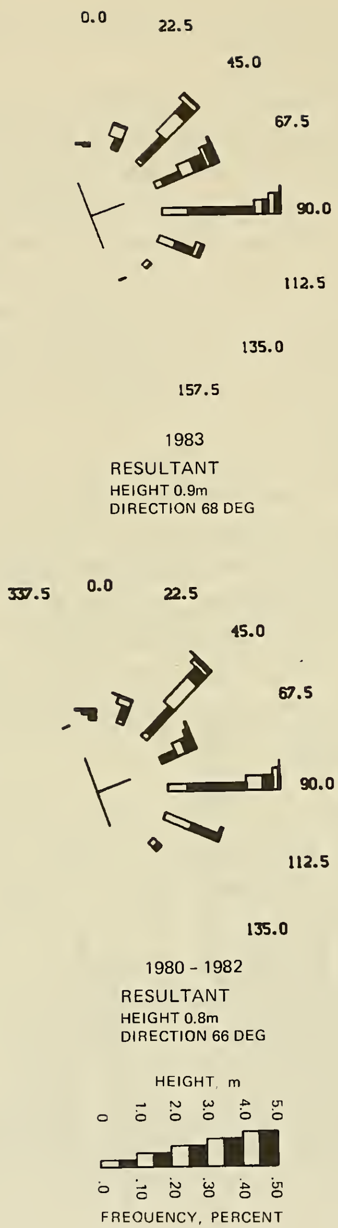


Figure 16. Comparison of annual wave roses for 1983 versus 1980-1982

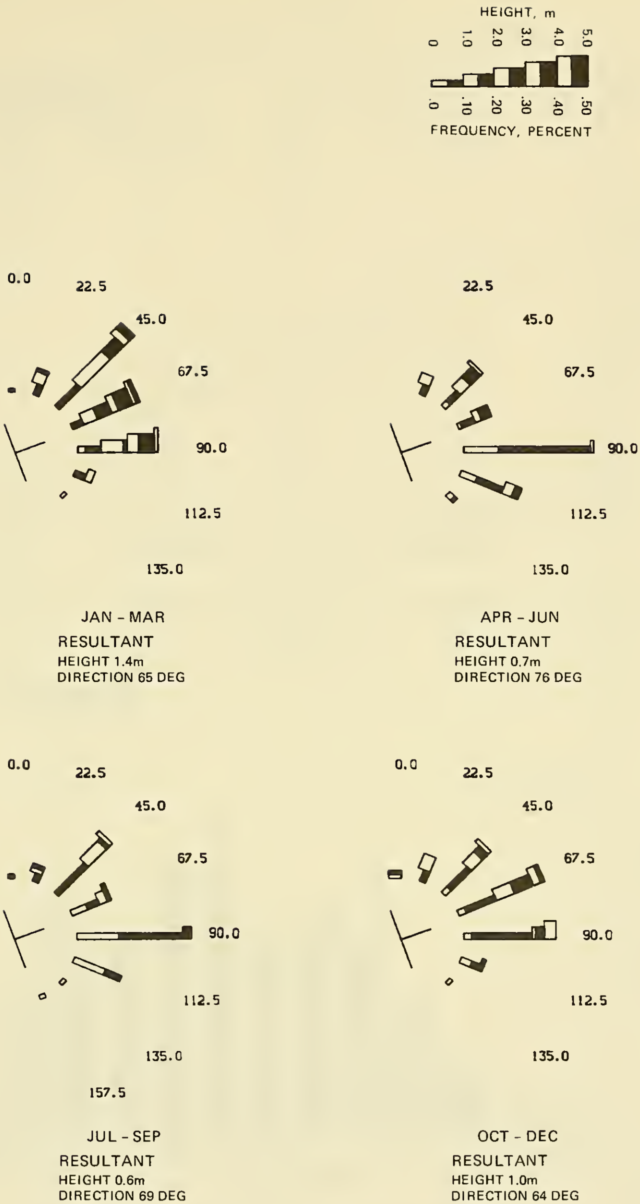


Figure 17. Seasonal variation of wave direction distributions for 1983

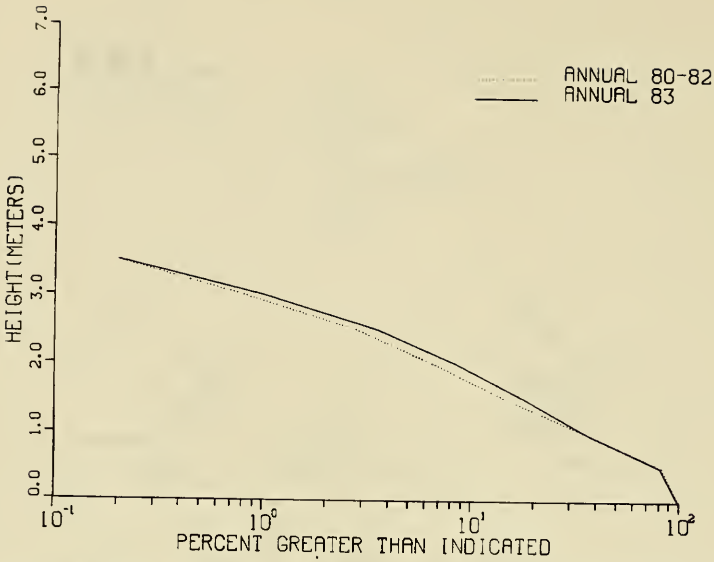


Figure 18. Comparison of annual wave height distributions for gage 625

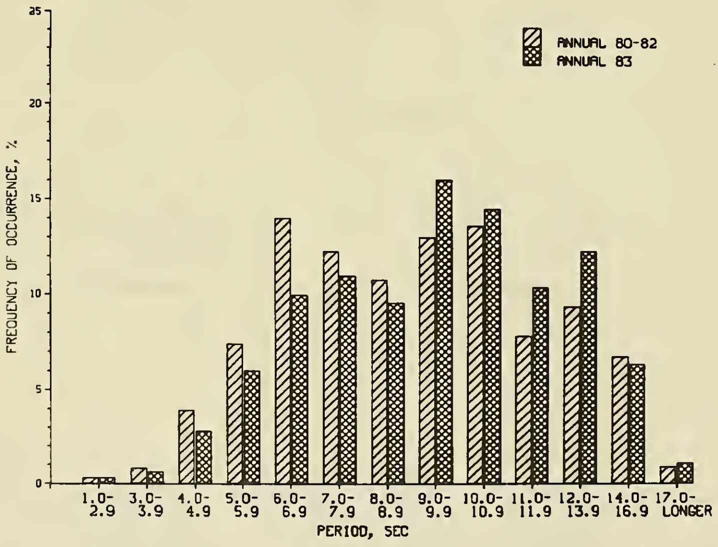


Figure 19. Comparison of annual wave period distributions for gage 625

Table 6

Resultant Wave Height and Direction

Season or Month	1983 Height m	1983 Direction deg True N	1980-1982 Height m	1980-1982 Direction deg True N	1980-1983 Height m	1980-1983 Direction deg True N
Annual	0.9	68	0.8	66	0.8	47
Jan-Mar	1.4	65	0.9	62	1.4	65
Apr-Jun	0.7	76	0.6	76	0.7	76
Jul-Sep	0.6	69	0.6	72	0.6	71
Oct-Dec	1.0	64	1.0	60	1.0	61
Jan	1.3	61	0.8	50	0.9	54
Feb	1.6	66	1.0	64	1.1	65
Mar	1.1	67	0.9	68	1.1	67
Apr	0.8	69	0.7	70	0.7	70
May	0.6	79	0.7	77	0.7	78
Jun	0.6	81	0.6	81	0.6	81
Jul	0.4	73	0.4	79	0.4	73
Aug	0.6	75	0.6	70	0.6	71
Sep	0.8	63	0.8	70	0.8	68
Oct	1.0	64	1.1	64	1.1	64
Nov	0.6	65	1.1	57	1.0	58
Dec	1.0	62	0.9	60	0.9	61

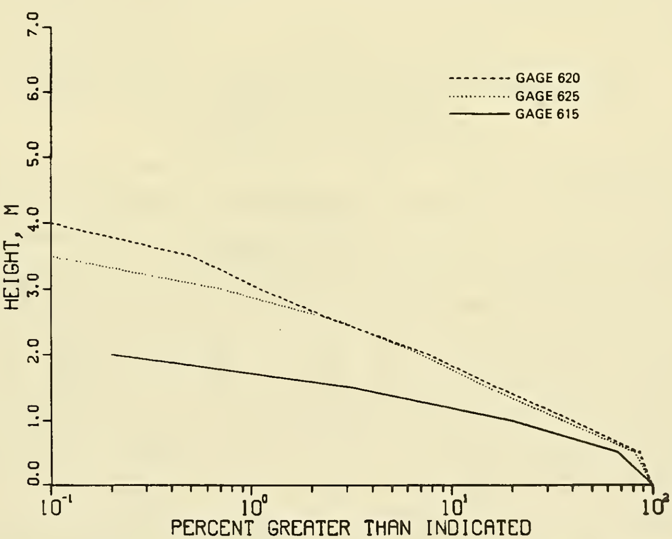


Figure 20. Wave height distributions, 1980 through 1983

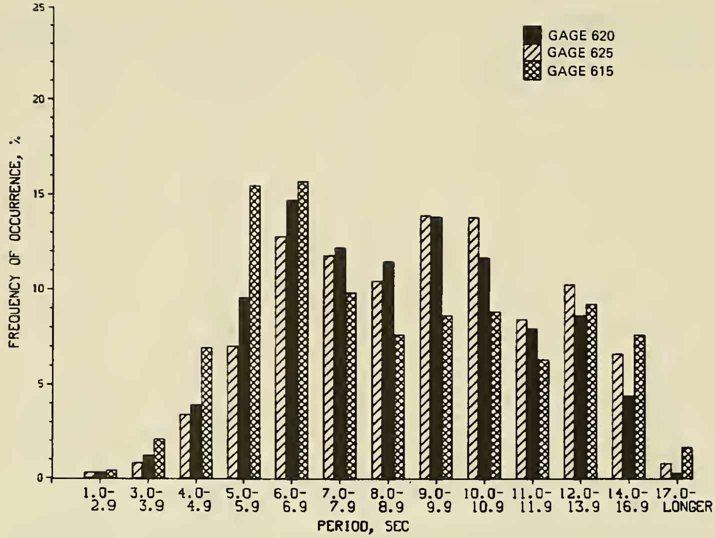


Figure 21. Wave period distributions, 1980 through 1983

Table 7

1980 Through 1983 Joint Distribution of Wave Height Versus Period for Gage 620

ANNUAL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	1	1	3	6	7	11	22	31	14	6	17	10	1	130
.50 - .99	2	10	27	44	55	51	61	73	59	37	25	19	2	465
1.00 - 1.49	.	1	9	34	47	32	18	19	25	20	19	4	.	228
1.50 - 1.99	.	.	.	9	28	14	7	6	9	6	12	4	.	95
2.00 - 2.49	.	.	.	2	8	10	4	4	5	5	7	5	.	50
2.50 - 2.99	.	.	.	.	1	3	1	2	2	2	4	1	.	16
3.00 - 3.49	.	.	.	.	.	.	1	1	1	1	1	1	.	6
3.50 - 3.99	.	.	.	.	.	.	.	1	1	1	1	.	.	4
4.00 - 4.49	.	.	.	.	.	.	.	.	.	1	.	.	.	1
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	12	39	95	146	121	114	137	116	79	86	44	3	

Table 8

1980 Through 1983 Joint Distribution of Wave Height

Versus Period for Gage 625

ANNUAL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	2	2	4	10	19	23	36	25	11	22	19	2	175
.50 - .99	.	6	27	34	52	46	54	73	71	37	31	24	6	461
1.00 - 1.49	.	.	5	27	42	30	15	17	25	18	21	5	.	205
1.50 - 1.99	.	.	.	5	19	15	4	5	8	9	12	6	.	83
2.00 - 2.49	.	.	.	.	4	5	4	4	4	6	9	7	.	43
2.50 - 2.99	.	.	.	.	.	2	3	2	3	2	5	4	.	21
3.00 - 3.49	.	.	.	.	.	.	1	1	1	1	1	1	.	6
3.50 - 3.99	.	.	.	.	.	.	.	.	.	..	1	.	.	1
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	34	70	127	117	104	138	137	84	102	66	8	

season; however, the winter-autumn versus spring-summer differences are the largest.

81. Annual and seasonal wave direction distributions for the combined years are shown in Figure 24. Fifty-two percent of the waves approach from the south, 43 percent from the north, and 5 percent approximately shore-normal. When wave heights exceed 2 m, 57 percent approach from the north, 34 percent from the south, and 9 percent shore-normal.

Longshore Currents

82. In this section, the results of daily surface longshore current measurements are presented. Figure 25 shows the 1983 measurements at the beach, pier midsurf, and pier end locations. Since the relative influences of the winds and waves vary with position from shore, the current speeds and, to some extent, direction vary at the three current measurement locations. Magnitudes generally are the largest at the midsurf location and smallest at the end of the pier. However, annual mean currents (Table 9) were directed southward at 6 cm/sec at the beach location, only 2 cm/sec at the midsurf location, and 13 cm/sec at the seaward end of the pier. Despite frequent reversals, the mean monthly currents were directed southward during fall and winter and northward during spring and summer. This seasonality of currents was consistent with wind and wave patterns previously discussed.

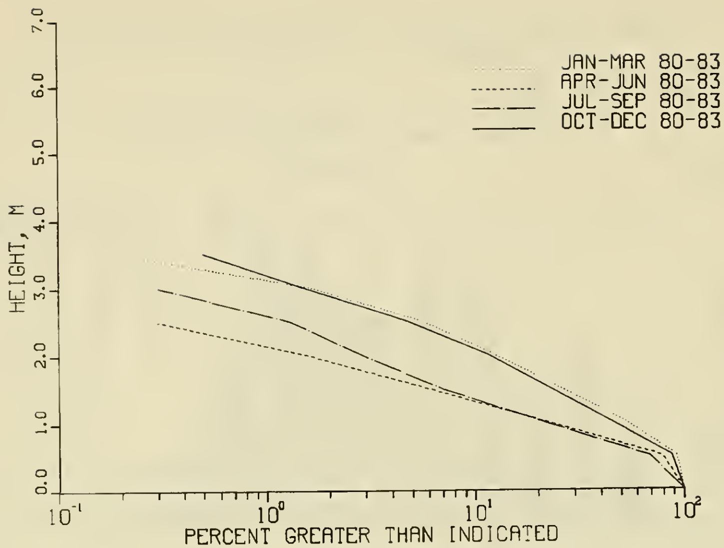


Figure 22. 1980 through 1983 seasonal wave height distributions for gage 625

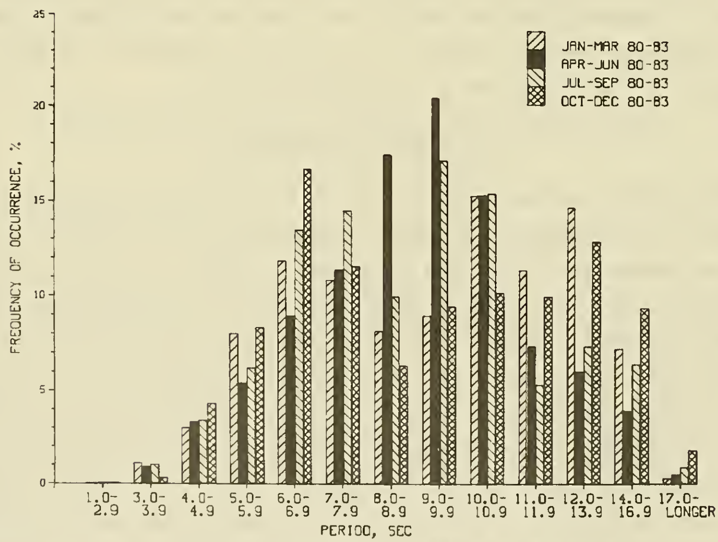


Figure 23. 1980 through 1983 seasonal wave period distributions for gage 625

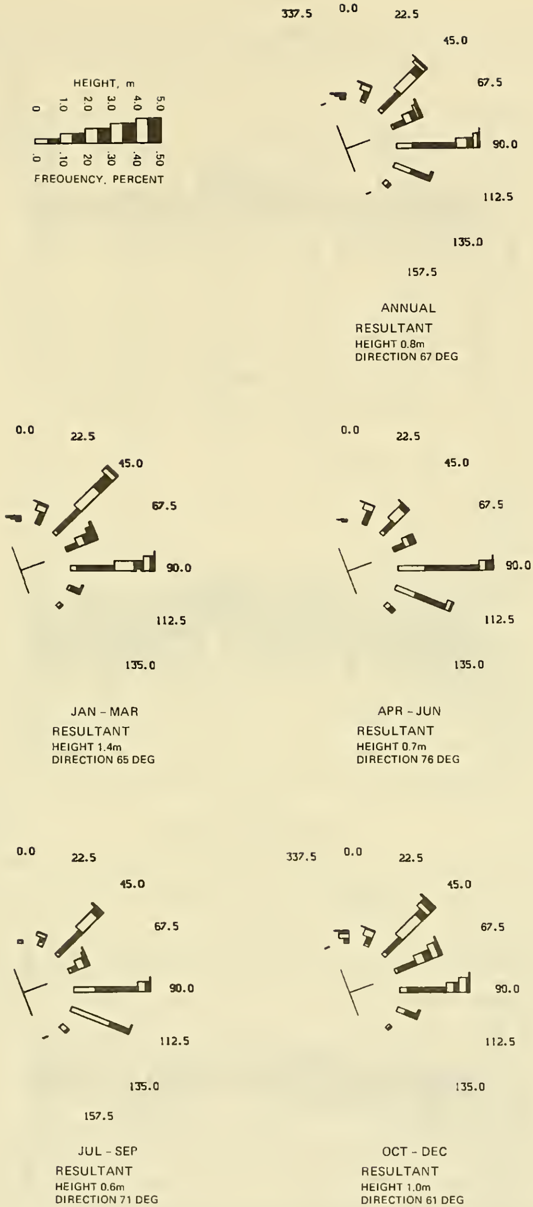
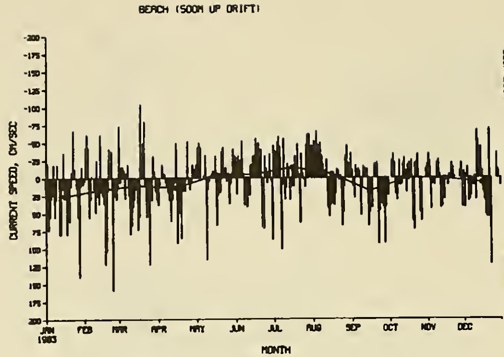
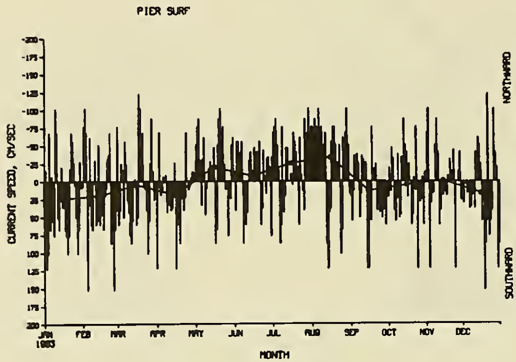


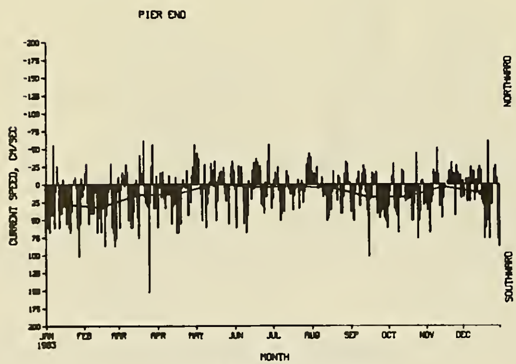
Figure 24. Annual and seasonal wave direction distributions, 1980 through 1983



a. Beach 500 m updrift location



b. Midsurf location



c. Pier end location

Figure 25. 1983 daily surface longshore current measurements

Table 9

Annual and Monthly Mean Longshore Surface Current

Speed (cm/sec) and Direction*

Month	Beach 1983	Beach 81-82	Beach 81-83	Pier Midsurf 1983	Pier Midsurf 81-82	Pier Midsurf 81-83	Pier End 1983	Pier End 80-82	Pier End 80-83
Jan	25	14	17	24	21	22	27	17	20
Feb	16	10	12	20	6	10	33	24	26
Mar	11	8	9	5	4	4	15	19	26
Apr	14	0	4	19	-13	-5	14	9	10
May	-4	-3	-3	-20	9	-12	0	11	8
Jun	-5	-12	-10	-7	-20	-17	4	6	6
Jul	-14	-16	-16	-25	-20	-21	3	4	4
Aug	-5	-10	-9	-33	-8	-14	5	8	7
Sep	19	-7	-1	14	-10	-4	18	11	13
Oct	1	14	4	5	11	10	18	10	12
Nov	1	17	13	-1	15	11	4	14	12
Dec	7	11	10	17	19	19	12	11	11
Annual	6	2	3	2	-1	0	13	12	12

* A minus sign indicates currents flowed northward.

1983 versus previous years

83. Longshore surface currents for 1983 were reasonably consistent with previous years of data (Figures 26-28). However, at the midsurf location, the monthly means were directed to the south in response to storm waves during April and September.

All years combined

84. All locations show consistent temporal variations and distinct spatial differences in both magnitude and direction (Figure 29). Near-zero annual means (Table 9) for both locations within the surf zone reflect the seasonal variations and frequent reversals caused by the varying wind and wave conditions at the FRF. These contrast with the predominantly southward currents at the pier end.

Tides and Water Levels

85. Water level variations caused by astronomical and meteorological forces are discussed in this section. Results for 1983 are followed by a comparison with previous data. All tidal heights are referenced to the local 1929 NGVD unless otherwise stated.

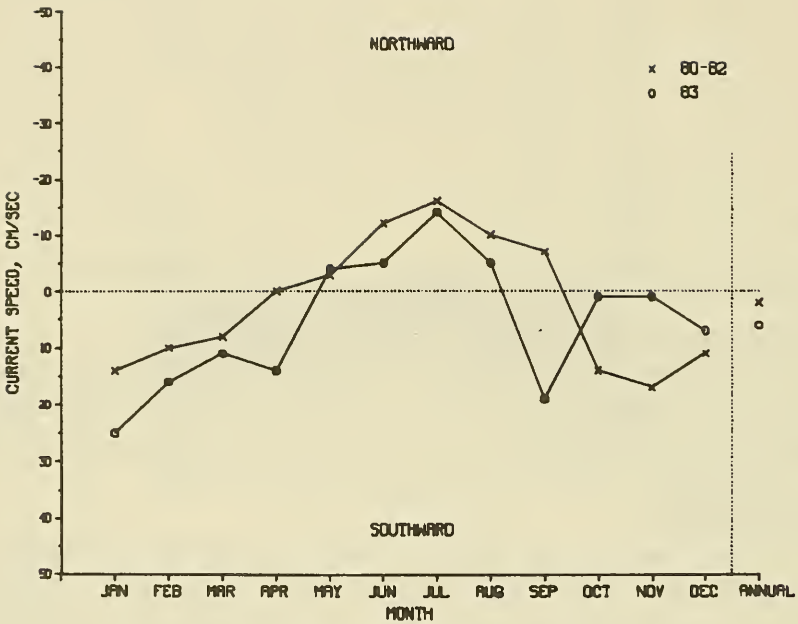


Figure 26. Comparison of surface currents at the beach 500 m updrift

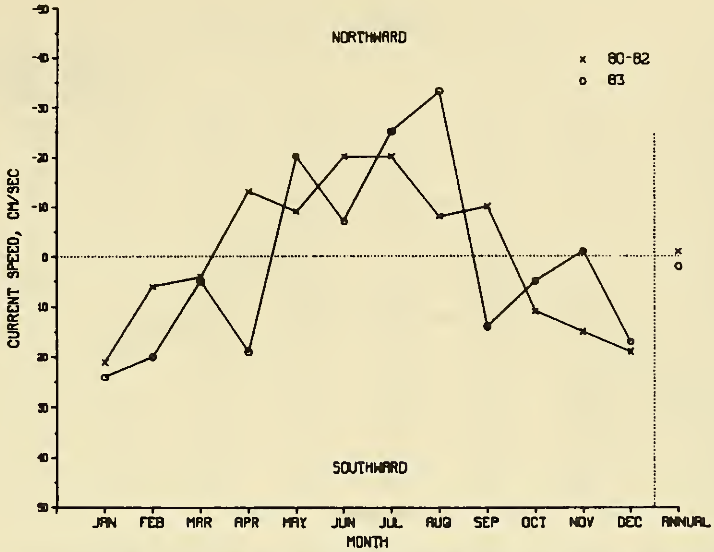


Figure 27. Comparison of surface currents at the midsurf location

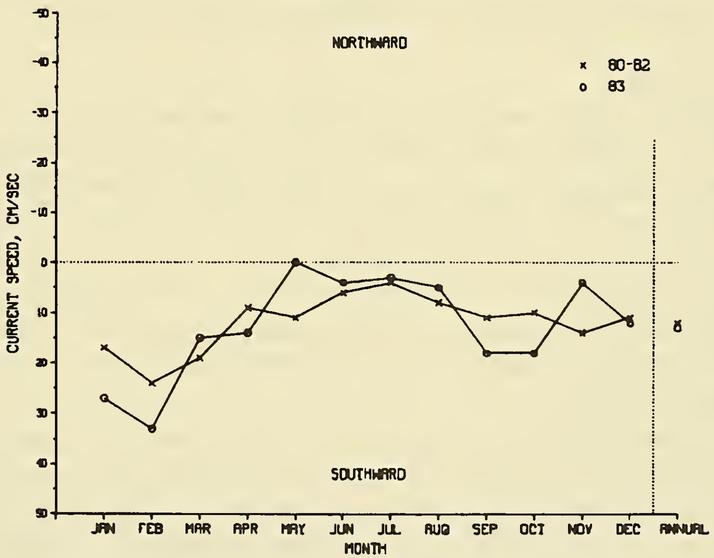


Figure 28. Comparison of surface currents at the seaward end of the pier

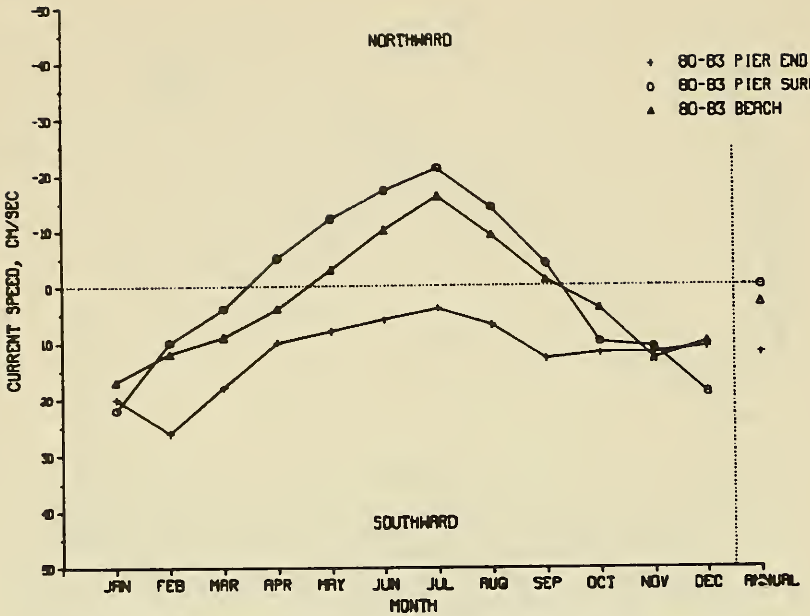


Figure 29. Comparison of surface currents at the FRF pier

Present data year

86. Tide height statistics for 1983 are presented in Table 10. Tides at the FRF are semidiurnal with both daily high and low tides approximately equal. Mean range varied from 95 cm in late spring to 102 cm in January. Mean sea level was 19 cm above NGVD. The highest water level for the year was measured on 28 January during the time of a severe storm with waves in excess of 3.6 m at the seaward end of the pier (Part IV). This extreme is within a few centimetres of the highest water level measured since 1978. Water levels in excess of 130 cm occurred on 25 March and 25 October during storms.

1983 versus past years

87. Since late 1981 there has been a rising trend for the water levels at the FRF (Table 10 and Figure 30). Mean sea level and other mean level statistics are approximately 10 cm above prior years. This same trend has been verified at nearby locations such as Hampton Roads, Va. In Figure 31, the distribution of daily high, daily low, and hourly tidal heights for 1983 and prior years are presented for comparison. The curves show the effect of

Table 10

Mean Tide Height Statistics, cm

Month or Year	MHW	MTL	MSL	MLW	MR	EX H	Date	EX L	Date
Jan	66	15	15	-36	102	143	28	-70	25
Feb	71	22	23	-26	98	118	26	-57	28
Mar	77	26	27	-24	101	132	25	-73	28
Apr	63	15	15	-34	97	108	16	-64	30
May	54	7	6	-41	95	97	17	-63	1
Jun	63	16	16	-32	95	98	10	-58	12
Jul	64	16	16	-32	96	111	10	-64	13
Aug	68	19	20	-29	97	105	13	-60	9
Sep	75	26	27	-22	97	104	29	-58	7
Oct	80	31	31	-17	97	132	25	-57	6,29
Nov	69	19	20	-31	100	110	25	-71	26
Dec	62	13	14	-36	98	113	20,21	-70	8
1983	68	19	19	-30	98	143	Jan	-73	Mar
1979-1982	59	8	9	-43	101	149	Nov 1981	-119	Mar 1980
1982	58	8	9	-42	99	127	Oct	-108	Feb
1981	59	8	9	-42	101	149	Nov	-110	Apr
1980	59	8	8	-43	102	118	Mar	-119	Mar
1979	60	9	9	-43	103	121	Feb	-95	Sep

Note: All elevations refer to 1929 NGVD.
Explanation of abbreviations: MHW = mean high water; MTL = mean tide level; MSL = mean sea level; MLW = mean low water; MR = mean range; EX H = extreme high water; and EX L = extreme low water.

Figure 30. Monthly tide and water level statistics for 1978 through 1983

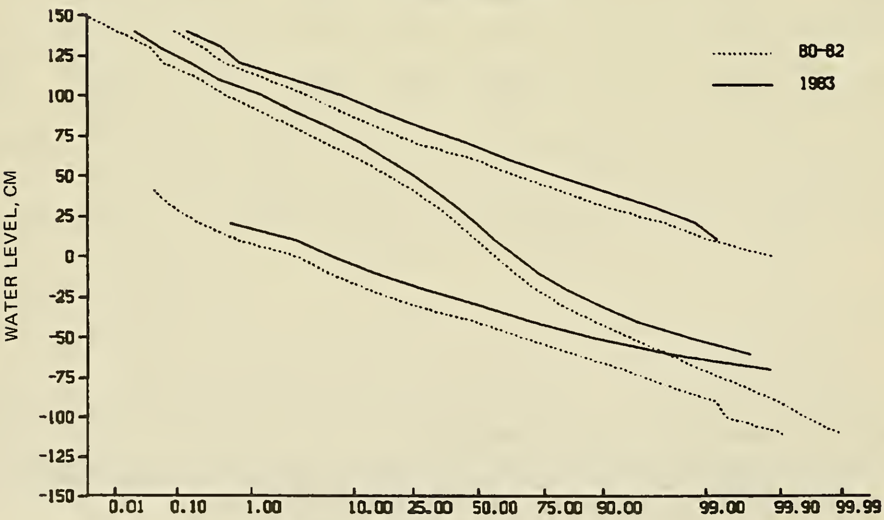


Figure 31. Comparison of hourly tide heights and daily high/low water level distributions

the 10-cm mean variation and the tendency for the daily lows to be somewhat higher than for prior years.

Combined years

88. Based on the distribution of the tide heights for 1980 through 1983 (Figure 32), the tide can be expected to exceed 110 cm for 0.25 percent of the time (110 hr). Likewise, the height can be expected to be less than -80 cm for 0.25 percent of the time (111 hr).

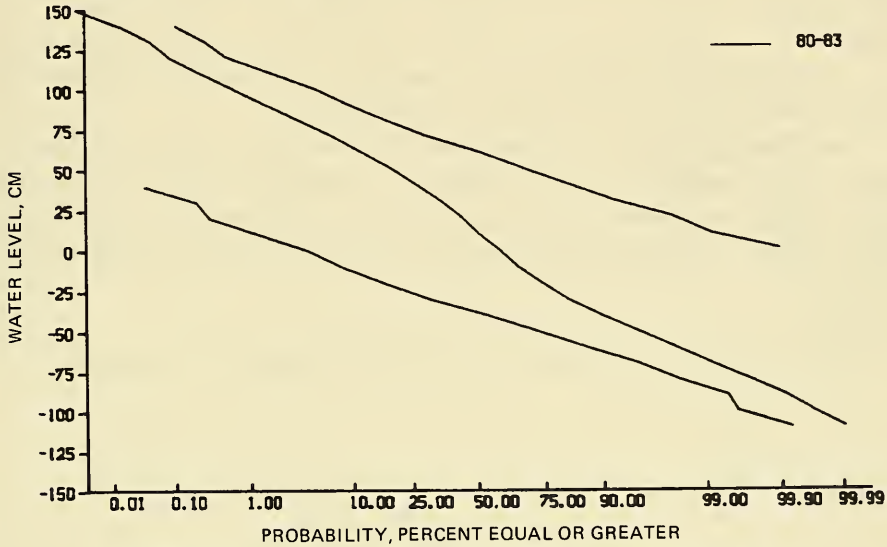


Figure 32. Distribution of hourly tide heights and daily high/low water levels for 1980 through 1983

Water Characteristics

89. The results of daily measurements of surface water temperature, visibility, and density are presented in this section. The summaries represent single observations made near 0700 EST and therefore may not reflect daily average conditions since such characteristics can change rapidly within a 24-hr period. A discussion of 1983 data is followed by a comparison with previous years.

Water temperature

90. Present year. Daily sea-surface water temperatures at the seaward

end of the FRF pier (Figure 33) experienced large variations during June through September when frequent offshore winds blew warm surface water seaward, allowing upward and landward circulation of much colder and more turbid bottom water. Persisent offshore winds (as high as 10 m/sec) during the first 12 days of August were responsible for unseasonably cold water temperatures during the month. Onshore winds reversed this circulation, piling up warm surface water against the shoreline. Monthly mean temperatures (Table 11) were lowest during January through March and highest from July through September.

91. 1983 versus prior years. In general, water temperatures during the year were higher than for prior years (Figure 34).

92. Combined years. The distribution of surface water temperatures for all years combined is shown in Figure 35. Temperatures in excess of 25° C can be expected 4 percent of the time (or 14 days per year), while temperatures below 4° C can be expected less than 6 percent of the time (or 20 days per year).

Visibility

93. Visibility in coastal nearshore waters depends on the amount of

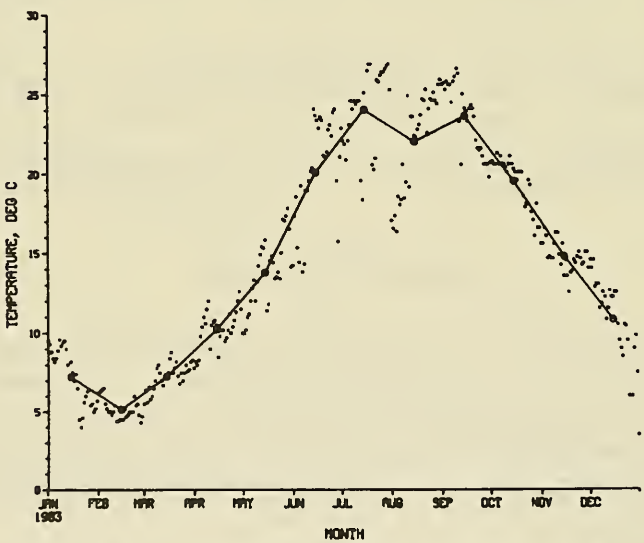


Figure 33. Daily sea-surface water temperature for 1983

Table 11

Mean Surface Water Characteristics Measured at the Seaward End of the FRF Pier

Month	Temperature, ° C			Visibility, m			Density, g/cc		
	1983	80-82	80-83	1983	80-82	80-83	1983	81-82	81-83
Jan	7.2	4.6	5.3	1.0	1.4	1.3	1.0237	1.0250	1.0245
Feb	5.1	4.1	4.4	0.9	1.5	1.4	1.0239	1.0243	1.0241
Mar	7.3	5.9	6.2	1.0	1.3	1.2	1.0233	1.0237	1.0236
Apr	10.2	10.6	10.5	2.1	2.1	2.1	1.0225	1.0252	1.0243
May	13.9	15.6	15.2	3.0	2.3	2.5	1.0235	1.0234	1.0235
Jun	20.0	19.5	19.6	3.6	3.5	3.5	1.0199	1.0223	1.0215
Jul	24.0	21.7	22.3	4.2	3.7	3.8	1.0201	1.0217	1.0212
Aug	21.9	22.4	22.3	2.8	3.0	2.9	1.0217	1.0216	1.0216
Sep	23.5	22.4	22.7	1.8	2.0	1.8	1.0210	1.0219	1.0216
Oct	19.4	18.4	18.7	1.0	1.3	1.2	1.0218	1.0227	1.0224
Nov	14.7	13.6	13.9	1.1	0.9	1.0	1.0237	1.0236	1.0236
Dec	10.8	9.3	9.7	1.0	0.9	1.0	1.0233	1.0245	1.0241
Annual	14.8	14.0	14.2	2.0	2.0	2.0	1.0224	1.0233	1.0230

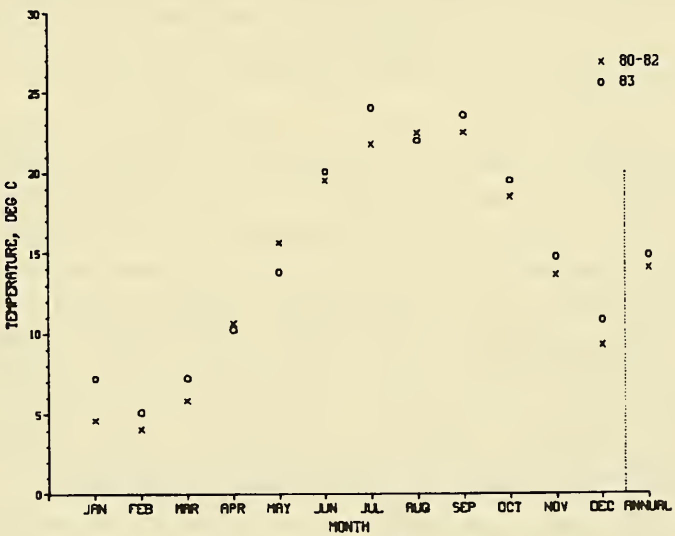


Figure 34. Comparison of mean surface water temperatures

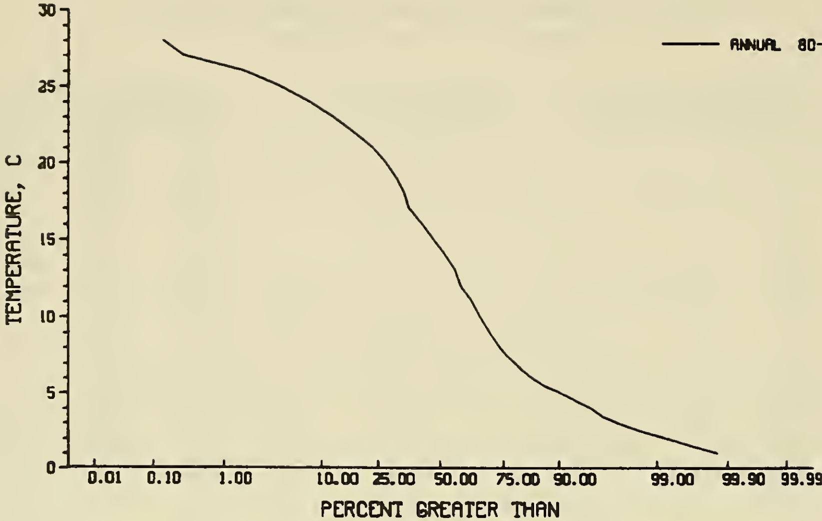


Figure 35. Distribution of surface water temperatures for 1980 through 1983

salts, soluble organic material, detritus, living organisms, and inorganic particles in the water. These dissolved and suspended materials change the absorption and attentuation characteristics of the water, which vary daily and throughout the year.

94. The surface water visibility at the seaward end of the pier varies in a manner similar to that of the temperature, with lows in January through March and highs in June and July (Figure 36). Since the pattern of offshore and onshore winds that produces major temperature differences also controls the visibility, the warm surface water is usually clearer, while the cooler bottom water contains large concentrations of suspended matter.

95. Present data year. Daily water visibility values, measured at the seaward end of the pier using a secci disc, reflect the wind-dominated processes discussed above. Between May and August the visibility was occasionally above 6 m, however, visibility was less than 2 m almost as often during those months. Table 11 shows the monthly means for the year.

96. 1983 versus prior years. Visibility during 1983 was similar to prior years (Figure 37), although visibility was lower during January through March and higher during May through July.

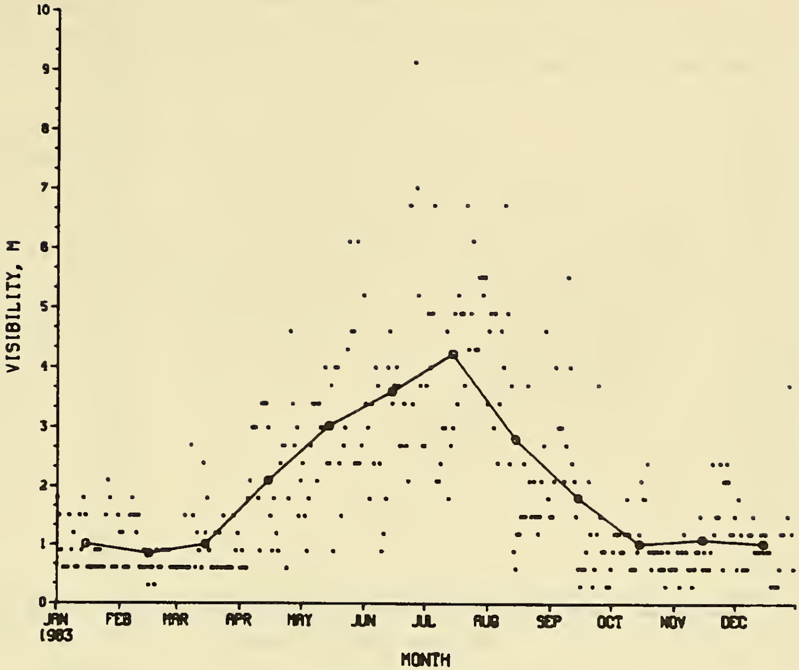


Figure 36. Daily sea-surface water visibility for 1983

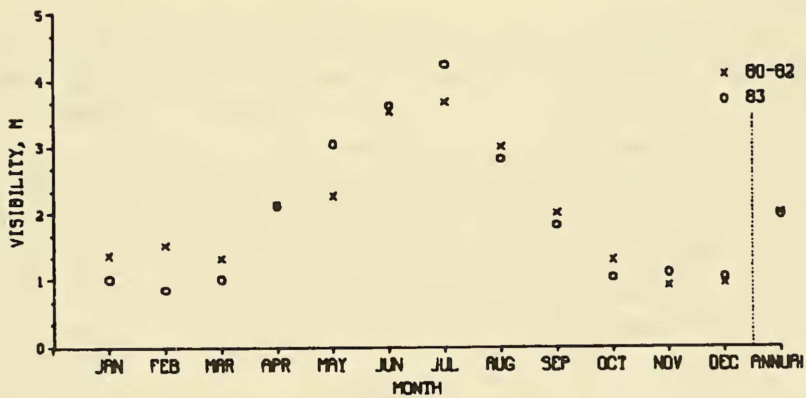


Figure 37. Comparison of mean surface water visibility

97. All years combined. Figure 38 shows the distribution of daily values for 1980 through 1983. For 121 days a year, the visibility at the FRF can be expected to be less than 1 m; while for 73 days a year, the visibility can be expected to be greater then 3 m.

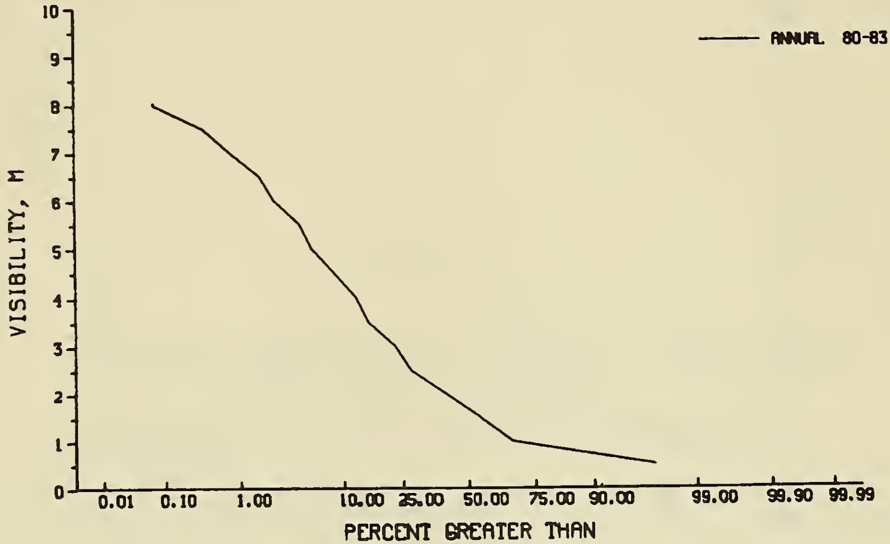


Figure 38. Distribution of surface water visibility for 1980 through 1983

Density

98. Present year. Daily density values show large daily variations (Figure 39). In general, the density varies inversely with water temperature such that maxima occur during the winter and minima during the summer. Table 11 shows the monthly means for the year.

99. 1983 versus prior years. The density throughout 1983 was lower than for prior years (Figure 40), which is consistent with the water temperatures being higher during the year as discussed above.

100. All years combined. The distribution of daily surface water density for 1981 through 1983 is shown in Figure 41.

Surveys

101. Waves and currents interacting with bottom sediments produce

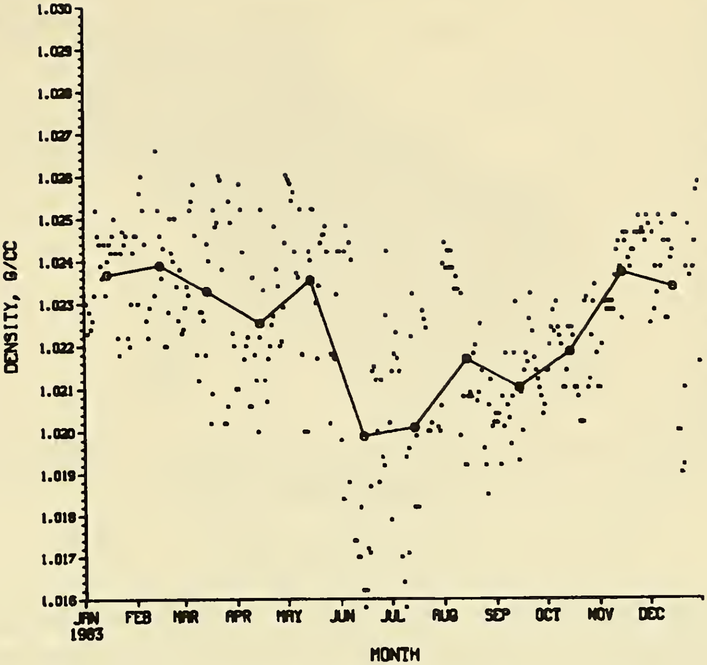


Figure 39. Daily sea-surface water density for 1983

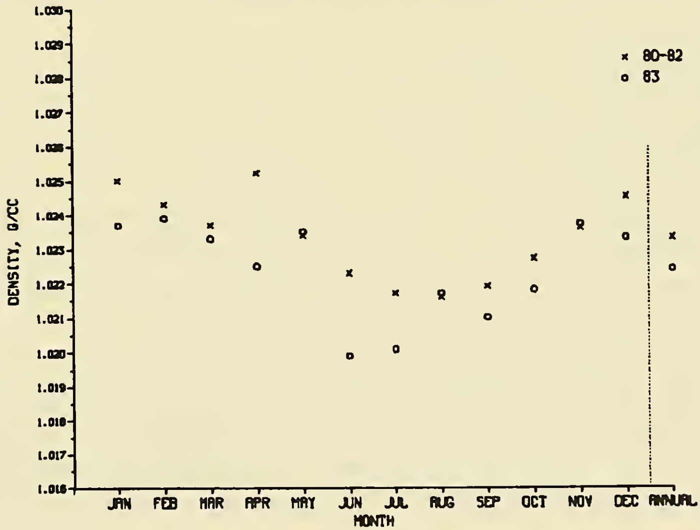


Figure 40. Comparison of mean sea-surface water density

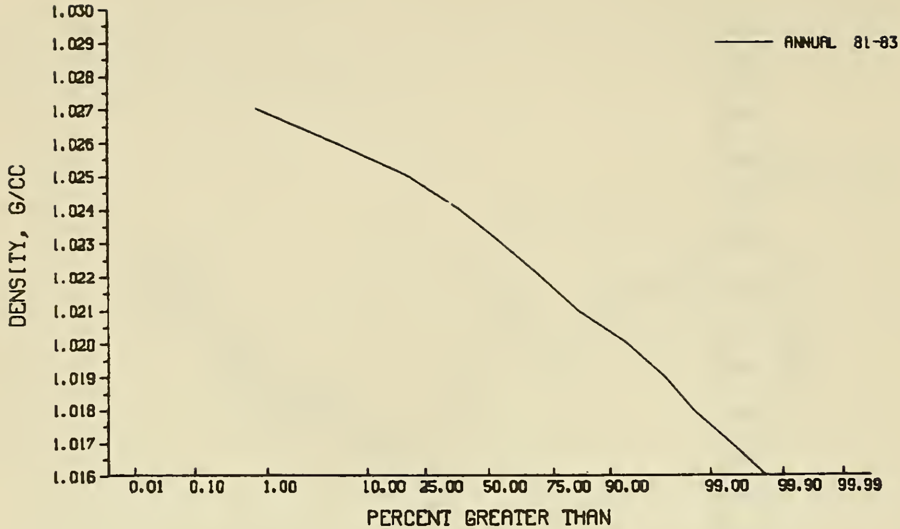


Figure 41. Distribution of surface water density for 1981 through 1983

changes in the beach and nearshore bathymetry. These changes can occur very rapidly in response to storms or slowly as a result of persistent but less forceful seasonal variations in wave and current conditions.

102. To document the temporal and spatial variability in bathymetry, surveys were conducted approximately monthly in an area extending 600 m north and south of the pier and approximately 950 m offshore. During January, May, July, and November, 24 profile lines were surveyed, while the remaining surveys consisted of approximately 15 profile lines each. In addition, soundings were taken on both the north and south sides of the pier.

103. A brief discussion of the effect of the research pier on the bathymetry precedes discussions of time-histories of bottom elevations at selected locations along the pier and contour diagrams of the bathymetry.

Pier effect

104. The research pier introduces a perturbation in bathymetry (Figure 42) in the form of a permanent trough under the pier, apparently a result of the interaction of waves and currents with the pilings. The trough deepens under the seaward end of the pier and varies in shape and depth with changing wave and current conditions. The pier's effect on shore-parallel contours

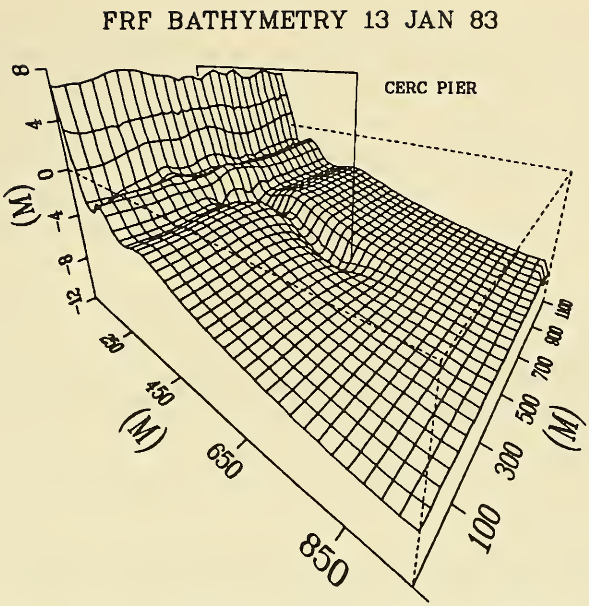


Figure 42. Permanent trough under the FRF pier

occurs as far away as 300 m, and the shoreline may be affected up to 350 m from the pier (Miller, Birkemeier, and DeWall 1983).

<u>History of bottom elevations</u>

105. Useful for interpretation of the wave data, a history of the bottom elevations is presented at the Baylor wave gage locations, pier sta 6+20 (189 m) and sta 19+00 (579 m); histories at intermediate locations at 323 and 433 m are also included (Figure 43). Variations of elevation under the pier are due to natural processes (such as profile changes due to bar movement) as well as scour due to the interaction of the pier piles with waves and currents. At the beginning of the year, the scour hole at the seaward end of the pier was 8.5 m deep. Following a storm in late January, the scour hole deepened to 9 m (measured during the 8 February survey). However, the scour hole rapidly shoaled to 8 m by late March due to unseasonably mild wave conditions. The scour hole, slightly less than 8 m deep, remained stable through the spring and summer. Tropical Storm Dean (28-30 September) caused 1 m of erosion in the scour hole as measured in the 1 October survey. By the end of the year sediment had again accumulated, and the depth was 8 m.

106. At 189 m, the depth varied more slowly with the seasonal trends in

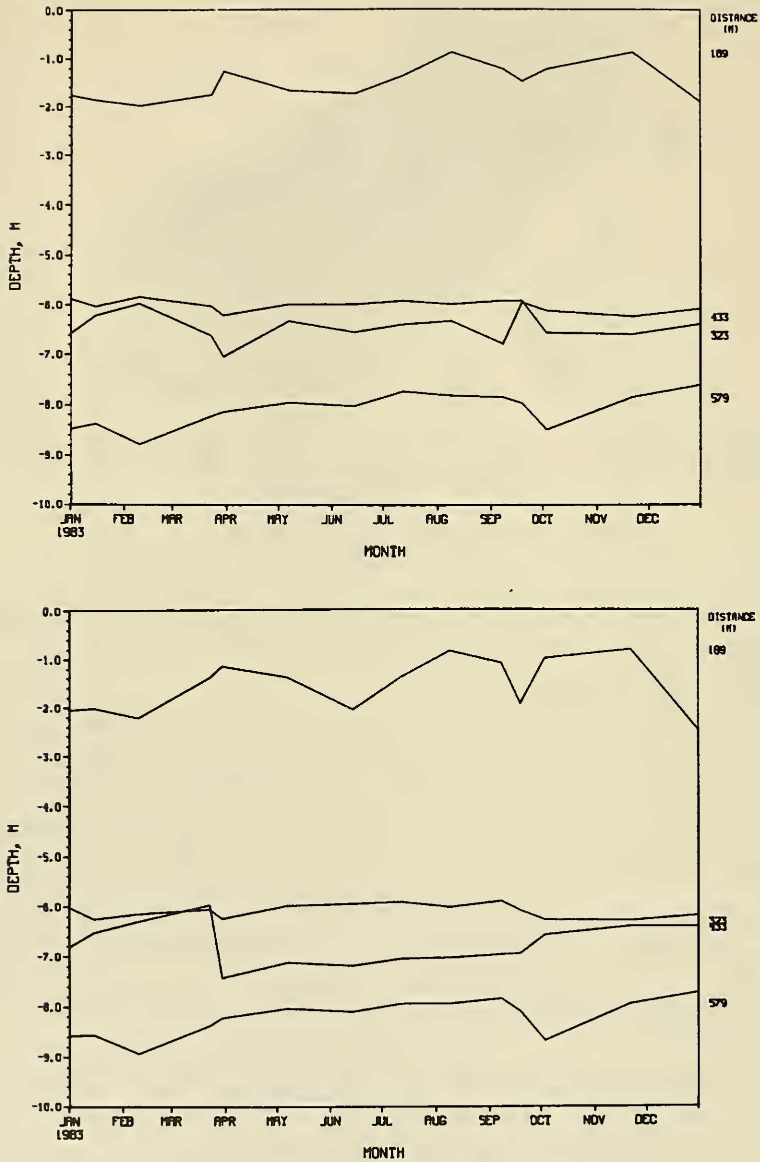


Figure 43. Time-history of the bottom elevations at selected locations under the FRF pier

the wave climate than did the scour hole. However, in September Tropical Storm Dean caused rapid erosion of 0.7 m, which was followed by rapid recovery. At 323 m, the depth remained relatively stable until September when 1 m of erosion occurred during Tropical Storm Dean. At 433 m, large waves at the end of March caused over 1 m of erosion due to the seaward movement of the offshore bar. Recovery was slow, only 0.25 m, until Tropical Storm Dean eroded the inshore (at 323 m) and reformed an offshore bar near 433 m.

Bathymetry

107. Contour diagrams created from the data obtained during the bathymetric surveys are presented in Appendix C; characteristics of the bathymetric conditions are discussed below. Figure 44 shows the locations of the profile lines surveyed away from the pier during the monthly bathymetric surveys.

108. The first survey of the year was performed on 13 and 14 January. The contours away from the pier are relatively straight and shore parallel. However, the trough was symmetric seaward of 350 m and widened to the south between 250 and 350 m, indicating recent wave action from the north.

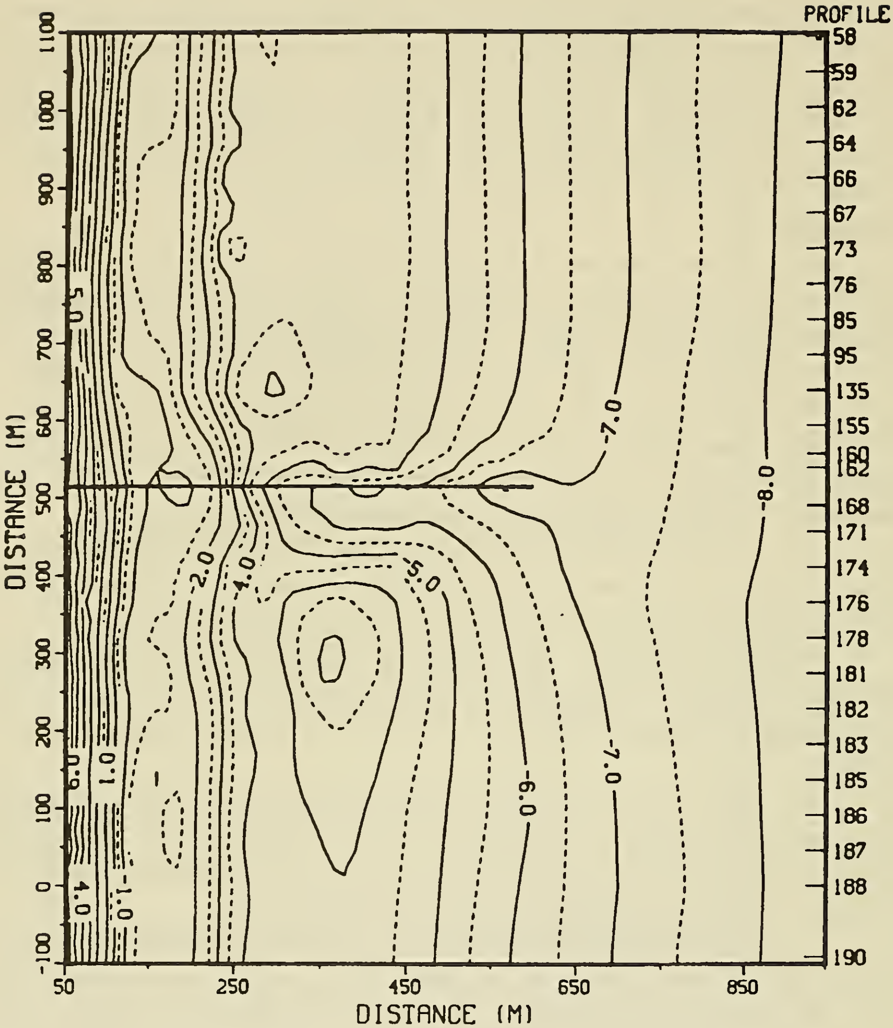
109. The next survey, performed on 7 and 8 February. shows small amounts of erosion and accretion on the beach at various locations away from the pier with up to 0.5 m of accretion along the pier out to 450 m.

110. The survey on 27 and 28 March revealed minor shoaling along the entire surveyed area between 250 and 450 m from shore. The trough was symmetric along the entire length with up 0.5 m of accretion since the February survey.

111. Up to 0.75 m of erosion of the nearshore bar was measured during the 4 and 5 May survey. The trough was slightly asymmetric with a steep side to the north and a gently sloping side to the south, indicative of southerly currents. Only minor changes were observed through June.

112. The 11-12 July survey showed up to 0.5 m of sediment had eroded between 100 and 200 m offshore. A similar amount of deposition occurred from 50 to 100 m offshore throughout the survey area. As much as 1.25 m of accretion occurred at the landward end of the pier, creating a large fillet (bulge in the foreshore). The trough narrowed along the seaward-half of the pier due to the deposition of 0.25 m of sediment.

113. The bathymetry was observed to continue to change from the 8 August survey. Deposition occurred in a rip channel located 200 m north of the pier. A prominent area of accretion (+0.25 m) occurred at about msl under the



FRF BATHYMETRY 21 NOV 83
CONTOURS IN METERS

Figure 44. Profile locations at the FRF

pier, and extended 100 m north and 150 m south of the pier. In addition, the trough under the pier enlarged about 25 m to the south along the seaward 200 m of the pier.

114. Two surveys were performed in September: one survey the first week and one pre-Tropical Storm Dean survey on the 18th (this was only a partial survey and is not presented in Appendix C). Both indicated very minor changes since the August survey.

115. Following Tropical Storm Dean (Part IV), a survey was completed on 1 October. Several deep areas of erosion occurred under and near the pier as well as along much of the -1.0 to -2.0 m contours. Accretion occurred in areas located 200 to 300 m north and south of the pier, generally between the -2.0 and -4.0 m contours. The large shoal south of the pier (300 m) also accreted up to 0.5 m. Figure 45 shows the prestorm and poststorm bathymetry changes as contours of accretion and erosion.

116. The last survey of the year was completed on 21 November. This survey showed as much as 0.75 m of erosion along the nearshore bar (100 to 200 m) and the seaward face of the offshore bar (400 to 500 m). Deposition of up to 1 m of sediment occurred in the trough under the pier and between the bars from 200 to 400 m.

Photography

117. Two sets of photographic data were used during 1983 to document nearshore and beach conditions in the vicinity of the FRF. Daily 35mm transparencies were taken of the beach from the pier while looking both north and south (Figure 46). Approximately every 4 months, aerial photographic missions were also flown on the flight lines and dates indicated in Table 12, usually at a scale of 1:12,000. Figure 47 is a sample of the imagery obtained on 3 October 1983.

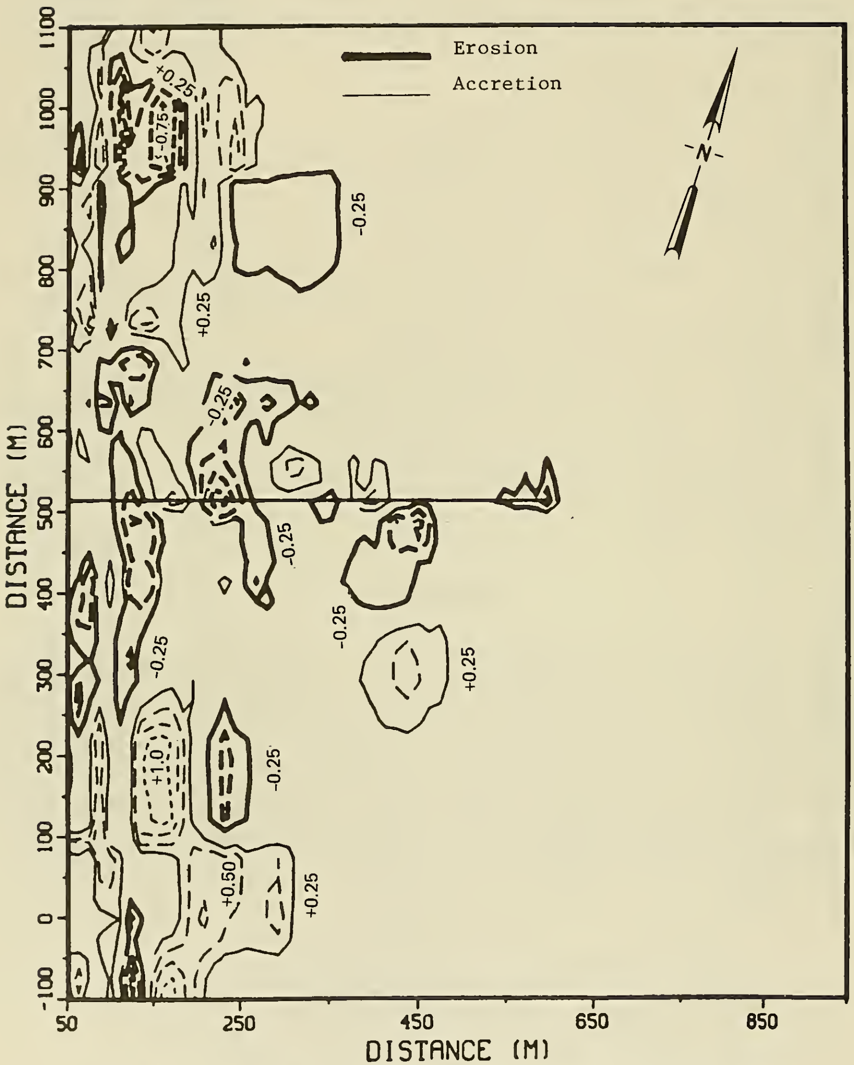


Figure 45. Changes in FRF bathymetry between 18 September and 1 October 1983 due to Tropical Storm Dean

a. North

b. South

Figure 46. Sample photographs of the FRF beach taken on 26 November 1983, looking both north and south at 102 m

Table 12

Aerial Photography Inventory for 1983

Date	Coverage	Format
26 January	11 miles north to 12 miles south of pier	B/W and color
27 April	12 miles north to 18 miles south of pier	B/W and color
8 July	Cape Henry, Va., to Cape Hatteras, N. C.	B/W
3 October	13 miles north to 12 miles south of pier	B/W and color

Figure 47. Sample aerial photograph taken 3 October 1983

PART VI: STORMS

118. This part discusses the details of storms affecting the FRF. As used here, "storms" are defined as times when the wave height parameter, H_{m_0}, equals or exceeds 2.0 m at the seaward end of the FRF pier. Hourly data collected during such times are presented in Appendix D. Sample spectra from the Baylor gage at the seaward end of the pier are given in Appendix B. Prestorm and/or poststorm bathymetry diagrams are given in Appendix C.

119. There were 24 storms during 1983; in the prior years 15 to 18 storms occurred. On an average, one storm a week occurred during January through March. this was particularly unusual for March when only one or two storms occurred in prior years.

January 1983

4 January

120. A low pressure system developed on 2 January off South Carolina. This low moved north to Cape Hatteras, N. C., on 3 January, then east and offshore on 4 January.

10-12 January

121. This low-pressure system developed off Georgia on 9 January and moved northward along the coast. It was off Cape Hatteras on 10 January, then into Canada on 11 January. A second low originated over western North Carolina on 11 January and moved northeast and offshore on 12 January.

21-22 January

122. A large low-pressure system over the Great Lakes and another low off Florida produced onshore winds at the FRF.

27-29 January

123. This low-pressure system formed over Florida on 26 January and moved north along the coast. On 28 January, it was positioned east of the FRF before moving to the north.

February 1983

11-12 February

124. A low-pressure system formed south of Cape Hatteras on 11 February. It moved north along the coast past the FRF.

14-15 February

125. A low-pressure system over Florida on 13 February moved north along the coast. On 14-15 February, the low was off the North Carolina coast before moving away to the north.

18 February

126. A large low-pressure system off South Carolina on 17 February moved north and offshore producing strong local winds at the FRF.

20-22 February

127. An intense low-pressure system offshore and an Artic high-pressure system produced strong northeasterly winds on 20 February. A continental high-pressure system then moved offshore north of the FRF.

26-27 February

128. This low-pressure system that developed south of Cape Hatteras on 25 February deepened and intensified on 26 February off the New England shore, producing winds and waves at the FRF through 27 February.

March 1983

1 March

129. Waves were caused by a low-pressure system which developed off Cape Hatteras.

12 March

130. A low developed over North Carolina on 11 March and moved offshore at Cape Hatteras, then moved past the FRF on 12 March.

17-19 March

131. A large high over Maine and a low over Florida on 17 March produced onshore winds. On 18 March, the low moved up the coast until it was off South Carolina. On 19 March, the low was north of the FRF.

24-27 March

132. A low over Florida moved north on 24 March and intensified over Hatteras on 25 March. On 26 March, a high-pressure system formed, and the combination produced strong winds and high waves. On 27 March, the high-pressure system was joined by a new continental low.

31 March-1 April

133. On 31 March, there was a high-pressure system over New England and a low off Georgia. By 1 April, the low had intensified and was off Maryland's eastern shore.

24 April 1983

134. This low-pressure system formed over Georgia and moved up the coast until it was over eastern North Carolina on 24 April.

9 June 1983

135. A high pressure over New England and a low off Georgia caused this summer storm.

September 1983

15 September

136. A low-pressure system which formed over the southeastern states moved offshore at Cape Hatteras on 15 September.

28-30 September

137. Tropical Storm Dean originated on 27 September 595 km southeast of Cape Hatteras. "Dean" slowly moved northwest in the direction of the Virginia coast. The storm made landfall inside Chesapeake Bay late on 30 September where it rapidly decayed. Wave heights H_{m_o} at the FRF remained above 2 m (measured at the seaward end of the pier) for 35 hours; the highest measurement, 3.05 m, was recorded at 2220 hours on 29 September. The highest sustained wind speed was 17.8 m/sec at 1900 hours on 29 September. Wind speeds over 13.5 m/sec were recorded from 1400 hours on 28 September to 2120 hours on 29 September; the direction varied between northeast and north as the storm passed within 200 miles of the pier.

October 1983

10-12 October

138. A large Canadian high-pressure system over the Great Lakes on 9 October moved eastward to northern New England on 10 October. By 11 October, it was off Maine and continued to move east.

20-22 October

139. A large high-pressure system over the Great Lakes on 19 October moved east over New England on 20 October where it remained through 22 October.

25 October

140. A low over Texas on 24 October moved rapidly east and off the FRF on 25 October.

December 1983

12-13 December

141. There were low-pressure systems located over Georgia and off Florida on 12 December. By 13 December, a single low was located over Cape Hatteras.

19-22 December

142. This low formed over South Carolina on 19 December and was coupled with a high over the Great Lakes. The high, over New England by 21 December, gave way to another low off Georgia on 22 December.

31 December

143. A continental high-pressure system over western North Carolina produced strong northerly winds at the FRF.

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APPENDIX A: WAVERIDER BUOY CALIBRATION INFORMATION

1. This appendix presents the 1983 calibration information required for the Waverider buoy gages. Table A1 lists the operational dates of each gage, as well as the predeployment and postdeployment calibration dates.

Table A1

Operational/Calibration Dates for the Waverider Buoys Used at the FRF During 1983

Serial Number	Operational	Calibrated
66966	1 January 1983- 29 August 1983	7 April 1982 8 November 1983
67715-7	29 August 1983- 31 December 1983	1 December 1982 20 March 1984

2. The buoys were calibrated either at the National Oceanic and Atmospheric Administration (NOAA) Engineering Support Office (ESO), Wave Instrument Facility (Ribe 1981),* or at Adamo Rupp Associates in Solana Beach, California. Calibration results are presented in terms of two factors: (a) the Datawell-specified decrease in electronic sensitivity as a function of oscillation period error, and (b) a difference error based on deviations from (a) found during the calibrations. These corrections and their application are discussed below.

Datawell-Predicted Decrease in Sensitivity Error (DW)

3. Waverider buoy sensitivity /A/ for buoy electronics decreases with increasing period T of sinusoidal vertical motion according to Datawell as follows:

$$/A/ = \frac{1}{\left[1 + \left(\frac{T}{T_o}\right)^4\right]^{1/2}} \tag{A1}$$

* References cited in this appendix are included in the References at the end of the main text.

where T_o = 30.8 sec is a characteristic period provided by Datawell. The manufacturer states that this sensitivity decrease results in amplitude errors of less than 3 percent for oscillation (wave) periods less than 15 sec. Figures A1 and A2 present curves for (DW) = /A/ - 1 , the Datawell-predicted sensitivity decrease error, and, as can be seen, the actual sensitivity does not decrease with period according to the Datawell relationship given in Equation A1.

Difference Error (d)

4. This is the difference (d) between the Datawell-predicted decrease in sensitivity error and that found from the actual buoy calibrations.

5. In Tables A2 through A5, DW (Datawell-predicted error) and d (difference error) are tabulated as a function of T (and frequency) for each buoy. Best accuracy would be obtained by choosing the calibration values nearest in time to the date of the measurements.

6. Since these error corrections are oscillation-period dependent, their application requires that the wave data be decomposed into amplitude

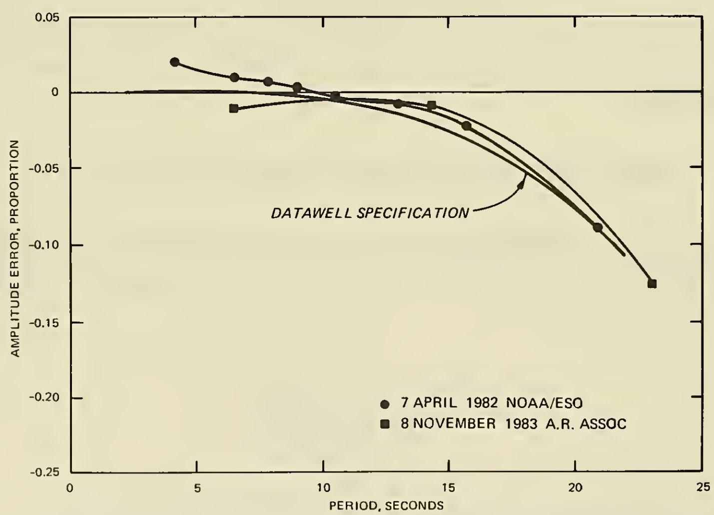


Figure A1. Waverider 66966 predeployment and postdeployment calibrations

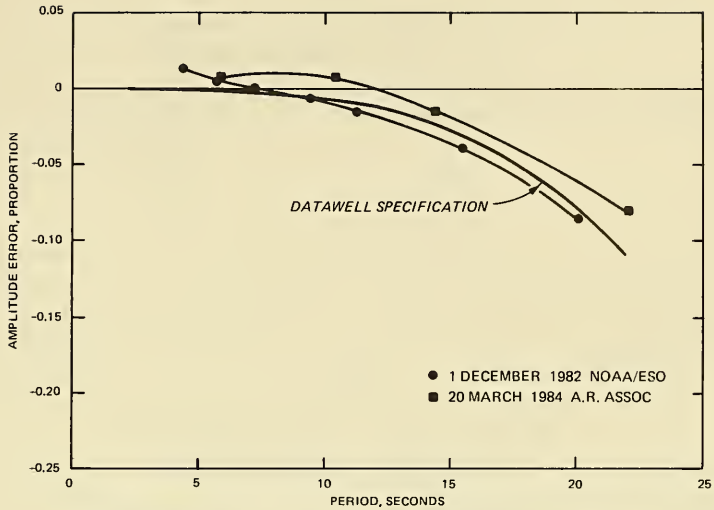


Figure A2. Waverider 67715-7 predeployment and postdeployment calibrations

Table A2

Waverider 66966 Errors (Proportion) for 7 April 1982 Calibration

Period, sec	Frequency, Hz	Difference	Datawell
20.90	0.0478	+0.0019	-0.0917
15.71	0.0637	+0.0056	-0.0322
12.89	0.0776	+0.0065	-0.0150
10.46	0.0956	+0.0051	-0.0066
8.96	0.1116	+0.0071	-0.0036
7.77	0.1287	+0.0105	-0.0020
6.45	0.1550	+0.0106	-0.0010
4.37	0.2288	+0.0208	-0.0002

Table A3

Waverider 66966 Errors (Proportion)

for 8 November 1983 Calibration

Period, sec	Frequency, Hz	Difference	Datawell
23.52	0.043	0.007	-0.136
14.55	0.069	0.016	-0.024
6.51	0.154	-0.010	-0.001

Table A4

Waverider 67715-7 Errors (Proportion)

for 1 December 1982 Calibration

Period, sec	Frequency, Hz	Difference	Datawell
20.17	0.050	-0.0058	-0.0809
15.56	0.064	-0.0106	-0.0310
11.33	0.088	-0.0076	-0.0090
9.40	0.106	-0.0021	-0.0043
7.25	0.138	+0.0030	-0.0015
5.90	0.169	+0.0052	-0.0007
4.66	0.215	+0.0127	-0.0002

Table A5

Waverider 67715-7 Errors (Proportion)

for 20 March 1984 Calibration

Period, sec	Frequency, Hz	Difference	Datawell
22.2	0.045	+0.030	-0.1126
14.3	0.070	+0.009	-0.0225
10.5	0.095	+0.018	-0.0067
6.1	0.165	+0.008	-0.0008

coefficients or variance-spectrum coefficients for each frequency or period. A less-accurate but also less-complicated procedure would be to apply a single correction to the wave height H_{m_o} based on the peak-spectral wave period T_p. For correction of amplitudes or derived parameters linearly related to amplitude, a correction factor F(T) can be obtained from the sum of the Datawell (DW) and difference error (d) by:

$$F(T) = \frac{1}{1 + (DW + D)} \qquad (A2)$$

which can be applied by multiplying the uncorrected amplitude by F(T) for T_p. For correction of parameters related to the square of the amplitude (i.e. total energy or variance spectrum coefficients), the following should be used:

$$\left[F(T)\right]^2 = \left[\frac{1}{1 + (DW + D)}\right]^2 \qquad (A3)$$

7. To apply the correction, first the difference error between the Datawell-predicted error and the error measured during calibration is determined. The Datawell-predicted error and the difference error are summed, and the decrease in sensitivity (based on the wave period) is computed by adding 1 to the sum.

8. To demonstrate the use of the calibration results, the Waverider buoy (620) located 3 km from shore recorded an H_{m_o} of 4.7 m and a T_p of 10 sec on 25 March 1983. From Figure A1 and Table A3 with calibration results for 8 November 1983, buoy 66966, the difference error (d) for 10 sec is +0.001 (interpolating from Table A3). This difference error is added to the Datawell-predicted error DW = -0.0055 (Equation A1 minus 1.0), e.g., -0.0045 = 0.001 + (-0.0055), and the sensitivity is computed by adding 1 or 0.9955 = 1 + (-0.0045). This sensitivity is used to correct the H_{m_o} = 4.7 m, T = 10 sec as follows:

Corrected H_{m_o} = Uncorrected H_{m_o} Divided by the Sensitivity

or

$$\frac{4.7 \text{ m}}{0.9955} = 4.72 \text{ m (less than a 0.5 percent increase)}$$

and the correction for a variance coefficient at this period is applied as:

$$\frac{\text{Uncorrected Variance Coefficient}}{(0.9955)^2}$$

9. In general, the wave statistics errors are less than 3 percent as specified by the manufacturer for wave periods less than 12 sec for 1983. However, data for prior years show a 5 percent error. Errors of this magnitude are generally tolerable for most engineering applications, although it is worthwhile to know the error bounds for some design considerations. When investigating coastal phenomena involving very long period swells of 15 sec or greater, such as surf beats and sediment accretion caused by swell waves, these corrections will produce substantial increases in the magnitudes of the wave parameters, and it is recommended that the corrections be used. For statistics based on multiple years of data, the manufacturer's specified error is recommended for use in estimating the correction.

APPENDIX B: WAVE DATA

Wave data summaries for 1983 and climatological summaries for 1980 through 1983 are presented in this appendix. An explanation of the summary formats is followed by a list of tables and figures, then the data for gages 615, 620, and 625. Wave data are summarized in the following forms:

a. Gage histories. Table B1 includes information about the gages, gage installations, and major interruptions in the data collection. Short interruptions in the operational status of the gage are not mentioned.

b. Time-histories. A continuous display of individual wave height and peak-spectral wave period values are plotted as a function of the time throughout the year (Figures B1, B20, B33). So that the sequence of the data can be followed easily, solid lines connect consecutive data points for times when there is a gap smaller than 24 hr between observations.

c. Annual; seasonal; and monthly maxima, mean, and standard deviations of wave height and peak period. The 1983 mean wave height and standard deviation, the mean peak wave period and standard deviation, and the extreme wave heights are listed in Tables B2, B12, and B22; 1980 through 1983 values are in Tables B7, B17, and B27. Also included is the total number of observations obtained; at four observations per day, the maximum number of observations per month (based on a 30-day period) is 120.

d. Maxima, mean, and standard deviations of wave height and peak period. The 1983 data presented in the tables described above are also graphed (Figures B2, B21, and B34) for each month and the year; 1980 through 1983 are in Figures B11, B27, and B40. The standard deviations are presented as vertical bars originating at the mean value and extending to the mean plus one standard deviation value. The extreme values are plotted above. No extreme period values are presented.

e. Joint distribution functions of wave height versus peak period. Annual, seasonal, and monthly joint distribution tables are presented for 1983 in Tables B3-B5, B13-B15, and B23-B25; data for 1980 through 1983 are in Tables B8-B10, B18-B20, and B28-B30. Each table gives the frequency (in parts per 1,000) for which the wave height and peak period were within the specified intervals; these values can be converted to percent by dividing by 10. Marginal totals are also included. The raw total gives the total number of observations out of 1,000 which fell within each specified peak period interval. The column total gives the number of observations out of 1,000 which fell within each specified wave height interval.

f. Cumulative distributions of wave height. For each gage, annual, seasonal, and monthly wave height distributions of 1983 are plotted in cumulative form in Figures B3-B5, B22-B24, and

B35-B37. Data for 1980 through 1983 are in Figures B12-B14, B28-B30, and B41-B43.

g. Peak spectral wave period distribution. Annual, seasonal, and monthly peak wave period T_p distributions histograms for 1983 are presented in Figures B6-B8, B25, B26, B38, and B39; data for 1980 through 1983 are in Figures B15-B17, B31-B32, B44, and B45.

h. Persistence of wave heights. Tables B6, B16, and B26 show the number of times throughout 1983 when the specified wave height was equaled or exceeded at least once during each day for the duration (consecutive days) indicated; data for 1980 through 1983 are in Tables B11, B21, and B31. For example, Table B6 for gage 625 (pier end Baylor) indicates wave heights equaled or exceeded 1.0 m, 41 times for at least 1 day; 34 times for at least 2 days; 25 times for at least 3 days; 18 times for at least 4 days, etc. Therefore, on seven occasions it was expected for the height to have equaled or exceeded 1.0 m for 1 day exactly; on nine occasions for 2 days; on seven occasions 3 days; etc. Note that the height exceeded 1.0 m, 41 times for 1 day or longer, while heights exceeded 0.5 m only 26 times for this same duration. This occurred because the longer durations of lower waves may be interspersed with shorter, but more frequent, intervals of higher waves. For example, the one time that wave heights exceeded 0.5 m for 64 days may represent 5 or 10 different times the height exceeded 1 m for shorter duration.

i. Wave roses. For the pier-end Baylor gage (625), wave roses showing the distribution of wave height versus approach angle are presented. Data for 1983 are in Figures B9 and B10, while 1980 through 1983 data are in Figures B18 and B19. The angles are referenced to true north. Northerly wave angles (e.g., less than 70 deg) generally produce southward currents while southerly wave angles greater than 70 deg produce northward currents.

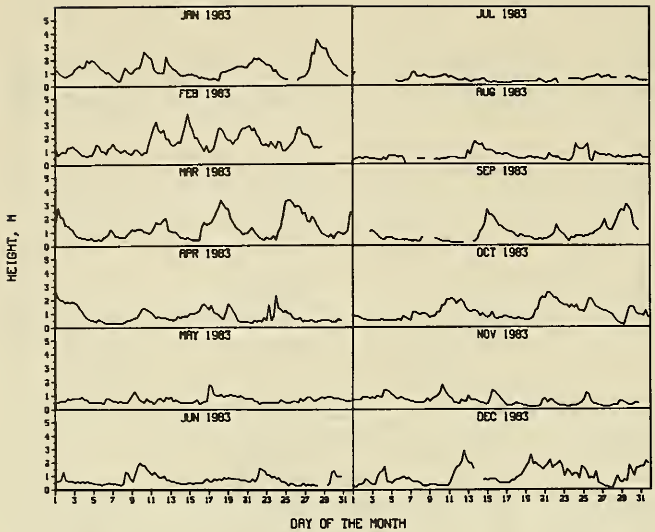
j. Spectra. Spectra for the pier-end Baylor gage (625) for days when wave heights exceeded 2 m are presented in the last figure. The plots show energy density as a function of wave frequency.

Table B1

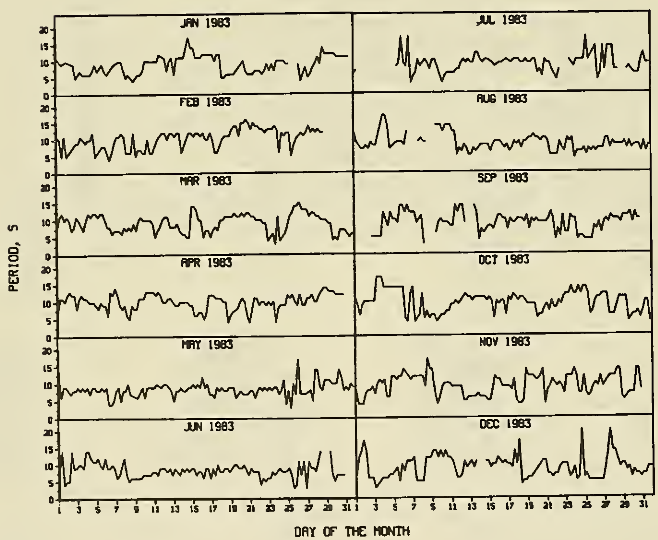
Wave Gage Histories for 1983

Type of Gage	Location	Beginning of Proper Operation	End of Proper Operation	Explanation	Range m	Depth m	Distance from Shore
			Pier-End Baylor (Gage 625)				
Continuous wire staff	Pier sta 19+00 (579 m ENE of coordinates given)	Nov 1978 5 Jul 1983	1 Jul 1983	Transducer failed	-2.1 to 7.0	8.2	475 m
			Offshore Waverider (Gage 620)				
Accelerometer buoy	36°11.1' N × 75°44.4' W (2.5 km ENE of seaward end of FRF pier)	Nov 1978 29 Aug 1983	29 Aug 1983	Replaced buoy for routine maintenance	Continuous	18	3 km
			Nearshore Baylor (Gage 615)				
Continuous wire staff	Pier sta 6+20 (189 m ENE of coordinates given)	Nov 1978			-1.5 to 7.0	2.1	100 m

* Pier-end Baylor (Gage No. 625).



a. H_{m_0}



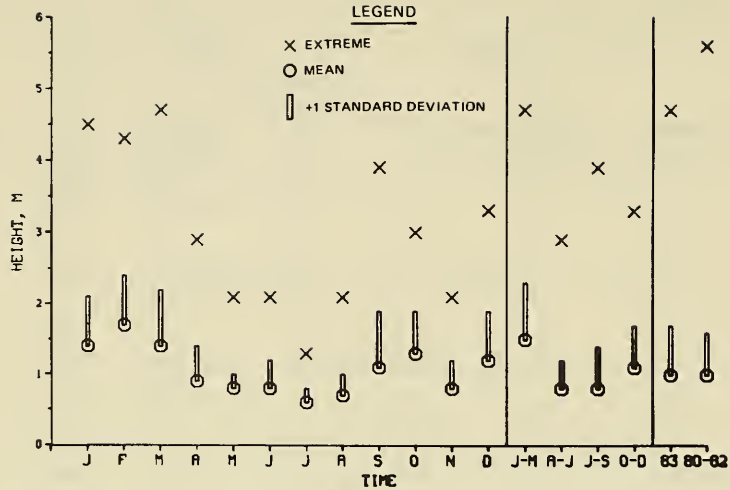
b. T_p

Figure B1. Time-history of H_{m_0} and T_p for gage 625

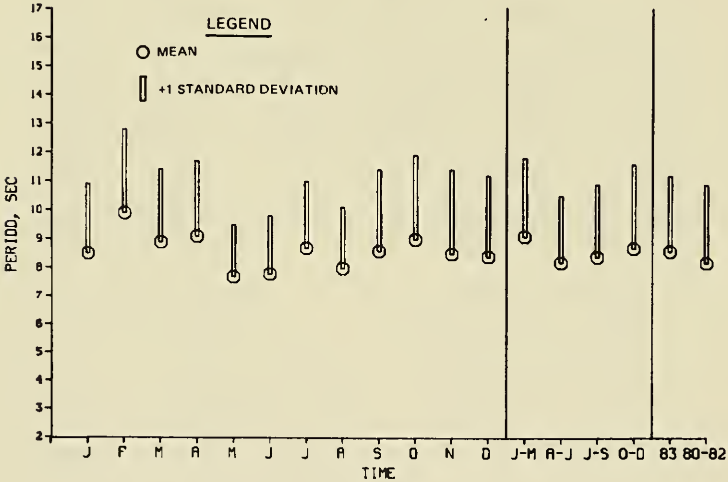
Table B2

1983 Mean, Standard Deviation, and Extreme H_{m_o} and T_p for Gage 625

Month	Mean Height, m	Standard Deviation Height, m	Mean Period sec	Standard Deviation Period sec	Extreme Height, m	Date	Number Observations
Jan	1.3	0.7	9.0	2.6	3.5	28	103
Feb	1.6	0.7	10.2	2.8	3.8	14	112
Mar	1.3	0.8	9.1	2.6	3.3	18	122
Apr	0.9	0.5	10.0	2.2	2.6	1	116
May	0.7	0.2	8.5	2.0	1.8	17	119
Jun	0.7	0.4	8.3	2.3	2.0	9	114
Jul	0.5	0.2	8.8	2.7	1.0	1	91
Aug	0.6	0.3	8.5	2.5	1.7	13	112
Sep	0.9	0.7	9.0	2.7	3.0	29	103
Oct	1.1	0.5	9.5	3.0	2.5	21	121
Nov	0.6	0.3	9.3	2.9	1.8	10	118
Dec	1.0	0.6	8.9	3.3	2.9	12	118
Jan-Mar	1.4	0.7	9.4	2.8	3.8	Feb	337
Apr-Jun	0.8	0.4	8.9	2.3	2.6	Apr	349
Jul-Sep	0.7	0.5	8.8	2.6	3.0	Sep	306
Oct-Dec	0.9	0.6	9.3	3.1	2.9	Dec	357
Annual	0.9	0.6	9.1	2.7	3.8	Feb	1,349



a. H_{m_o}



b. T_p

Figure B2. 1983 mean, standard deviation, and extreme H_{m_o} and T_p for gage 625

Table B3

1983 Annual Joint Distribution of H_{m_0} Versus T_p

for Gage 625

ANNUAL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	TOTAL
0.00 - .49	.	1	3	4	6	16	12	42	26	14	34	23	4	185
.50 - .99	.	5	21	29	36	39	56	84	79	33	33	26	7	448
1.00 - 1.49	.	.	4	25	32	24	13	17	17	27	21	3	.	183
1.50 - 1.99	.	.	.	2	19	21	5	7	10	13	18	2	.	97
2.00 - 2.49	.	.	.	.	6	7	5	7	7	7	9	2	.	50
2.50 - 2.99	.	.	.	.	.	2	3	1	3	6	5	6	.	26
3.00 - 3.49	.	.	.	.	.	.	1	1	2	2	1	1	.	8
3.50 - 3.99	.	.	.	.	.	.	.	.	.	1	1	.	.	2
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	6	28	60	99	109	95	159	144	103	122	63	11	

Table B4

1983 Seasonal Joint Distribution of H_{m_0} Versus T_p

for Gage 625

SEASONAL JAN-MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	6	12	6	12	3	.	39
.50 - .99	.	3	12	21	30	24	15	24	53	33	45	12	3	275
1.00 - 1.49	.	.	9	39	45	36	18	21	36	50	36	3	.	293
1.50 - 1.99	.	.	.	3	30	27	12	12	18	30	39	6	.	177
2.00 - 2.49	.	.	.	.	12	18	6	3	12	15	36	9	.	111
2.50 - 2.99	.	.	.	.	.	.	9	.	9	18	18	24	.	78
3.00 - 3.49	.	.	.	.	.	.	3	3	9	6	6	3	.	30
3.50 - 3.99	.	.	.	.	.	.	.	.	.	3	3	.	.	6
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	3	21	63	117	105	63	69	149	161	195	60	3	

(Continued)

Table B4 (Concluded)

SEASONAL APR-JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	6	.	11	14	17	37	14	20	32	9	.	160
.50 - .99	.	9	17	17	20	49	126	175	106	40	32	26	3	620
1.00 - 1.49	.	.	3	9	20	26	20	29	.	14	23	.	.	144
1.50 - 1.99	.	.	.	6	11	17	3	3	.	3	17	.	.	60
2.00 - 2.49	.	.	.	.	.	3	3	.	3	6	.	.	.	15
2.50 - 2.99	.	.	.	.	.	3	.	.	.	.	.	.	.	3
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	9	26	32	62	112	169	244	123	83	104	35	3	

SEASONAL JUL-SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	3	13	29	26	118	75	7	36	42	10	359
.50 - .99	.	10	33	36	52	65	59	72	82	10	16	20	7	462
1.00 - 1.49	.	.	.	20	20	20	13	10	20	7	.	.	.	110
1.50 - 1.99	.	.	.	.	7	13	3	3	7	3	3	.	.	39
2.00 - 2.49	.	.	.	.	.	3	3	7	.	.	.	.	.	13
2.50 - 2.99	.	.	.	.	.	.	3	3	.	7	3	.	.	16
3.00 - 3.49	.	.	.	.	.	.	.	.	.	3	.	.	.	3
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	10	33	59	92	130	107	213	184	37	58	62	17	

SEASONAL OCT-DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	3	6	14	.	20	6	17	8	22	56	39	6	197
.50 - .99	.	.	25	42	45	22	22	62	73	45	39	45	14	434
1.00 - 1.49	.	.	6	34	42	14	3	8	14	34	25	8	.	188
1.50 - 1.99	.	.	.	.	25	28	3	11	14	14	11	3	.	109
2.00 - 2.49	.	.	.	.	11	6	8	17	11	8	.	.	.	61
2.50 - 2.99	.	.	.	.	.	6	.	3	3	.	.	.	.	12
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	3	37	90	123	96	42	118	123	123	131	95	20	

Table B5

1983 Monthly Joint Distribution of H_{m_o}

Versus T_p for Gage 625

MONTH JAN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	10	19	.	10	.	.	39
.50 - .99	.	.	10	10	.	.	10	39	49	68	58	29	10	283
1.00 - 1.49	.	.	10	58	97	39	.	19	29	49	10	.	.	311
1.50 - 1.99	.	.	.	.	49	49	10	29	19	19	10	.	.	185
2.00 - 2.49	.	.	.	.	10	49	.	10	29	.	19	.	.	117
2.50 - 2.99	.	.	.	.	.	.	10	.	10	.	19	10	.	49
3.00 - 3.49	.	.	.	.	.	.	.	10	.	.	.	.	.	10
3.50 - 3.99	.	.	.	.	.	.	.	.	.	10	.	.	.	10
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	20	68	156	137	30	117	155	146	126	39	10	

MONTH FEB
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
.50 - .99	.	.	.	18	45	9	.	9	45	9	36	.	.	171
1.00 - 1.49	.	.	9	27	36	27	27	18	27	62	89	9	.	331
1.50 - 1.99	.	.	.	.	45	.	9	9	18	27	89	18	.	215
2.00 - 2.49	.	.	.	.	9	.	9	.	.	27	54	27	.	126
2.50 - 2.99	.	.	.	.	.	.	18	.	9	27	27	45	.	126
3.00 - 3.49	.	.	.	.	.	.	.	.	18	.	9	.	.	27
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	9	.	.	9
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	9	45	135	36	63	36	117	152	313	99	0	

MONTH MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	8	16	16	25	8	.	73
.50 - .99	.	8	25	33	41	57	33	25	66	25	41	8	.	362
1.00 - 1.49	.	.	8	33	8	41	25	25	49	41	8	.	.	238
1.50 - 1.99	.	.	.	8	.	33	16	.	16	41	16	.	.	130
2.00 - 2.49	.	.	.	.	16	8	8	.	8	16	33	.	.	89
2.50 - 2.99	.	.	.	.	.	.	.	.	8	25	8	16	.	57
3.00 - 3.49	.	.	.	.	.	.	8	.	8	16	8	8	.	48
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	33	74	65	139	90	58	171	180	139	40	0	

(Continued)

(Sheet 1 of 4)

Table B5 (Continued)

MONTH APR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	.	9	.	26	.	17	43	26	26	60	9	.	216
.50 - .99	.	.	9	9	.	.	26	78	164	60	78	17	.	441
1.00 - 1.49	.	.	9	.	17	17	.	34	.	43	69	.	.	189
1.50 - 1.99	.	.	.	9	9	17	9	9	.	9	52	.	.	114
2.00 - 2.49	.	.	.	.	.	.	9	.	9	17	.	.	.	35
2.50 - 2.99	.	.	.	.	.	9	.	.	.	.	.	.	.	9
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	27	18	52	43	61	164	199	155	259	26	0	

MONTH MAY
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	.	.	.	.	.	8	8	8	.	8	.	.	32
.50 - .99	.	8	25	34	25	92	244	252	92	42	8	25	8	855
1.00 - 1.49	.	.	.	.	17	17	17	42	.	.	.	.	.	93
1.50 - 1.99	.	.	.	.	8	8	.	.	.	.	.	.	.	16
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	25	34	50	117	269	302	100	42	16	25	8	

MONTH JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	.	9	.	9	44	26	61	9	35	26	18	.	237
.50 - .99	.	18	18	9	35	53	105	193	61	18	9	35	.	554
1.00 - 1.49	.	.	.	26	26	44	44	9	.	.	.	.	.	149
1.50 - 1.99	.	.	.	9	18	26	.	.	.	.	.	.	.	53
2.00 - 2.49	.	.	.	.	.	9	.	.	.	.	.	.	.	9
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	18	27	44	98	176	175	263	70	53	35	53	0	

(Continued)

(Sheet 2 of 4)

MONTH JUL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	11	11	33	33	187	143	.	33	.	22	473
.50 - .99	.	22	22	11	99	88	33	44	110	.	.	55	11	495
1.00 - 1.49	.	.	.	11	11	11	.	.	.	.	.	.	.	33
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	22	22	33	121	132	66	231	253	0	33	55	33	

MONTH AUG
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	27	54	27	98	54	.	27	54	9	350
.50 - .99	.	.	9	54	36	98	116	107	45	9	18	9	9	510
1.00 - 1.49	.	.	.	18	27	18	36	.	.	.	.	.	.	99
1.50 - 1.99	.	.	.	.	18	18	9	.	.	.	.	.	.	45
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	9	72	108	188	186	205	99	9	45	63	18	

MONTH SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	19	78	39	19	49	68	.	272
.50 - .99	.	10	68	39	29	10	19	58	97	19	29	.	.	378
1.00 - 1.49	.	.	.	29	19	29	.	29	58	19	.	.	.	183
1.50 - 1.99	.	.	.	.	.	19	.	10	19	10	10	.	.	68
2.00 - 2.49	.	.	.	.	.	10	10	19	.	.	.	.	.	39
2.50 - 2.99	.	.	.	.	.	.	10	10	.	19	10	.	.	49
3.00 - 3.49	.	.	.	.	.	.	.	.	.	10	.	.	.	10
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	10	68	68	48	68	58	204	213	96	98	68	0	

(Continued)

Table B5 (Concluded)

MONTH OCT
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	.	.	33	.	.	.	33
.50 - .99	.	.	33	25	41	8	.	50	116	58	25	83	17	456
1.00 - 1.49	.	.	8	50	50	17	.	.	17	58	50	25	.	275
1.50 - 1.99	.	.	.	.	17	8	.	17	17	17	33	8	.	117
2.00 - 2.49	.	.	.	.	17	17	25	25	17	8	.	.	.	109
2.50 - 2.99	.	.	.	.	.	8	.	.	8	.	.	.	.	16
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	41	75	125	58	25	92	175	174	108	116	17	

MONTH NOV
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	8	34	.	51	17	42	25	34	102	51	.	364
.50 - .99	.	.	42	25	68	42	42	102	25	25	76	34	8	489
1.00 - 1.49	.	.	.	.	42	8	.	8	17	34	25	.	.	134
1.50 - 1.99	.	.	.	.	.	.	.	.	8	.	.	.	.	8
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	50	59	110	101	59	152	75	93	203	85	8	

MONTH DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	8	8	8	.	8	.	8	.	.	68	68	17	193
.50 - .99	.	.	.	76	25	17	25	34	76	51	17	17	17	355
1.00 - 1.49	.	.	8	51	34	17	8	17	8	8	.	.	.	151
1.50 - 1.99	.	.	.	.	59	76	8	17	17	25	.	.	.	202
2.00 - 2.49	.	.	.	.	17	.	.	25	17	17	.	.	.	76
2.50 - 2.99	.	.	.	.	.	8	.	8	.	.	.	.	.	16
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	16	135	135	126	41	109	118	101	85	85	34	

(Sheet 4 of 4)

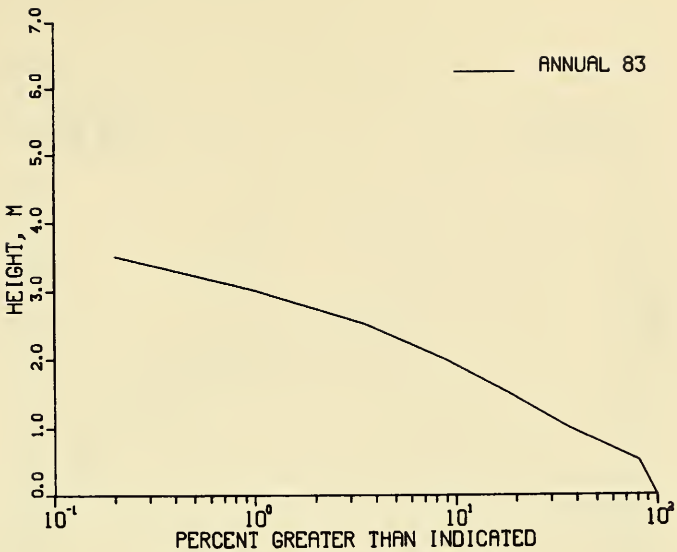


Figure B3. 1983 annual cumulative distribution of H_{m_o} for gage 625

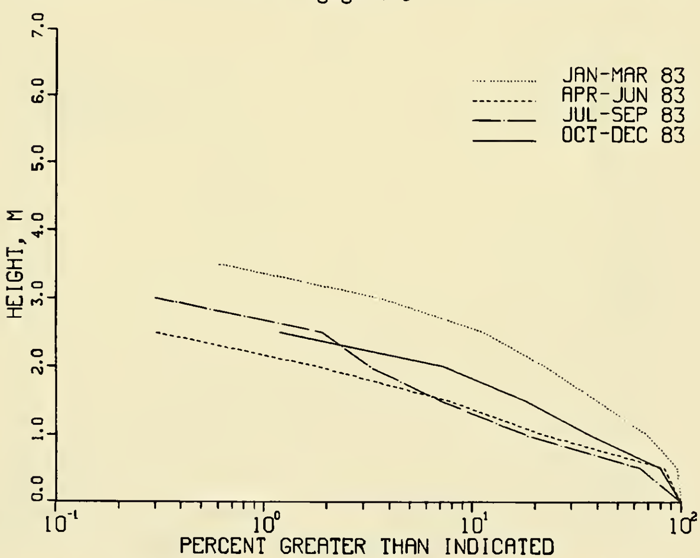
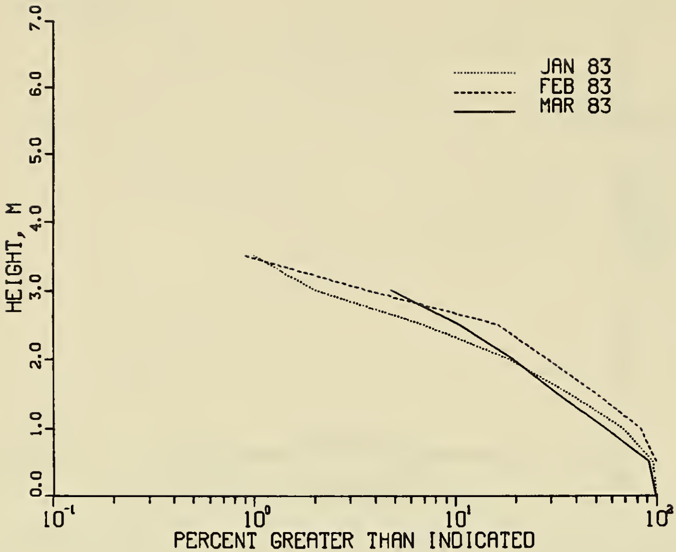


Figure B4. 1983 seasonal cumulative distribution of H_{m_o} for gage 625



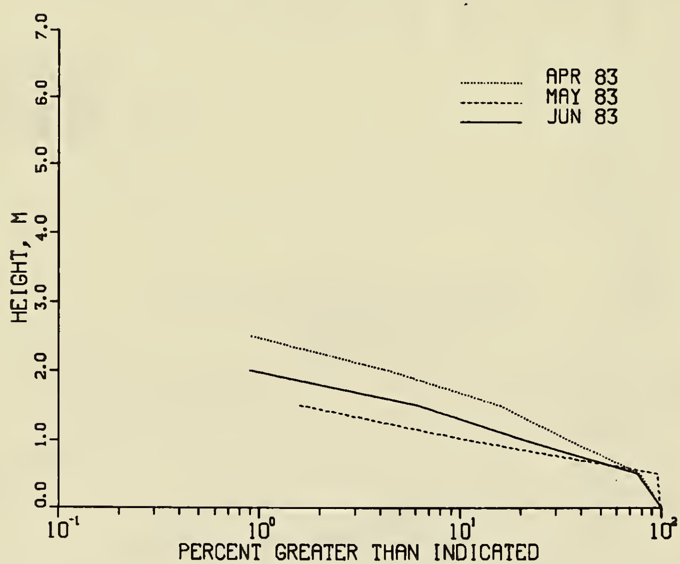
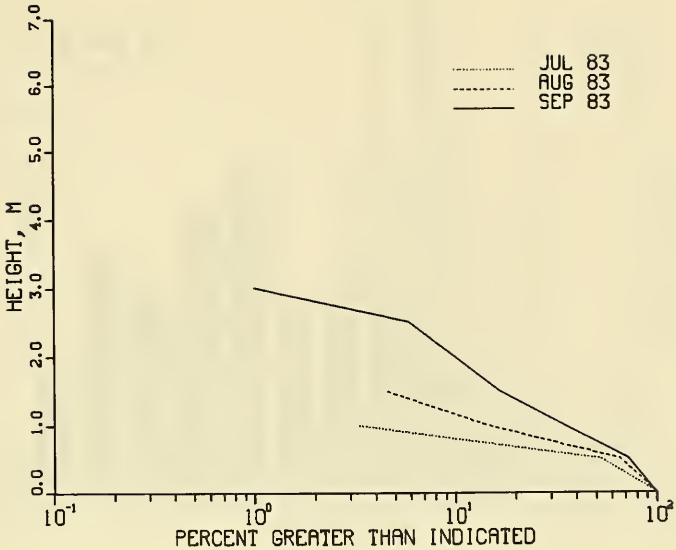


Figure B5. 1983 monthly cumulative distribution of H_{m_0} for gage 625 (Continued)



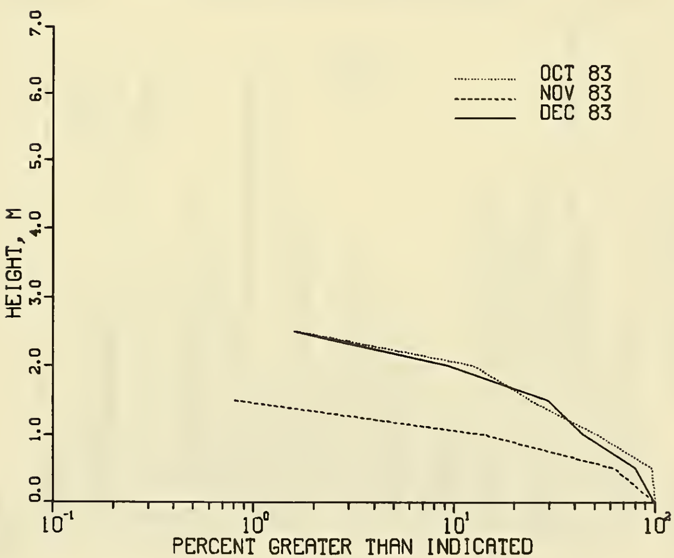


Figure B5. (Concluded)

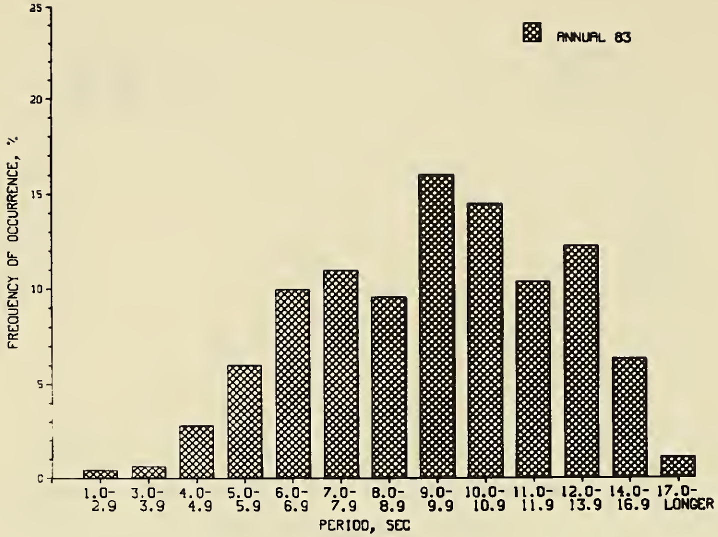


Figure B6. 1983 annual distribution of T_p for gage 625

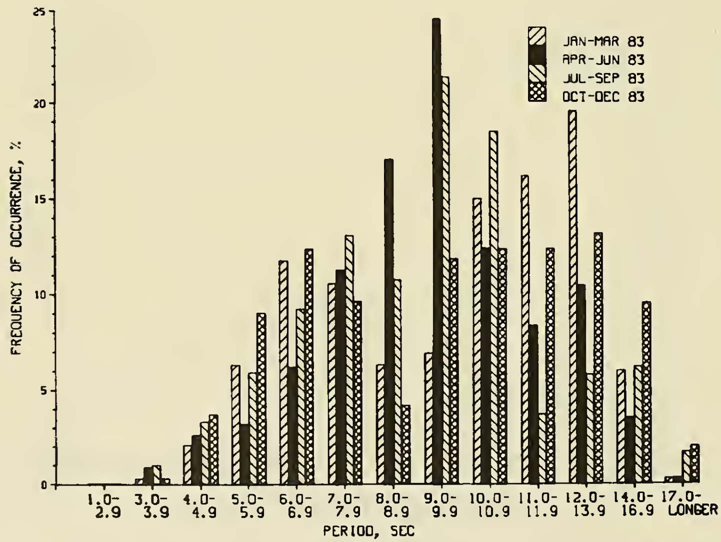
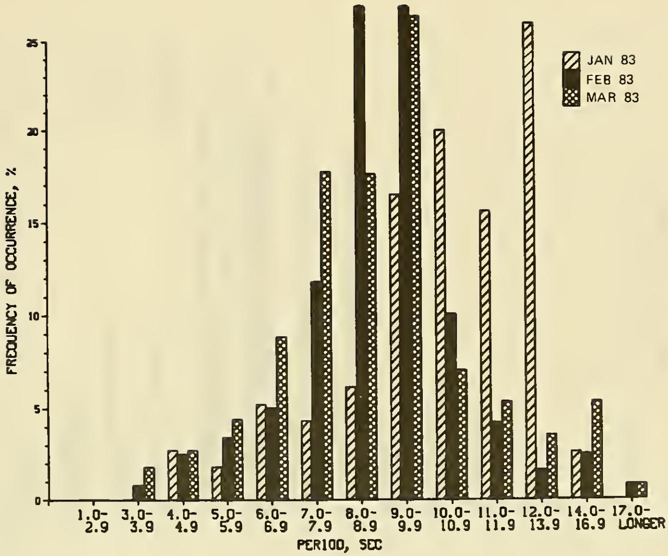


Figure B7. 1983 seasonal distribution of T_p for gage 625



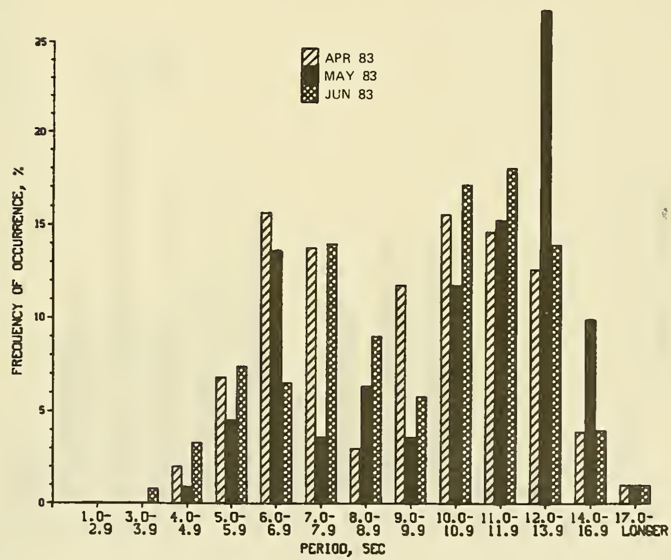


Figure B8. 1983 monthly distribution of T_p for gage 625 (Continued)

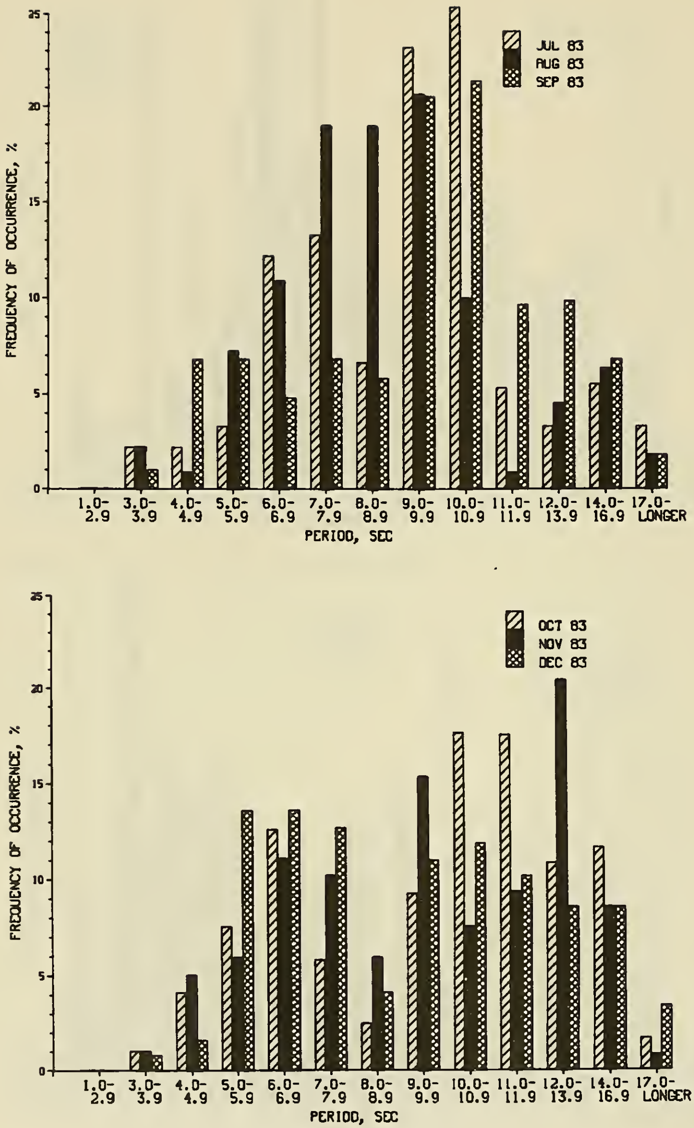


Figure B8. (Concluded)

Table B6

1983 Persistence of H_{m_0} for Gage 625

Height, m	Consecutive Day(s) or Longer																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	36	58	60	64
0.5	26	21	17	13		11	10	9	8	7						6			5						4	3	2	1	
1.0	41	34	25	18	14	9	7	5	3															1					
1.5	31	22	15	10	4		3											1											
2.0	24	15	9	2																									
2.5	16	7	1																										
3.0	6	1																											
3.5	2																												
4.0																													

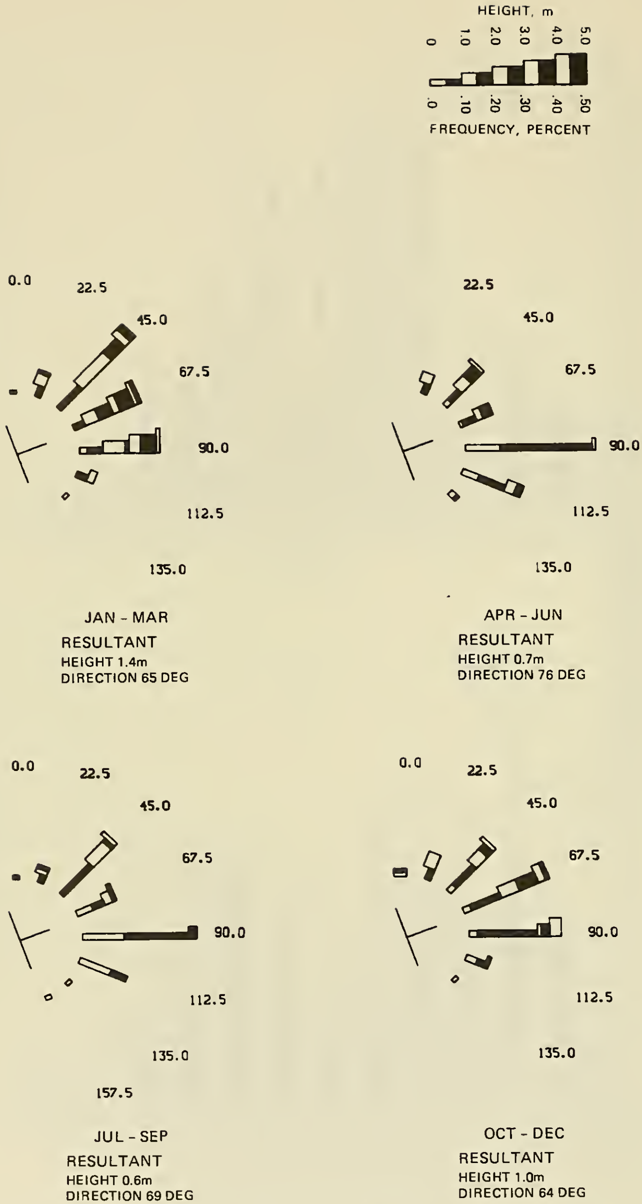


Figure B9. 1983 annual and seasonal wave roses

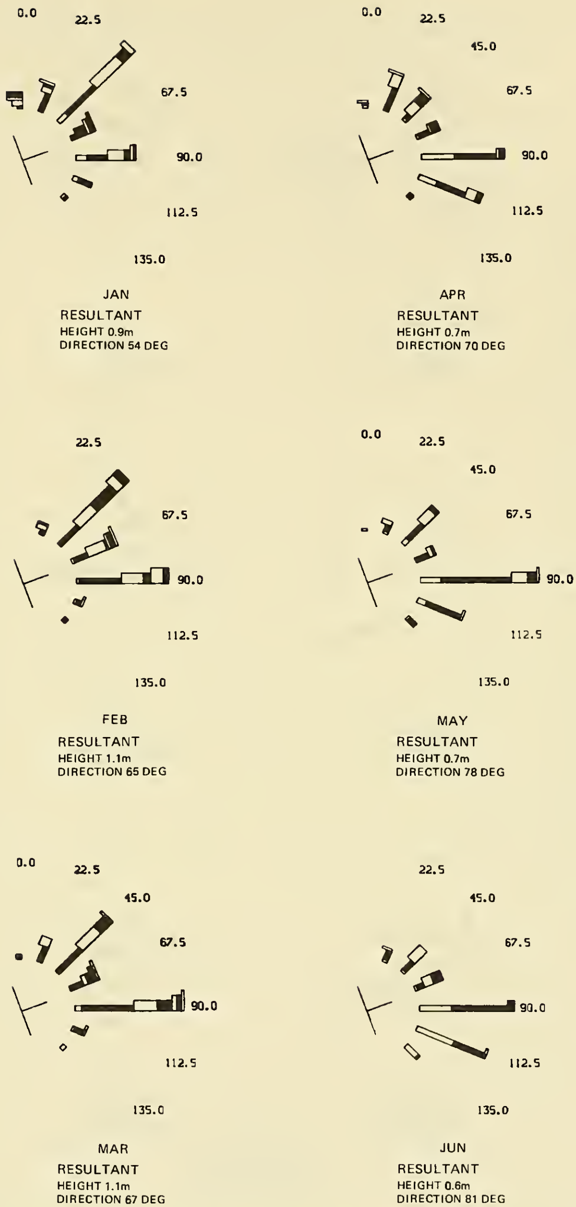


Figure B10. 1983 monthly wave roses (Continued)

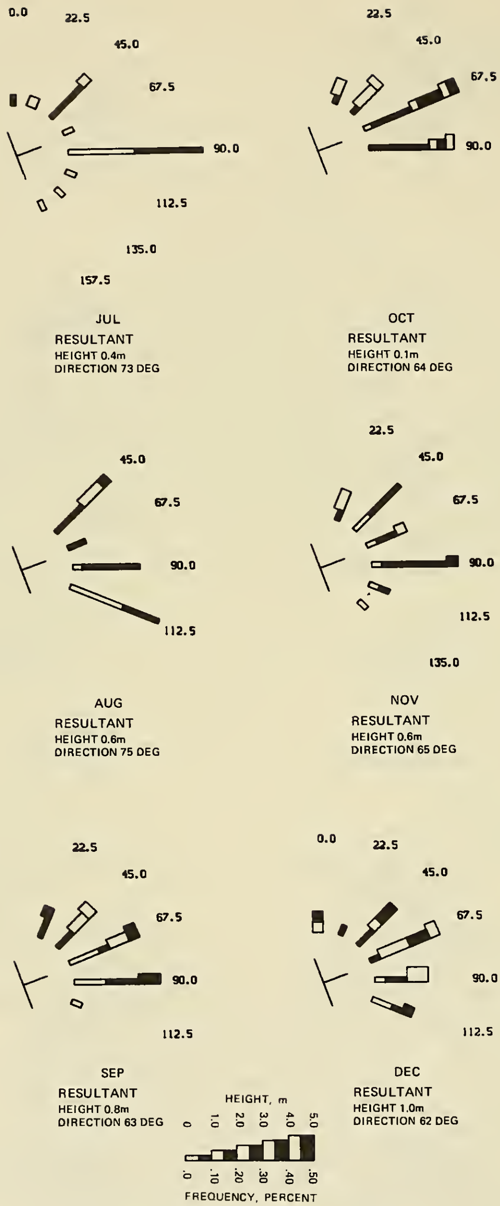
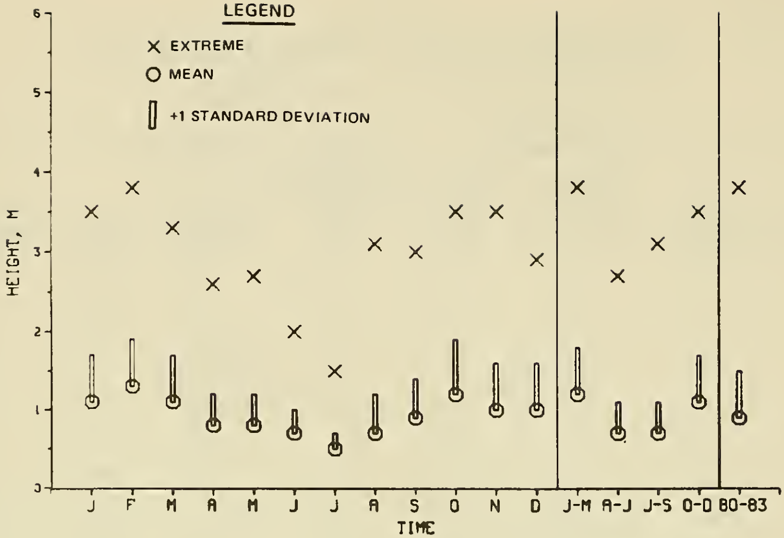


Figure B10. (Concluded)

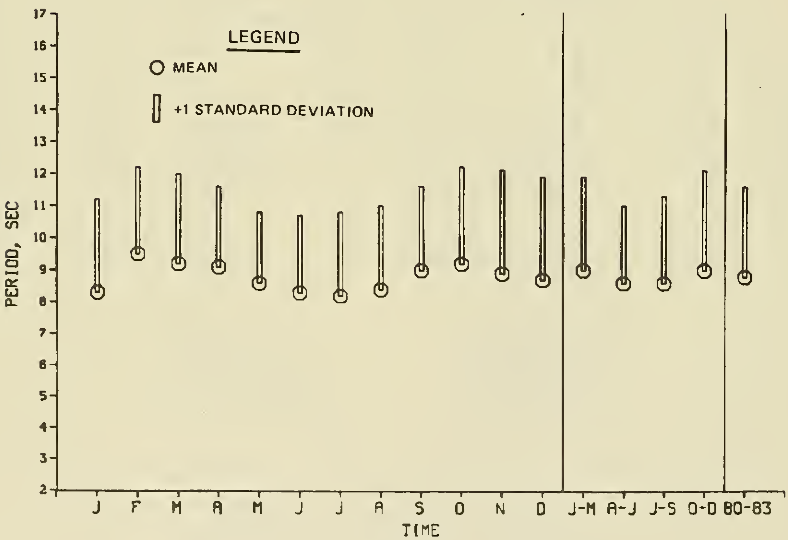
Table B7

1980 Through 1983 Mean, Standard Deviation, and Extreme H_{m_o} and T_p for Gage 625

Month	Mean Height, m	Standard Deviation Height, m	Mean Period sec	Standard Deviation Period sec	Extreme Height, m	Date	Number Observations
Jan	1.1	0.6	8.3	2.9	3.5	28	352
Feb	1.3	0.6	9.5	2.7	3.8	14	370
Mar	1.1	0.6	9.2	2.8	3.3	18	416
Apr	0.8	0.4	9.1	2.5	2.6	1	354
May	0.8	0.4	8.6	2.2	2.7	4	446
Jun	0.7	0.3	8.3	2.4	2.0	9	379
Jul	0.5	0.2	8.2	2.6	1.5	28	292
Aug	0.7	0.5	8.4	2.6	3.1	20	387
Sep	0.9	0.5	9.0	2.6	3.0	29	375
Oct	1.2	0.7	9.2	3.0	3.5	24	464
Nov	1.0	0.6	8.9	3.2	3.5	13	440
Dec	1.0	0.6	8.7	3.2	2.9	12	395
Jan-Mar	1.2	0.6	9.0	2.9	3.8	Feb	1,138
Apr-Jun	0.7	0.4	8.6	2.4	2.7	May	1,179
Jul-Sep	0.7	0.4	8.6	2.7	3.1	Aug	1,054
Oct-Dec	1.1	0.6	9.0	3.1	3.5	Oct	1,299
Annual	0.9	0.6	8.8	2.8	3.8	Feb	4,670



a. H_{m_0}



b. T_p

Figure B11. 1980 through 1983 mean, standard deviation, and extreme H_{m_0} and T_p for gage 625

Table B8

1980 Through 1983 Annual Joint Distribution of

H_{m_0} Versus T_p for Gage 625

ANNUAL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	2	2	4	10	19	23	36	25	11	22	19	2	175
.50 - .99	.	6	27	34	52	46	54	73	71	37	31	24	6	461
1.00 - 1.49	.	.	5	27	42	30	15	17	25	18	21	5	.	205
1.50 - 1.99	.	.	.	5	19	15	4	5	8	9	12	6	.	83
2.00 - 2.49	.	.	.	.	4	5	4	4	4	6	9	7	.	43
2.50 - 2.99	.	.	.	.	.	2	3	2	3	2	5	4	.	21
3.00 - 3.49	.	.	.	.	.	.	1	1	1	1	1	1	.	6
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	1	.	.	1
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	34	70	127	117	104	138	137	84	102	66	8	

Table B9

1980 Through 1983 Seasonal Joint Distribution of

H_{m_0} Versus T_p for Gage 625

SEASONAL JAN-MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	2	1	3	5	4	8	10	11	7	13	7	.	71
.50 - .99	.	9	21	34	38	33	38	45	63	45	45	19	2	392
1.00 - 1.49	.	.	8	35	46	36	16	18	46	27	39	6	.	277
1.50 - 1.99	.	.	.	8	25	23	8	10	18	14	19	11	1	137
2.00 - 2.49	.	.	.	.	4	11	5	4	5	8	17	16	.	70
2.50 - 2.99	.	.	.	.	.	1	4	1	6	7	10	11	.	40
3.00 - 3.49	.	.	.	.	.	.	2	1	3	4	2	2	.	14
3.50 - 3.99	.	.	.	.	.	.	.	.	.	1	1	.	.	2
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	11	30	80	118	108	81	89	152	113	146	72	3	

(Continued)

Table B9 (Concluded)

SEASONAL APR-JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	2	3	5	20	22	45	43	24	12	18	14	1	209
.50 - .99	.	7	26	29	39	56	103	131	98	33	19	22	3	566
1.00 - 1.49	.	.	4	16	22	25	20	23	24	18	12	2	.	166
1.50 - 1.99	.	.	.	4	7	6	4	5	3	7	10	.	.	46
2.00 - 2.49	.	.	.	.	1	2	1	1	2	3	1	1	1	13
2.50 - 2.99	.	.	.	.	.	2	.	.	1	.	.	.	.	3
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	9	33	54	89	113	173	203	152	73	60	39	5	

SEASONAL JUL-SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	4	2	3	12	43	33	83	62	12	26	34	5	319
.50 - .99	.	6	30	33	75	69	48	66	68	24	23	20	4	466
1.00 - 1.49	.	.	2	21	37	22	14	13	17	9	9	5	.	149
1.50 - 1.99	.	.	.	5	9	9	1	3	5	2	5	3	.	42
2.00 - 2.49	.	.	.	.	1	1	1	2	.	2	7	2	.	16
2.50 - 2.99	.	.	.	.	.	.	2	2	1	2	3	.	.	10
3.00 - 3.49	.	.	.	.	.	.	.	1	.	2	.	.	.	3
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	10	34	62	134	144	99	170	153	53	73	64	9	

SEASONAL OCT-DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	1	3	4	2	11	8	13	10	12	32	22	2	120
.50 - .99	.	2	31	38	58	31	28	50	56	46	36	34	12	422
1.00 - 1.49	.	.	7	36	61	37	9	15	14	19	25	8	.	231
1.50 - 1.99	.	.	2	5	35	23	4	3	8	12	12	12	1	117
2.00 - 2.49	.	.	.	.	8	8	8	8	7	8	10	10	1	68
2.50 - 2.99	.	.	.	.	2	5	5	4	2	1	8	4	2	33
3.00 - 3.49	.	.	.	.	.	.	1	1	2	1	3	2	.	10
3.50 - 3.99	.	.	.	.	.	.	.	.	2	.	2	1	.	5
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	3	43	83	166	115	63	94	101	99	128	93	18	

Table B10

1980 Through 1983 Monthly Joint Distribution of H_{m_o} Versus T_p for Gage 625

MONTH JAN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	6	3	6	11	3	14	11	28	6	11	6	.	105
.50 - .99	.	17	37	48	31	31	28	26	28	40	54	31	3	374
1.00 - 1.49	.	.	3	62	80	28	17	14	34	23	11	.	.	272
1.50 - 1.99	.	.	.	6	26	40	6	17	14	14	3	6	.	132
2.00 - 2.49	.	.	.	.	6	23	3	6	14	6	14	14	.	86
2.50 - 2.99	.	.	.	.	.	.	3	.	6	.	9	9	.	27
3.00 - 3.49	.	.	.	.	.	.	.	3	.	.	.	.	.	3
3.50 - 3.99	.	.	.	.	.	.	.	.	.	3	.	.	.	3
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	23	43	122	154	125	71	77	124	92	102	66	3	

MONTH FEB
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	3	3	3	3	3	.	3	8	8	.	34
.50 - .99	.	3	3	19	35	22	32	54	78	46	41	5	3	341
1.00 - 1.49	.	.	8	19	35	35	19	27	59	41	46	8	.	297
1.50 - 1.99	.	.	.	16	41	16	11	11	27	14	32	11	.	179
2.00 - 2.49	.	.	.	.	3	8	5	8	.	11	22	22	.	79
2.50 - 2.99	.	.	.	.	.	.	5	3	8	11	16	14	.	57
3.00 - 3.49	.	.	.	.	.	.	.	.	5	5	3	.	.	13
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	3	.	.	3
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	3	11	57	117	84	75	106	177	131	171	68	3	

MONTH MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIDD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	2	5	7	14	7	12	19	7	.	73
.50 - .99	.	7	24	36	46	46	50	53	79	48	41	22	.	452
1.00 - 1.49	.	.	12	26	26	43	12	14	43	19	55	10	.	260
1.50 - 1.99	.	.	.	2	12	14	7	2	12	14	22	14	2	101
2.00 - 2.49	.	.	.	.	5	2	7	.	2	7	14	12	.	49
2.50 - 2.99	.	.	.	.	.	2	5	.	5	10	5	12	.	39
3.00 - 3.49	.	.	.	.	.	.	5	.	2	5	2	5	.	19
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	7	36	64	91	112	93	83	150	115	158	82	2	

(Continued)

Table B10 (Continued)

MONTH APR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	3	3	3	14	14	25	28	23	14	28	20	.	175
.50 - .99	.	.	17	20	28	48	62	88	138	59	31	25	3	519
1.00 - 1.49	.	.	14	20	37	34	11	23	11	28	23	.	.	201
1.50 - 1.99	.	.	.	3	8	8	8	11	3	11	23	.	.	75
2.00 - 2.49	.	.	.	.	3	.	3	.	6	11	.	.	.	23
2.50 - 2.99	.	.	.	.	.	6	.	.	.	.	.	.	.	6
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	3	34	46	90	110	109	150	181	123	105	45	3	

MONTH MAY
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	2	2	11	11	40	43	22	7	16	9	.	163
.50 - .99	.	7	25	34	49	56	135	157	87	34	22	13	2	621
1.00 - 1.49	.	.	.	13	18	25	29	25	31	13	11	4	.	169
1.50 - 1.99	.	.	.	7	4	2	4	4	2	2	4	.	.	29
2.00 - 2.49	.	.	.	.	.	2	.	2	.	.	2	2	2	10
2.50 - 2.99	.	.	.	.	.	.	.	.	2	.	.	.	.	2
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	7	27	56	82	96	208	231	144	56	55	28	4	

MONTH JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	3	5	11	34	42	69	58	26	16	11	16	3	294
.50 - .99	.	13	37	32	37	63	103	142	71	8	3	29	5	543
1.00 - 1.49	.	.	.	16	13	16	18	21	26	13	3	.	.	126
1.50 - 1.99	.	.	.	3	8	8	.	.	3	8	5	.	.	35
2.00 - 2.49	.	.	.	.	.	3	.	.	.	.	.	.	.	3
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	16	42	62	92	132	190	221	126	45	22	45	8	

(Continued)

(Sheet 2 of 4)

Table B10 (Continued)

MONTH JUL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	10	7	10	10	58	65	130	89	27	21	34	7	468
.50 - .99	.	10	38	45	72	75	48	58	58	17	.	24	3	448
1.00 - 1.49	.	.	7	14	34	17	7	.	.	.	.	.	.	79
1.50 - 1.99	.	.	.	.	.	3	.	.	.	.	.	.	.	3
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	20	52	69	116	153	120	188	147	44	21	58	10	

MONTH AUG
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	3	.	.	26	65	31	90	75	3	31	44	3	371
.50 - .99	.	5	23	39	80	96	57	62	41	21	21	16	8	469
1.00 - 1.49	.	.	.	21	26	23	16	3	.	5	.	.	.	94
1.50 - 1.99	.	.	.	5	10	8	3	.	3	.	5	3	.	37
2.00 - 2.49	.	.	.	.	3	.	.	.	.	5	13	.	.	21
2.50 - 2.99	.	.	.	.	.	.	3	3	3	.	.	.	.	9
3.00 - 3.49	.	.	.	.	.	.	.	3	.	3	.	.	.	6
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	23	65	145	192	110	161	122	37	70	63	11	

MONTH SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	8	11	37	27	11	24	24	5	147
.50 - .99	.	3	32	19	72	37	40	77	104	32	43	21	.	480
1.00 - 1.49	.	.	.	27	51	24	19	35	48	19	24	13	.	260
1.50 - 1.99	.	.	.	8	13	13	.	8	11	5	8	5	.	71
2.00 - 2.49	.	.	.	.	.	3	3	5	.	.	5	5	.	21
2.50 - 2.99	.	.	.	.	.	.	3	3	.	5	8	.	.	19
3.00 - 3.49	.	.	.	.	.	.	.	.	.	3	.	.	.	3
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	3	32	54	136	85	76	165	190	75	112	68	5	

(Continued)

(Sheet 3 of 4)

Table B10 (Concluded)

MONTH OCT
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	4	13	13	6	15	13	4	.	68
.50 - .99	.	2	24	28	45	22	26	47	75	47	41	41	9	407
1.00 - 1.49	.	.	4	39	50	34	2	13	24	30	41	11	.	248
1.50 - 1.99	.	.	4	9	32	15	4	4	13	17	22	9	.	129
2.00 - 2.49	.	.	.	.	15	13	13	13	11	6	6	11	2	90
2.50 - 2.99	.	.	.	.	4	6	9	2	4	.	6	4	4	39
3.00 - 3.49	.	.	.	.	.	.	2	.	.	.	4	2	.	8
3.50 - 3.99	.	.	.	.	.	.	.	.	4	.	.	2	.	6
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	2	32	76	146	94	69	92	137	115	133	84	15	

MONTH NOV
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	7	9	2	20	9	18	16	11	50	30	.	172
.50 - .99	.	5	45	39	73	48	36	50	30	48	34	32	7	447
1.00 - 1.49	.	.	7	18	75	34	11	14	5	16	18	9	.	207
1.50 - 1.99	.	.	.	2	20	18	2	.	2	2	9	23	2	80
2.00 - 2.49	.	.	.	.	2	2	7	.	2	5	16	14	.	48
2.50 - 2.99	.	.	.	.	.	2	5	2	.	.	9	7	.	25
3.00 - 3.49	.	.	.	.	.	.	.	2	5	2	5	2	.	16
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	5	.	.	5
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	5	59	68	172	124	70	86	60	84	146	117	9	

MONTH DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	3	3	3	5	8	3	8	8	10	35	33	5	124
.50 - .99	.	.	23	48	56	23	23	53	63	43	33	28	23	416
1.00 - 1.49	.	.	10	53	58	43	15	18	13	10	13	3	.	236
1.50 - 1.99	.	.	.	3	53	38	5	5	10	15	5	3	.	137
2.00 - 2.49	.	.	.	.	8	8	3	13	8	15	8	5	.	68
2.50 - 2.99	.	.	.	.	.	5	.	8	3	3	8	.	.	27
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	3	36	107	180	125	49	105	105	96	102	72	28	

(Sheet 4 of 4)

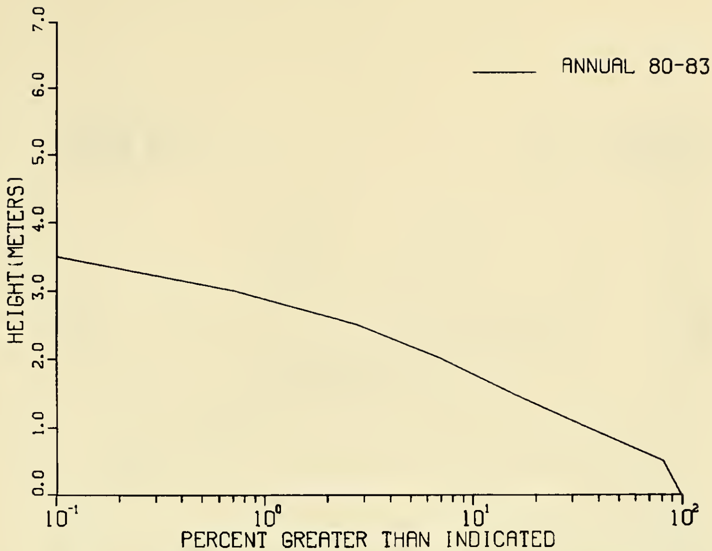


Figure B12. 1980 through 1983 annual cumulative distribution of H_{m_0} for gage 625

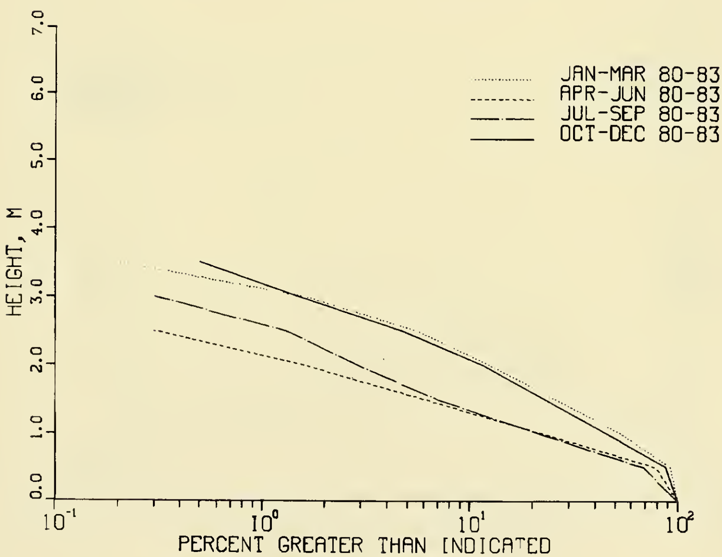
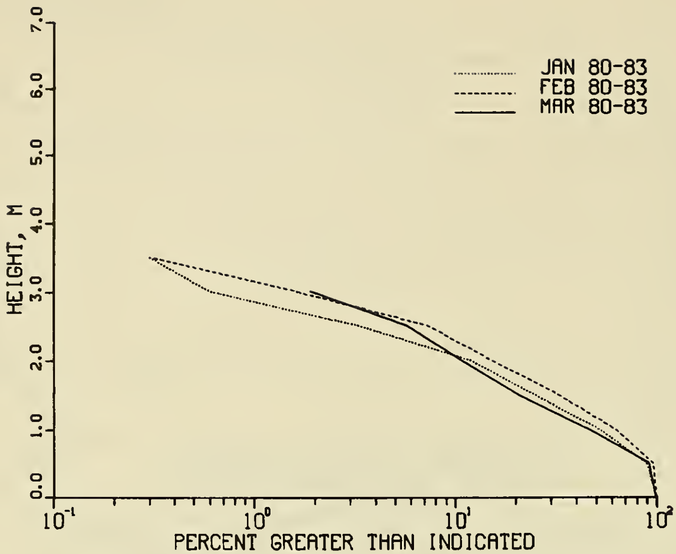


Figure B13. 1980 through 1983 seasonal cumulative distribution of H_{m_0} for gage 625



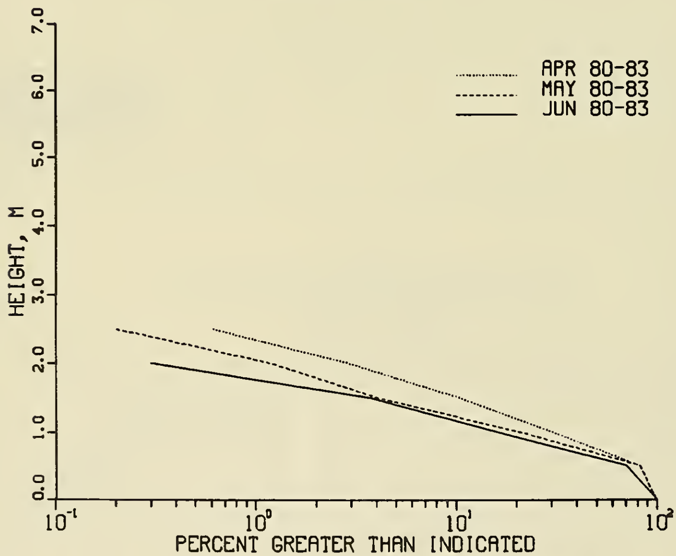


Figure B14. 1980 through 1983 monthly cumulative distribution of H_{m_o} for gage 625 (Continued)

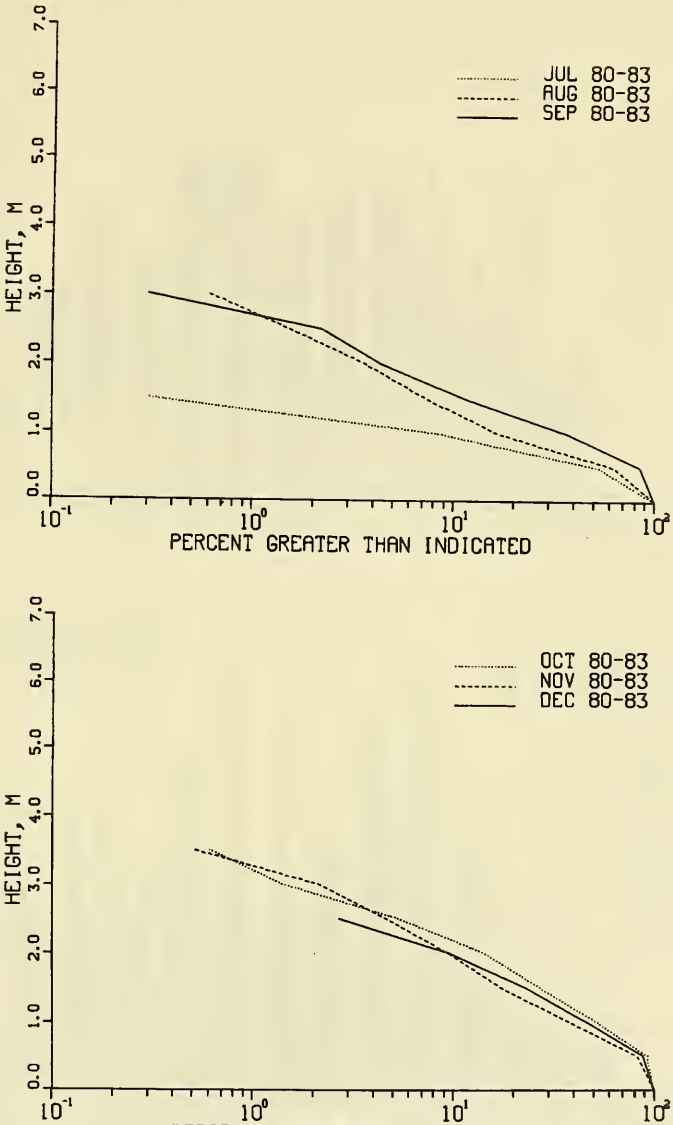


Figure B14. (Concluded)

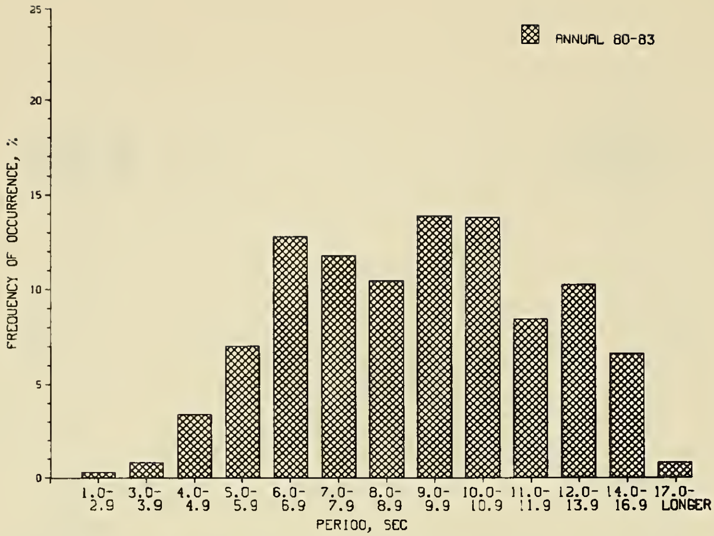


Figure B15. 1980 through 1983 annual distribution of T_p for gage 625

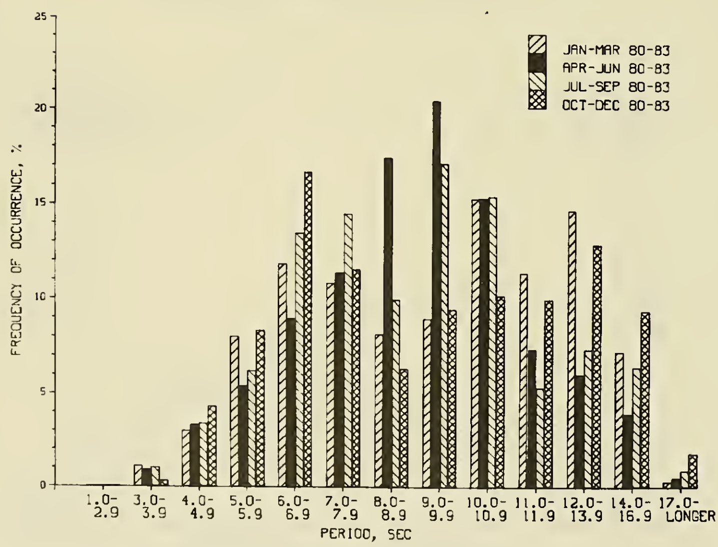
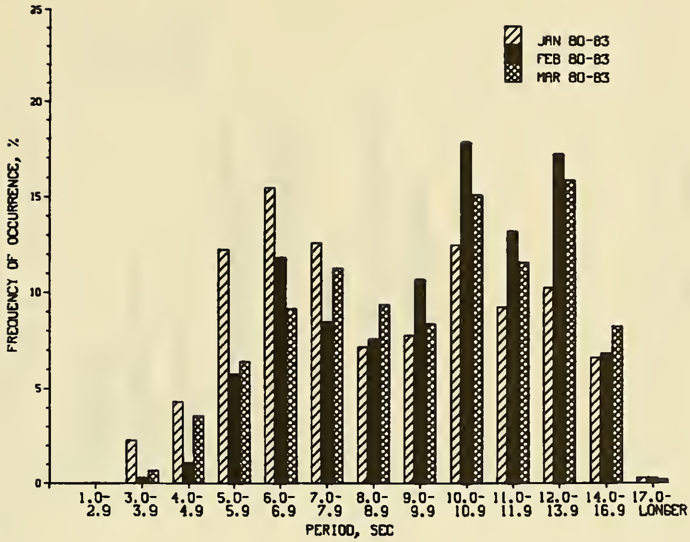


Figure B16. 1980 through 1983 seasonal distribution of T_p for gage 625



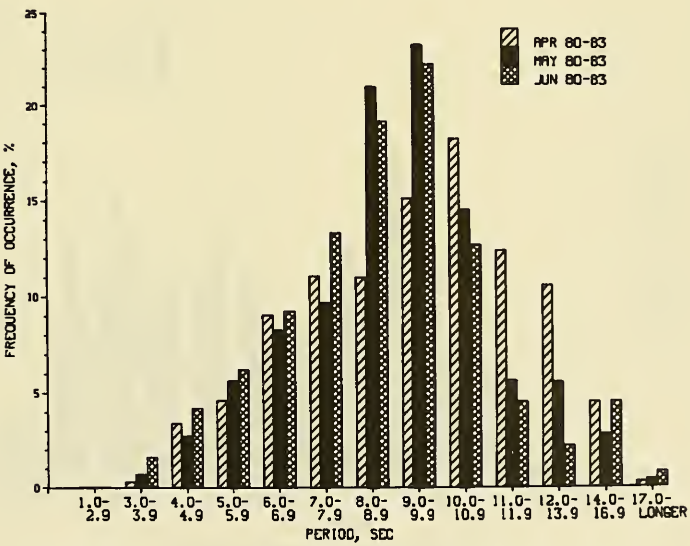
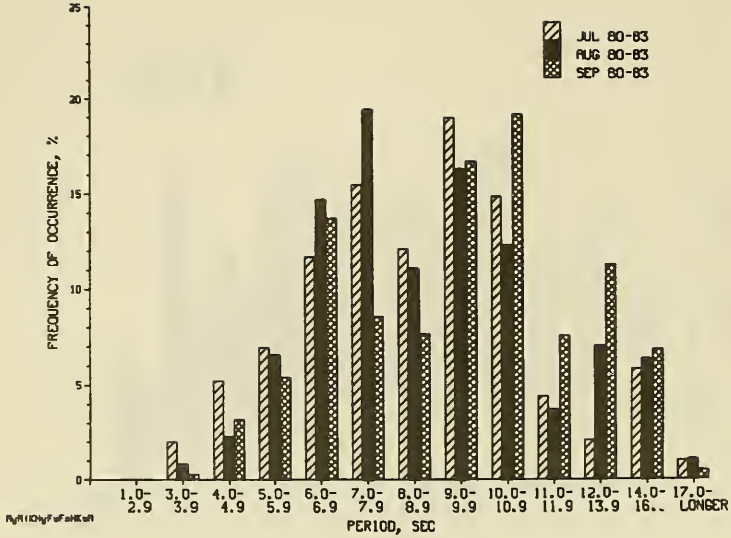


Figure B17. 1980 through 1983 monthly distribution of T_p for gage 625 (Continued)



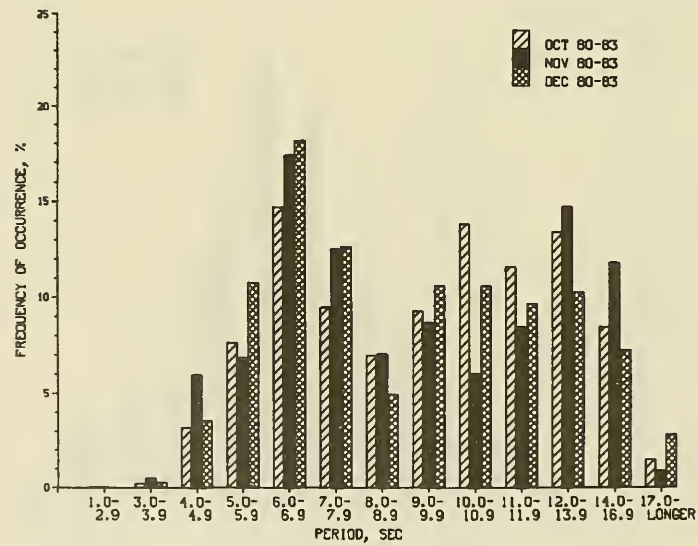


Figure B17. (Concluded)

Table B11

1980 Through 1983 Persistence of H_{m_o} for Gage 625

	Consecutive Day(s) or Longer																								
Height, m	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0.5	28	24	22	17	0	13	11	10	0	8		7				6			4						
1.0	45	32	23	16	11	10	0	6	4	3	2														
1.5	31	18	11	7	5	3	2																		
2.0	18	10	6	3																					
2.5	11	5	2	1																					
3.0	3	1																							
3.5	2	1																							
4.0																									

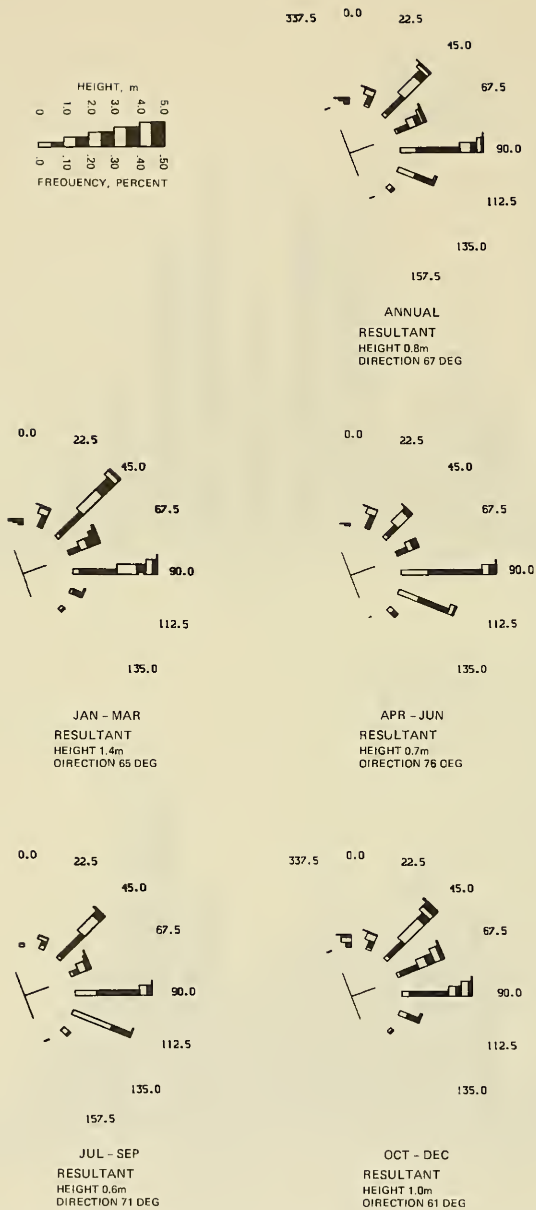


Figure B18. 1980 through 1983 annual and seasonal wave roses

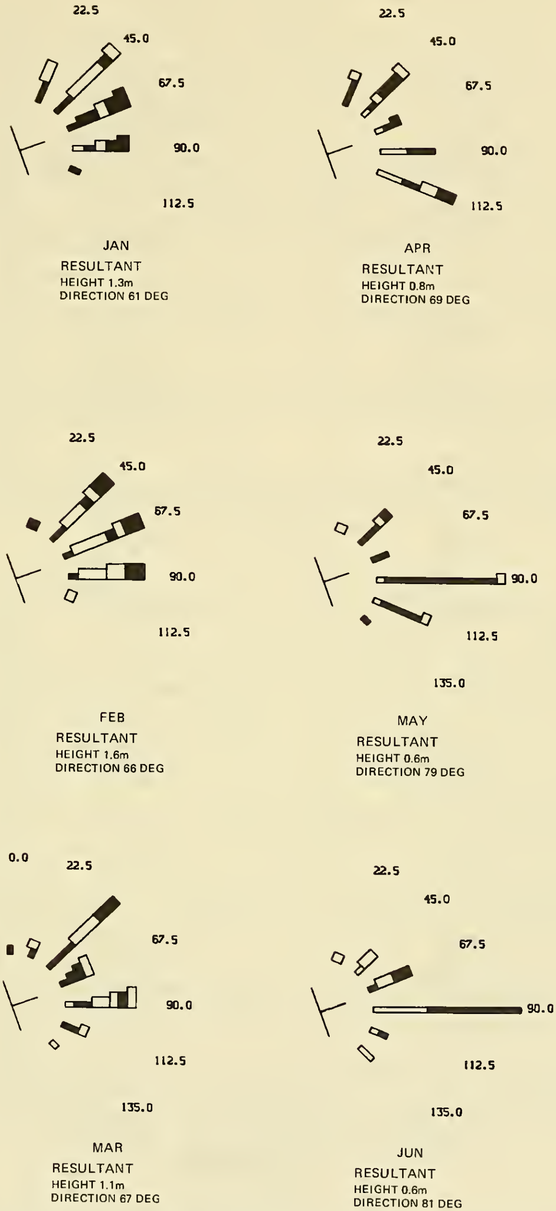


Figure B19. 1980 through 1983 monthly wave roses (Continued)

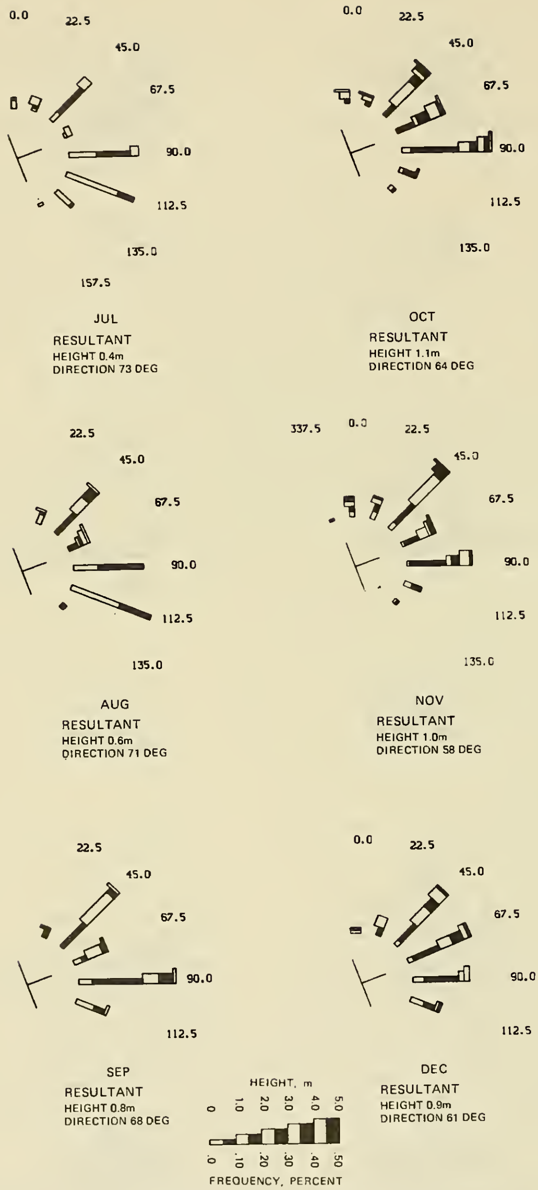
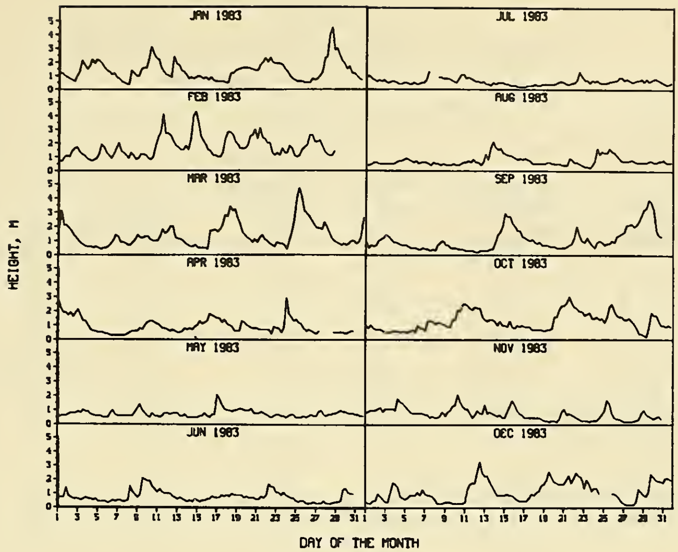
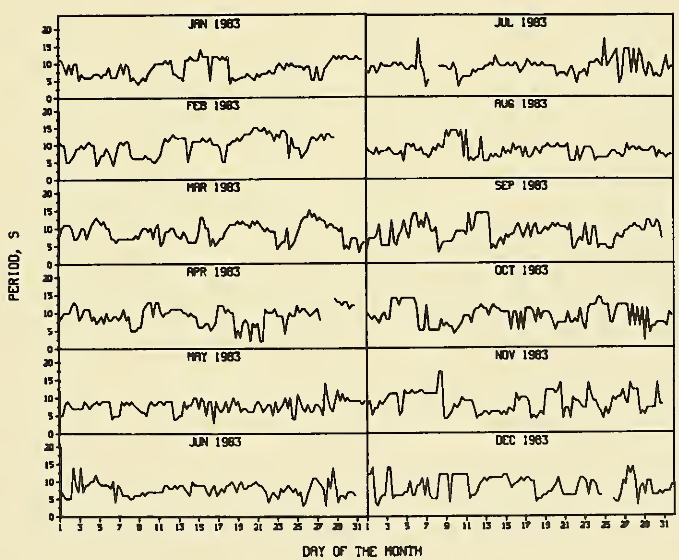


Figure B19. (Concluded)



a. H_{m_o}



b. T_p

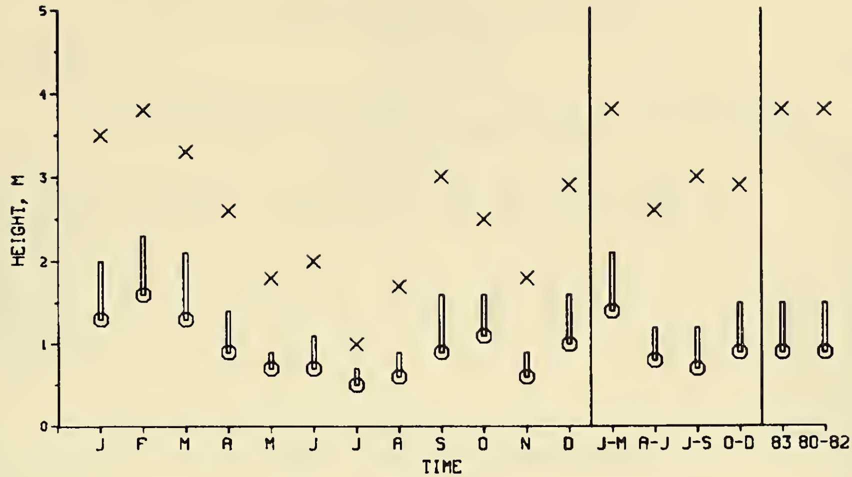
Figure B20. Time-history of H_{m_o} and T_p for gage 620

Table B12

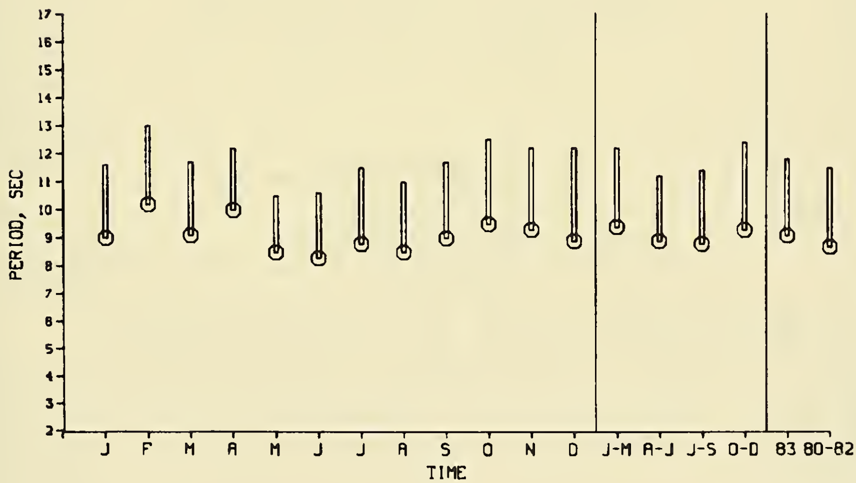
1983 Mean, Standard Deviation, and Extreme

H_{m_0} and T_p for Gage 620

Month	Mean Height, m	Standard Deviation Height, m	Mean Period sec	Standard Deviation Period sec	Extreme Height, m	Date	Number Observations
Jan	1.4	0.7	8.5	2.4	4.5	28	119
Feb	1.7	0.7	9.9	2.9	4.3	14	112
Mar	1.4	0.8	8.9	2.5	4.7	25	123
Apr	0.9	0.5	9.1	2.6	2.9	24	113
May	0.8	0.2	7.7	1.8	2.1	17	121
Jun	0.8	0.4	7.8	2.0	2.1	9	117
Jul	0.6	0.2	8.7	2.3	1.3	7	119
Aug	0.7	0.3	8.0	2.1	2.1	13	123
Sep	1.1	0.8	8.6	2.8	3.9	29	119
Oct	1.3	0.6	9.0	2.9	3.0	21	124
Nov	0.8	0.4	8.5	2.9	2.1	10	115
Dec	1.2	0.7	8.4	2.8	3.3	12	117
Jan-Mar	1.5	0.8	9.1	2.7	4.7	Mar	354
Apr-Jun	0.8	0.4	8.2	2.3	2.9	Apr	351
Jul-Sep	0.8	0.6	8.4	2.5	3.9	Sep	361
Oct-Dec	1.1	0.6	8.7	2.9	3.3	Dec	356
Annual	1.0	0.7	8.6	2.6	4.7	Mar	1,422



a. H_{m_o}



b. T_p

Figure B21. 1983 mean, standard deviation, and extreme H_{m_o} and T_p for gage 620

Table B13

1983 Annual Joint Distribution of H_{m_0} Versus T_p for Gage 620

ANNUAL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	1	1	2	2	4	6	13	34	15	8	21	14	1	122
.50 - .99	2	7	23	32	52	58	56	96	60	33	25	18	2	464
1.00 - 1.49	.	.	6	34	26	32	14	23	25	27	16	1	.	204
1.50 - 1.99	.	.	.	9	25	20	3	7	6	8	23	1	.	102
2.00 - 2.49	.	.	.	1	9	16	6	4	10	9	6	4	.	65
2.50 - 2.99	.	.	.	.	1	4	3	5	4	3	6	1	.	27
3.00 - 3.49	.	.	.	.	.	1	1	1	2	3	1	1	.	10
3.50 - 3.99	.	.	.	.	.	.	.	.	1	1	1	.	.	3
4.00 - 4.49	.	.	.	.	.	.	1	.	1	1	1	.	.	4
4.50 - 4.99	.	.	.	.	.	.	.	.	1	1	.	.	.	2
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	8	31	78	117	137	97	170	125	94	100	40	3	

Table B14

1983 Seasonal Joint Distribution of H_{m_0} Versus T_p for Gage 620

SEASONAL JAN-MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	3	8	3	.	.	.	14
.50 - .99	.	3	11	14	34	34	11	34	42	34	48	3	.	268
1.00 - 1.49	.	.	11	42	28	37	11	40	51	48	28	3	.	299
1.50 - 1.99	.	.	.	20	37	34	8	14	8	17	48	3	.	189
2.00 - 2.49	.	.	.	3	6	28	8	3	17	17	20	14	.	116
2.50 - 2.99	.	.	.	.	6	3	.	6	11	8	23	6	.	63
3.00 - 3.49	.	.	.	.	.	.	3	.	3	11	3	6	.	26
3.50 - 3.99	.	.	.	.	.	.	.	.	.	3	.	.	.	3
4.00 - 4.49	.	.	.	.	.	.	3	.	6	6	3	.	.	18
4.50 - 4.99	.	.	.	.	.	.	.	.	3	3	.	.	.	6
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	3	22	79	111	136	44	100	149	150	173	35	0	

(Continued)

Table B14 (Concluded)

SEASONAL APR-JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	3	.	11	6	20	37	11	14	3	3	.	108
.50 - .99	9	14	26	46	48	85	100	171	68	31	23	11	.	632
1.00 - 1.49	.	.	.	14	34	37	20	23	11	17	20	.	.	176
1.50 - 1.99	.	.	.	6	11	14	.	6	11	.	14	.	.	62
2.00 - 2.49	.	.	.	.	3	6	3	3	.	.	.	.	.	15
2.50 - 2.99	.	.	.	.	.	.	6	.	.	.	.	.	.	6
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	9	14	29	66	107	148	149	240	101	62	60	14	0	

SEASONAL JUL-SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	3	3	3	8	22	83	30	3	19	30	3	207
.50 - .99	.	8	22	39	69	83	94	139	75	17	8	30	3	587
1.00 - 1.49	.	.	6	25	22	30	11	6	6	8	3	.	.	117
1.50 - 1.99	.	.	.	.	8	14	.	6	.	3	3	.	.	34
2.00 - 2.49	.	.	.	3	6	.	3	3	14	3	.	.	.	32
2.50 - 2.99	.	.	.	.	.	3	6	3	.	.	.	.	.	12
3.00 - 3.49	.	.	.	.	.	.	.	3	3	.	3	.	.	9
3.50 - 3.99	.	.	.	.	.	.	.	.	3	.	3	.	.	6
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	31	70	108	138	136	243	131	34	39	60	6	

SEASONAL OCT-DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	3	3	3	6	3	11	8	11	11	11	62	22	.	154
.50 - .99	.	3	34	31	56	31	20	39	53	51	20	28	6	372
1.00 - 1.49	.	.	6	53	20	25	14	25	31	34	14	3	.	225
1.50 - 1.99	.	.	.	11	45	17	3	3	6	11	25	3	.	124
2.00 - 2.49	.	.	.	.	22	31	8	6	8	17	3	.	.	95
2.50 - 2.99	.	.	.	.	.	8	.	11	3	3	.	.	.	25
3.00 - 3.49	.	.	.	.	.	3	.	.	3	.	.	.	.	6
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	6	43	101	146	126	53	95	115	127	124	56	6	

Table B15

1983 Monthly Joint Distribution of H_{m_o} Versus

T_p for Gage 620

MONTH JAN

PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	8	8	.	.	.	.	16
.50 - .99	.	.	.	25	8	25	17	59	34	67	76	8	.	319
1.00 - 1.49	.	.	17	67	42	17	.	25	34	59	8	.	.	269
1.50 - 1.99	.	.	.	17	76	42	8	17	17	8	17	.	.	202
2.00 - 2.49	.	.	.	.	8	76	17	8	17	8	.	.	.	134
2.50 - 2.99	.	.	.	.	.	.	.	8	.	.	17	.	.	25
3.00 - 3.49	.	.	.	.	.	.	8	.	.	8	.	.	.	16
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	8	.	.	.	.	8
4.50 - 4.99	.	.	.	.	.	.	.	.	.	8	.	.	.	8
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	17	109	134	160	50	125	118	158	118	8	0	

MONTH FEB

PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
.50 - .99	.	.	9	.	45	.	.	.	36	27	.	.	.	117
1.00 - 1.49	.	.	9	45	36	18	9	62	54	36	80	9	.	358
1.50 - 1.99	.	.	.	18	18	45	9	9	.	27	98	9	.	233
2.00 - 2.49	.	.	.	9	9	.	9	.	9	18	45	36	.	135
2.50 - 2.99	.	.	.	.	.	9	.	.	27	27	36	9	.	108
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	18	.	18
3.50 - 3.99	.	.	.	.	.	.	.	.	.	9	.	.	.	9
4.00 - 4.49	.	.	.	.	.	.	.	.	9	18	.	.	.	27
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	18	72	108	72	27	71	135	162	259	81	0	

MONTH MAR

PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	.	16	8	.	.	.	24
.50 - .99	.	8	24	16	49	73	16	41	57	8	65	.	.	357
1.00 - 1.49	.	.	8	16	8	73	24	33	65	49	.	.	.	276
1.50 - 1.99	.	.	.	24	16	16	8	16	8	16	33	.	.	137
2.00 - 2.49	.	.	.	.	.	8	.	.	24	24	16	8	.	80
2.50 - 2.99	.	.	.	.	16	.	.	8	8	.	16	8	.	56
3.00 - 3.49	.	.	.	.	.	.	.	.	8	24	8	.	.	40
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	8	.	.	.	8	.	.	16
4.50 - 4.99	.	.	.	.	.	.	.	.	8	.	.	.	.	8
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	32	56	89	170	56	98	194	129	146	16	0	

(Continued)

(Sheet 1 of 4)

Table B15 (Continued)

MONTH APR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	35	35	18	18	9	.	.	115
.50 - .99	27	18	9	35	27	35	27	88	80	88	53	9	.	496
1.00 - 1.49	.	.	.	.	27	35	9	18	35	44	62	.	.	230
1.50 - 1.99	.	.	.	9	9	9	.	18	35	.	44	.	.	124
2.00 - 2.49	.	.	.	.	.	.	9	9	.	.	.	.	.	18
2.50 - 2.99	.	.	.	.	.	.	18	.	.	.	.	.	.	18
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	27	18	9	44	63	79	98	168	168	150	168	9	0	

MONTH MAY
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
.50 - .99	.	8	41	74	50	116	190	264	66	8	8	8	.	833
1.00 - 1.49	.	.	.	17	58	25	17	25	.	8	.	.	.	150
1.50 - 1.99	.	.	.	.	8	.	.	.	.	.	.	.	.	8
2.00 - 2.49	.	.	.	.	.	8	.	.	.	.	.	.	.	8
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	41	91	116	149	207	289	66	16	8	8	0	

MONTH JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	9	.	34	17	26	77	17	26	.	9	.	215
.50 - .99	.	17	26	26	68	103	77	154	60	.	9	17	.	557
1.00 - 1.49	.	.	.	26	17	51	34	26	.	.	.	.	.	154
1.50 - 1.99	.	.	.	9	17	34	.	.	.	.	.	.	.	60
2.00 - 2.49	.	.	.	.	9	9	.	.	.	.	.	.	.	18
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	17	35	61	145	214	137	257	77	26	9	26	0	

(Continued)

(Sheet 2 of 4)

Table B15 (Continued)

MONTH JUL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	8	8	42	143	59	8	17	.	8	293
.50 - .99	.	17	17	.	84	76	109	185	92	8	8	50	8	654
1.00 - 1.49	.	.	.	17	8	25	.	.	.	.	.	.	.	50
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	17	17	17	100	109	151	328	151	16	25	50	16	

MONTH AUG
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	16	16	57	8	.	24	24	.	145
.50 - .99	.	.	.	81	89	122	138	179	57	.	.	24	.	690
1.00 - 1.49	.	.	.	8	33	24	24	8	8	.	.	.	.	105
1.50 - 1.99	.	.	.	.	24	24	.	.	.	.	.	.	.	48
2.00 - 2.49	.	.	.	.	8	.	.	.	.	.	.	.	.	8
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	0	89	154	186	178	244	73	0	24	48	0	

MONTH SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	8	8	.	.	8	50	25	.	17	67	.	183
.50 - .99	.	8	50	34	34	50	34	50	76	42	17	17	.	412
1.00 - 1.49	.	.	17	50	25	42	8	8	8	25	8	.	.	191
1.50 - 1.99	.	.	.	.	.	17	.	17	.	8	8	.	.	50
2.00 - 2.49	.	.	.	8	8	.	8	8	42	8	.	.	.	82
2.50 - 2.99	.	.	.	.	.	8	17	8	.	.	.	.	.	33
3.00 - 3.49	.	.	.	.	.	.	.	8	8	.	8	.	.	24
3.50 - 3.99	.	.	.	.	.	.	.	.	8	.	8	.	.	16
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	75	100	67	117	75	149	167	83	66	84	0	

(Continued)

(Sheet 3 of 4)

Table B15 (Concluded)

MONTH OCT
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	8	.	.	.	8	.	.	.	.	16	.	.	.	32
.50 - .99	.	.	8	16	24	24	32	40	73	40	24	73	.	354
1.00 - 1.49	.	.	8	81	16	32	16	8	40	32	40	8	.	281
1.50 - 1.99	.	.	.	16	24	16	.	.	.	16	65	8	.	145
2.00 - 2.49	.	.	.	.	8	65	8	8	16	24	8	.	.	137
2.50 - 2.99	.	.	.	.	.	16	.	16	8	.	.	.	.	40
3.00 - 3.49	.	.	.	.	.	8	.	.	.	.	.	.	.	8
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	8	0	16	113	80	161	56	72	137	128	137	89	0	

MONTH NOV
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	17	.	35	26	26	17	17	70	26	.	234
.50 - .99	.	.	70	52	78	52	17	61	43	61	17	9	17	477
1.00 - 1.49	.	.	.	26	17	43	17	43	9	61	.	.	.	216
1.50 - 1.99	.	.	.	17	17	9	.	.	9	.	9	.	.	61
2.00 - 2.49	.	.	.	.	.	.	9	.	.	.	.	.	.	9
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	70	112	112	139	69	130	78	139	96	35	17	

MONTH DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	9	9	.	.	.	.	9	17	.	120	43	.	207
.50 - .99	.	9	26	26	68	17	9	17	43	51	17	.	.	283
1.00 - 1.49	.	.	9	51	26	.	9	26	43	9	.	.	.	173
1.50 - 1.99	.	.	.	.	94	26	9	9	9	17	.	.	.	164
2.00 - 2.49	.	.	.	.	60	26	9	9	9	26	.	.	.	139
2.50 - 2.99	.	.	.	.	.	9	.	17	.	9	.	.	.	35
3.00 - 3.49	.	.	.	.	.	.	.	.	9	.	.	.	.	9
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	18	44	77	248	78	36	87	130	112	137	43	0	

(Sheet 4 of 4)

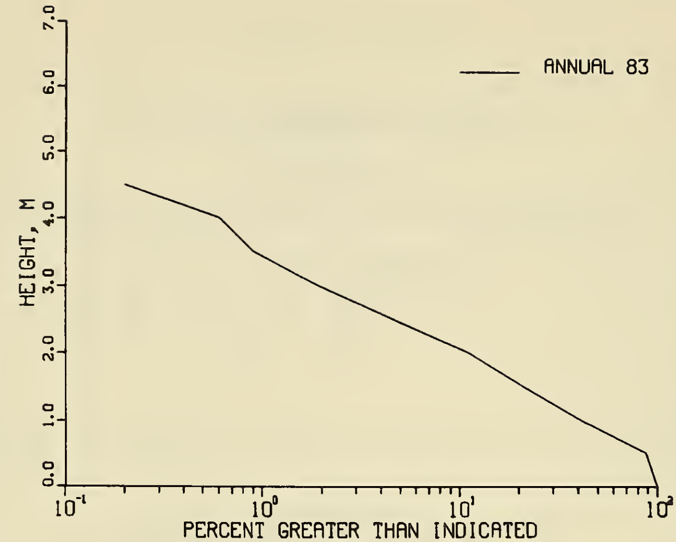


Figure B22. 1983 annual cumulative distribution of H_{m_o} for gage 620

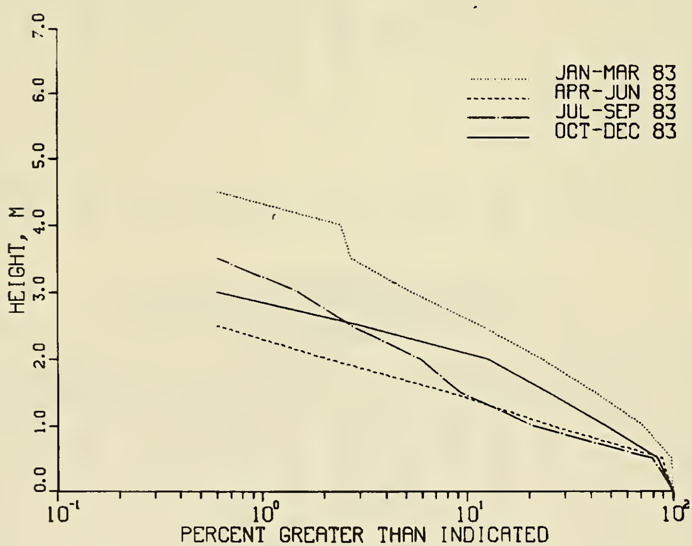
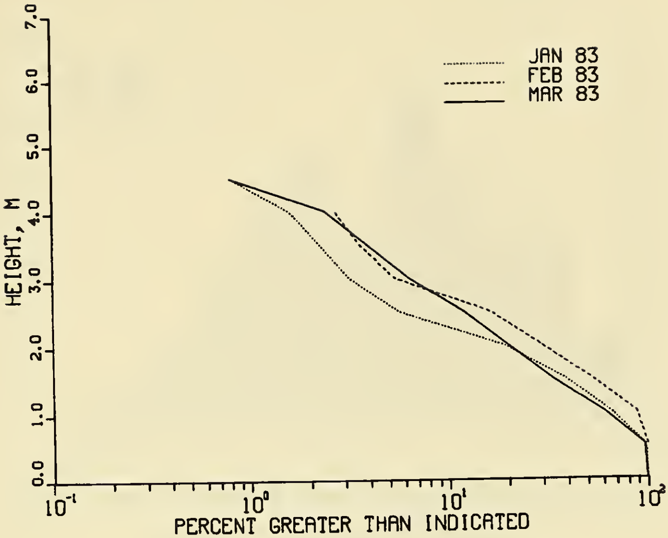


Figure B23. 1983 seasonal cumulative distribution of H_{m_o} for gage 620



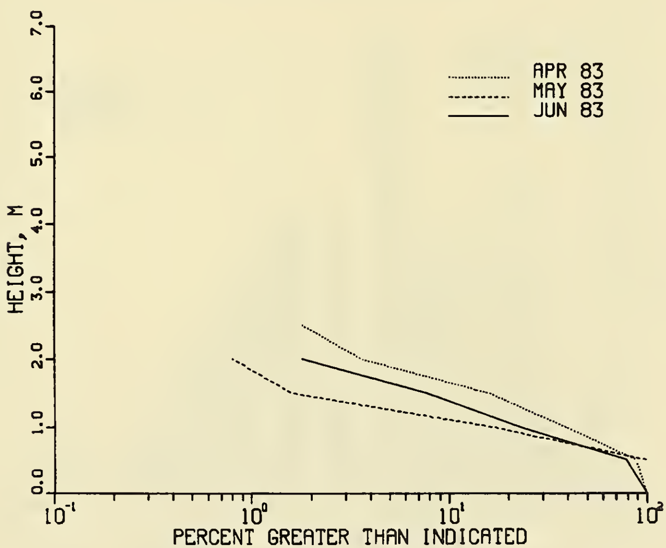
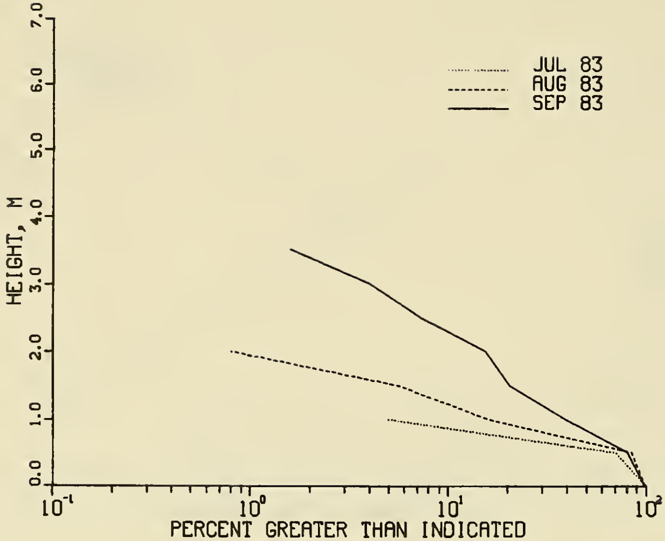


Figure B24. 1983 monthly cumulative distribution of H_{m_0} for gage 620 (Continued)



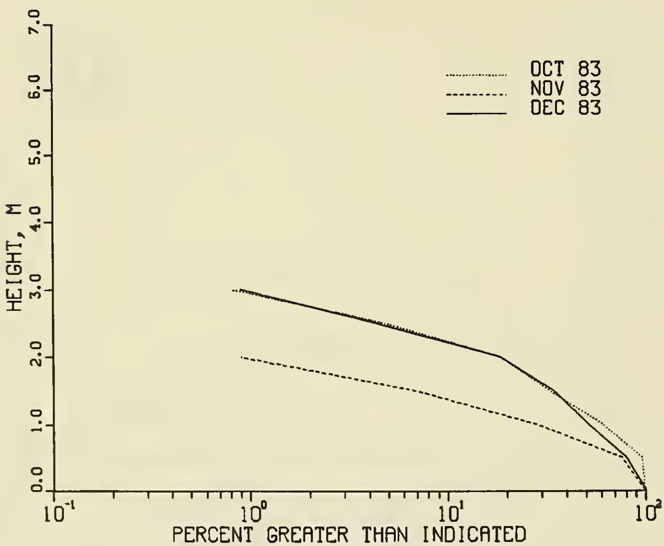


Figure B24. (Concluded)

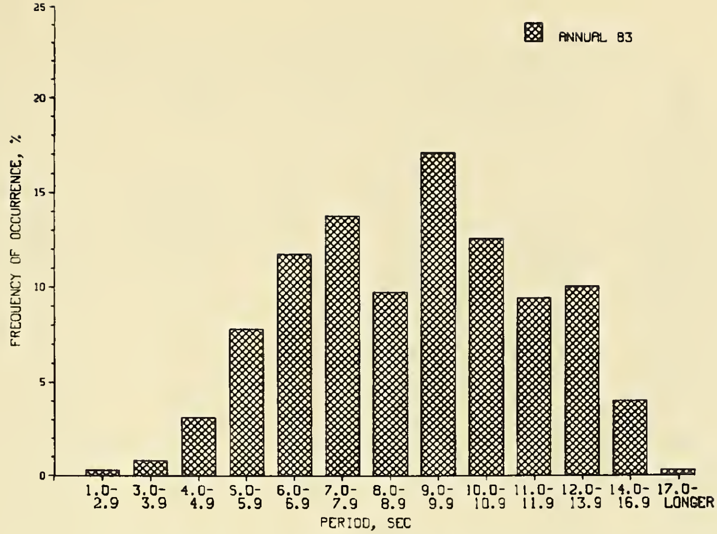


Figure B25. 1983 annual distribution of T_p for gage 620

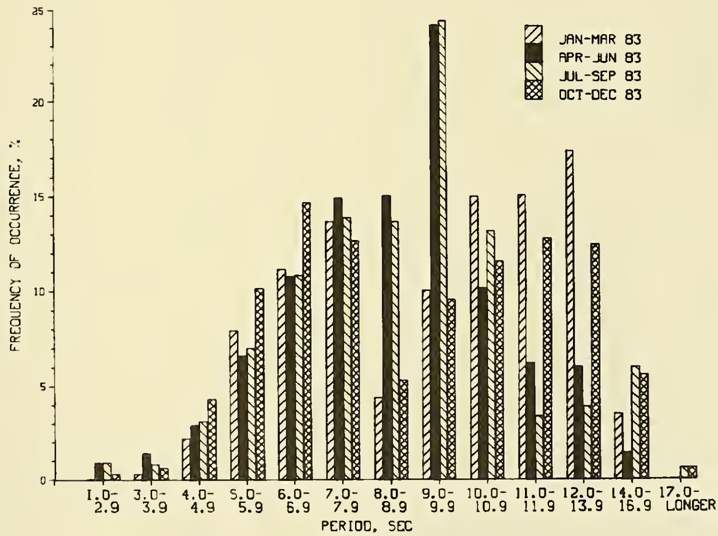


Figure B26. 1983 seasonal distribution of T_p for gage 620

Table B16

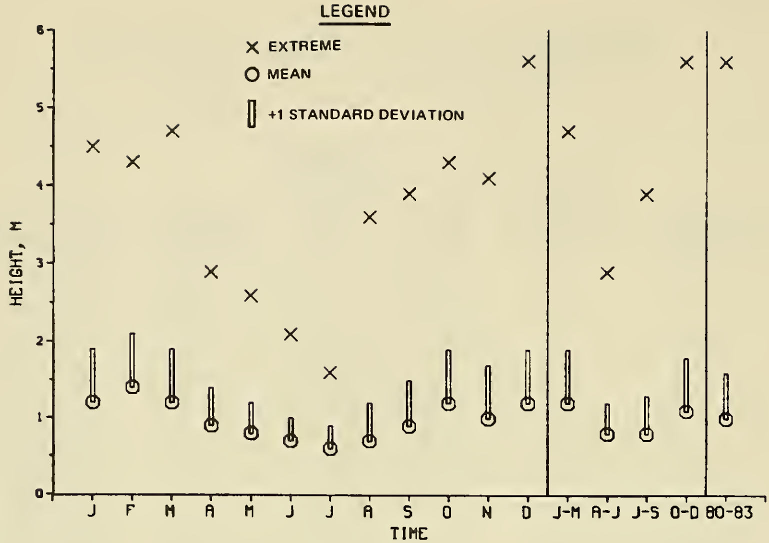
1983 Persistence of H_{m_o} for Gage 620

Height, m	Consecutive Day(s) or Longer																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	34	36	58	60	66
0.5	16	15	14	11							10			9		8				6					5	4	3	2	1	
1.0	48	32	26	19	16	13	10	7		5	3						2							1						
1.5	33	24	17	10	7	3		2										1												
2.0	31	20	12	2	1																									
2.5	20	9	3																											
3.0	7	4																												
3.5	4	1																												
4.0	4																													

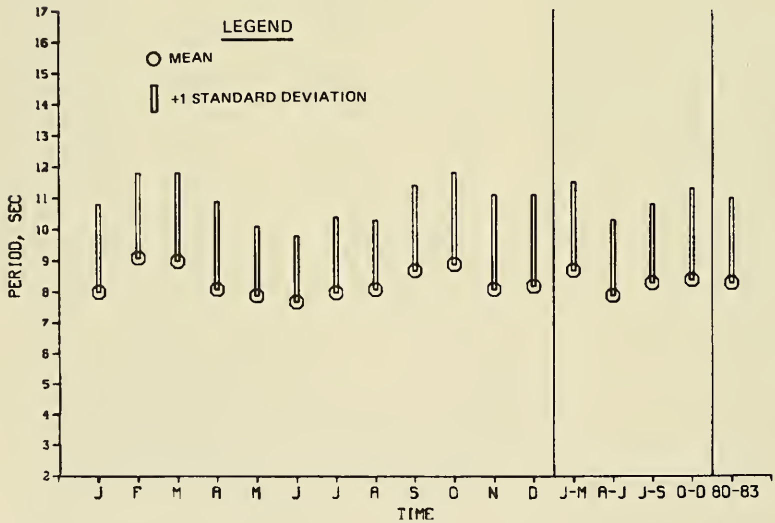
Table B17

1980 Through 1983 Mean, Standard Deviation, and Extreme H_{m_o} and T_p for Gage 620

Month	Mean Height, m	Standard Deviation Height, m	Mean Period sec	Standard Deviation Period sec	Extreme Height, m	Date	Number Observations
Jan	1.2	0.7	8.0	2.8	4.5	28	400
Feb	1.4	0.7	9.1	2.7	4.3	14	374
Mar	1.2	0.7	9.0	2.8	4.7	25	415
Apr	0.9	0.5	8.1	2.8	2.9	24	387
May	0.8	0.4	7.9	2.2	2.6	4	417
Jun	0.7	0.3	7.7	2.1	2.1	9	361
Jul	0.6	0.3	8.0	2.4	1.6	28	374
Aug	0.7	0.5	8.1	2.2	3.6	20	357
Sep	0.9	0.6	8.7	2.7	3.9	29	390
Oct	1.2	0.7	8.9	2.9	4.3	24	471
Nov	1.0	0.7	8.1	3.0	4.1	13	369
Dec	1.2	0.7	8.2	2.9	5.6	28	446
Jan-Mar	1.2	0.7	8.7	2.8	4.7	Mar	1,189
Apr-Jun	0.8	0.4	7.9	2.4	2.9	Apr	1,165
Jul-Sep	0.8	0.5	8.3	2.5	3.9	Sep	1,121
Oct-Dec	1.1	0.7	8.4	2.9	5.6	Dec	1,286
Annual	1.0	0.6	8.3	2.7	5.6	Dec	4,761



a. H_{m_0}



b. T_p

Figure B27. 1980 through 1983 mean, standard deviation, and extreme H_{m_0} and T_p for gage 620

Table B18

1980 Through 1983 Annual Joint Distribution of

H_{m_0} Versus T_p for Gage 620

ANNUAL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	1	1	3	6	7	11	22	31	14	6	17	10	1	130
.50 - .99	2	10	27	44	55	51	61	73	59	37	25	19	2	465
1.00 - 1.49	.	1	9	34	47	32	18	19	25	20	19	4	.	228
1.50 - 1.99	.	.	.	9	28	14	7	6	9	6	12	4	.	95
2.00 - 2.49	.	.	.	2	8	10	4	4	5	5	7	5	.	50
2.50 - 2.99	.	.	.	.	1	3	1	2	2	2	4	1	.	16
3.00 - 3.49	.	.	.	.	.	.	1	1	1	1	1	1	.	6
3.50 - 3.99	.	.	.	.	.	.	.	1	1	1	1	.	.	4
4.00 - 4.49	.	.	.	.	.	.	.	.	.	1	.	.	.	1
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	12	39	95	146	121	114	137	116	79	86	44	3	

Table B19

1980 Through 1983 Seasonal Joint Distribution of

H_{m_0} Versus T_p for Gage 620

SEASONAL JAN-MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	1	.	.	6	3	1	7	4	10	3	11	3	.	49
.50 - .99	.	9	22	36	34	29	24	44	64	36	34	15	1	348
1.00 - 1.49	.	1	15	45	51	29	19	24	50	32	34	8	.	308
1.50 - 1.99	.	.	1	14	38	24	8	12	19	8	21	9	.	154
2.00 - 2.49	.	.	.	4	11	13	7	5	11	8	13	11	1	84
2.50 - 2.99	.	.	.	.	2	3	1	2	7	4	13	4	.	36
3.00 - 3.49	.	.	.	.	.	.	2	2	2	4	2	2	.	14
3.50 - 3.99	.	.	.	.	.	.	.	2	1	1	1	.	.	5
4.00 - 4.49	.	.	.	.	.	.	1	.	2	2	1	.	.	6
4.50 - 4.99	.	.	.	.	.	.	.	.	1	1	.	.	.	2
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	1	10	38	105	139	99	69	95	167	99	130	52	2	

(Continued)

SEASONAL APR-JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	1	3	6	11	11	32	37	12	6	7	3	1	130
.50 - .99	6	15	39	58	58	71	106	112	65	33	17	15	.	595
1.00 - 1.49	.	1	11	22	31	30	24	26	21	18	13	1	.	198
1.50 - 1.99	.	.	1	6	9	9	6	5	11	3	7	.	.	57
2.00 - 2.49	.	.	.	2	2	3	2	5	.	2	1	1	.	18
2.50 - 2.99	.	.	.	.	.	1	2	.	.	.	.	1	.	4
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	6	17	54	94	111	125	172	185	109	62	45	21	1	

SEASONAL JUL-SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	2	4	9	12	26	44	70	25	9	17	18	2	238
.50 - .99	.	9	21	42	67	70	87	99	58	36	20	23	1	533
1.00 - 1.49	.	1	4	30	40	30	16	9	7	8	10	4	1	160
1.50 - 1.99	.	.	.	4	9	7	4	3	.	4	6	1	.	38
2.00 - 2.49	.	.	.	1	3	.	2	2	4	2	3	2	.	19
2.50 - 2.99	.	.	.	.	1	1	3	1	1	.	1	.	.	8
3.00 - 3.49	.	.	.	.	.	1	.	1	1	1	1	.	.	5
3.50 - 3.99	.	.	.	.	.	.	.	1	1	.	1	.	.	3
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	12	29	86	132	135	156	186	97	60	59	48	4	

SEASONAL OCT-DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	2	2	4	3	2	7	8	15	9	7	31	15	2	107
.50 - .99	3	9	27	40	61	38	32	43	48	44	26	23	7	401
1.00 - 1.49	.	.	8	38	65	37	14	16	19	23	19	4	1	244
1.50 - 1.99	.	.	.	11	51	16	8	4	6	10	14	7	.	127
2.00 - 2.49	.	.	.	.	17	22	6	5	5	10	9	5	1	80
2.50 - 2.99	.	.	.	.	1	8	1	6	1	5	2	.	.	24
3.00 - 3.49	.	.	.	.	.	1	4	2	1	1	2	1	.	12
3.50 - 3.99	.	.	.	.	.	.	.	2	2	2	1	2	.	9
4.00 - 4.49	.	.	.	.	.	.	.	.	.	2	.	1	.	3
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	1	1	.	2
TOTAL	5	11	39	92	197	129	73	93	91	104	105	59	11	

Table B20

1980 Through 1983 Monthly Joint Distribution

of H_{m_o} Versus T_p for Gage 620

MONTH JAN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	2	.	.	17	7	.	15	7	20	2	5	5	.	80
.50 - .99	.	20	25	45	30	35	12	35	45	42	42	17	.	348
1.00 - 1.49	.	.	17	62	62	22	.	12	40	30	10	.	.	255
1.50 - 1.99	.	.	2	17	65	35	7	10	25	5	5	2	.	173
2.00 - 2.49	.	.	.	2	15	30	7	2	12	10	2	10	2	92
2.50 - 2.99	.	.	.	.	.	2	2	2	2	2	10	5	.	25
3.00 - 3.49	.	.	.	.	.	.	2	.	2	2	.	.	.	6
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	2	.	.	.	.	2
4.50 - 4.99	.	.	.	.	.	.	.	.	.	2	.	.	.	2
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	2	20	44	143	179	124	45	68	148	95	74	39	2	

MONTH FEB
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	.	.	.	.	3	.	19	.	.	22
.50 - .99	.	3	5	27	32	5	27	37	72	37	24	3	3	275
1.00 - 1.49	.	3	11	40	51	11	35	45	59	40	51	8	.	354
1.50 - 1.99	.	.	.	13	35	29	16	16	13	8	35	8	.	173
2.00 - 2.49	.	.	.	11	13	5	5	11	13	5	19	16	.	98
2.50 - 2.99	.	.	.	.	.	5	.	.	16	11	19	3	.	54
3.00 - 3.49	.	.	.	.	.	.	.	3	.	3	3	5	.	14
3.50 - 3.99	.	.	.	.	.	.	.	.	.	3	.	.	.	3
4.00 - 4.49	.	.	.	.	.	.	.	.	3	5	.	.	.	8
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	6	16	91	131	55	83	112	179	112	170	43	3	

MONTH MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	.	.	2	2	5	5	7	5	10	5	.	41
.50 - .99	.	5	34	36	41	43	31	58	75	29	36	24	.	412
1.00 - 1.49	.	.	17	31	41	51	24	17	51	27	43	17	.	319
1.50 - 1.99	.	.	.	12	14	10	2	10	17	10	24	17	.	116
2.00 - 2.49	.	.	.	.	5	2	7	2	7	7	17	7	.	54
2.50 - 2.99	.	.	.	.	5	.	.	2	2	.	10	5	.	24
3.00 - 3.49	.	.	.	.	.	.	2	2	2	7	2	.	.	15
3.50 - 3.99	.	.	.	.	.	.	.	5	2	.	2	.	.	9
4.00 - 4.49	.	.	.	.	.	.	2	.	.	.	2	.	.	4
4.50 - 4.99	.	.	.	.	.	.	.	.	2	.	.	.	.	2
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	5	51	79	108	108	73	101	165	85	146	75	0	

(Continued)

(Sheet 1 of 4)

Table B20 (Continued)

MONTH APR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	3	5	5	5	.	26	13	13	8	13	3	.	94
.50 - .99	16	16	36	52	67	62	62	62	72	57	31	28	.	561
1.00 - 1.49	.	3	13	26	36	47	10	36	18	18	18	3	.	228
1.50 - 1.99	.	.	.	10	10	13	5	13	18	3	18	.	.	90
2.00 - 2.49	.	.	.	3	.	.	3	10	.	5	.	.	.	21
2.50 - 2.99	.	.	.	.	.	3	5	.	.	.	.	.	.	8
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	16	22	54	96	118	125	111	134	121	91	80	34	0	

MONTH MAY
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	2	7	7	12	12	38	7	2	5	2	.	94
.50 - .99	.	14	41	55	36	72	125	173	67	26	17	2	.	628
1.00 - 1.49	.	.	12	26	36	17	34	24	34	24	7	.	.	214
1.50 - 1.99	.	.	.	5	12	2	12	.	10	.	2	.	.	43
2.00 - 2.49	.	.	.	2	2	5	.	2	.	.	2	2	.	15
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	2	.	2
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	14	55	95	93	108	183	237	118	52	33	8	0	

MONTH JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	3	6	22	22	61	61	17	8	3	3	3	209
.50 - .99	3	14	42	69	72	80	133	97	55	14	3	17	.	599
1.00 - 1.49	.	.	8	14	19	28	28	17	11	11	14	.	.	150
1.50 - 1.99	.	.	3	3	6	11	.	3	6	6	.	.	.	38
2.00 - 2.49	.	.	.	.	3	3	3	3	.	.	.	.	.	12
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	14	56	92	122	144	225	181	89	39	20	20	3	

(Continued)

(Sheet 2 of 4)

Table B20 (Continued)

MONTH JUL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	5	5	8	19	32	83	136	37	11	19	13	3	371
.50 - .99	.	16	24	45	80	59	96	107	48	8	3	32	3	521
1.00 - 1.49	.	3	3	24	29	21	11	5	.	.	.	.	.	96
1.50 - 1.99	.	.	.	3	.	.	5	.	.	.	.	.	.	8
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	24	32	80	128	112	195	248	85	19	22	45	6	

MONTH AUG
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	3	11	17	45	45	42	25	8	22	17	.	235
.50 - .99	.	3	14	53	70	109	109	101	64	28	20	14	.	585
1.00 - 1.49	.	.	.	22	31	31	11	3	3	6	.	.	.	107
1.50 - 1.99	.	.	.	3	14	11	6	.	.	3	6	.	.	43
2.00 - 2.49	.	.	.	.	3	.	3	.	.	3	3	.	.	12
2.50 - 2.99	.	.	.	.	3	.	3	.	3	.	3	.	.	12
3.00 - 3.49	.	.	.	.	.	3	.	.	.	3	.	.	.	6
3.50 - 3.99	.	.	.	.	.	.	.	3	.	.	.	.	.	3
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	3	17	89	138	199	177	149	95	51	54	31	0	

MONTH SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	3	8	3	3	5	33	13	8	10	23	3	112
.50 - .99	.	8	23	28	51	46	56	90	62	69	36	23	.	492
1.00 - 1.49	.	.	8	44	59	38	26	18	18	18	28	13	3	273
1.50 - 1.99	.	.	.	5	13	10	.	8	.	10	13	3	.	62
2.00 - 2.49	.	.	.	3	5	.	3	5	13	3	5	5	.	42
2.50 - 2.99	.	.	.	.	.	3	5	3	.	.	.	.	.	11
3.00 - 3.49	.	.	.	.	.	.	.	3	3	.	3	.	.	9
3.50 - 3.99	.	.	.	.	.	.	.	.	3	.	3	.	.	6
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	8	34	88	131	100	95	160	112	108	98	67	6	

(Continued)

(Sheet 3 of 4)

Table B20 (Concluded)

MONTH OCT
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	2	.	.	.	2	8	13	17	8	8	19	6	.	83
.50 - .99	.	4	11	25	38	23	40	38	55	47	47	34	2	364
1.00 - 1.49	.	.	6	55	51	30	11	15	23	28	30	8	.	257
1.50 - 1.99	.	.	.	6	51	8	4	4	8	13	32	13	.	139
2.00 - 2.49	.	.	.	.	17	34	6	4	13	11	15	6	2	108
2.50 - 2.99	.	.	.	.	2	15	2	11	2	2	2	.	.	36
3.00 - 3.49	.	.	.	.	.	2	.	.	.	.	.	.	.	2
3.50 - 3.99	.	.	.	.	.	.	.	2	.	.	.	.	.	2
4.00 - 4.49	.	.	.	.	.	.	.	.	.	4	.	.	.	4
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	2	4	17	86	161	120	76	91	109	113	145	67	4	

MONTH NOV
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	3	3	3	5	3	14	8	22	14	8	27	14	.	124
.50 - .99	5	5	62	62	70	68	30	51	41	54	11	19	14	492
1.00 - 1.49	.	.	8	24	81	33	14	19	5	27	5	3	3	222
1.50 - 1.99	.	.	.	14	24	24	8	.	3	8	3	8	.	92
2.00 - 2.49	.	.	.	.	3	5	8	.	.	5	3	3	.	27
2.50 - 2.99	.	.	.	.	.	3	.	3	.	5	3	.	.	14
3.00 - 3.49	.	.	.	.	.	.	3	3	.	.	3	3	.	12
3.50 - 3.99	.	.	.	.	.	.	.	.	8	.	3	5	.	16
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	3	.	3
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	8	8	73	105	181	147	71	98	71	107	58	58	17	

MONTH DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	2	9	4	.	.	2	7	7	4	47	25	2	109
.50 - .99	4	16	16	36	76	29	25	40	47	31	18	16	7	361
1.00 - 1.49	.	.	9	31	67	47	18	16	27	13	18	.	.	246
1.50 - 1.99	.	.	.	13	72	16	11	7	7	9	4	.	.	139
2.00 - 2.49	.	.	.	.	29	22	4	9	2	13	9	7	.	95
2.50 - 2.99	.	.	.	.	.	4	.	4	.	7	.	.	.	15
3.00 - 3.49	.	.	.	.	.	.	9	2	2	2	2	.	.	17
3.50 - 3.99	.	.	.	.	.	.	.	2	.	7	.	.	.	9
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	2	2	.	4
TOTAL	4	18	34	84	244	118	69	87	92	86	100	50	9	

(Sheet 4 of 4)

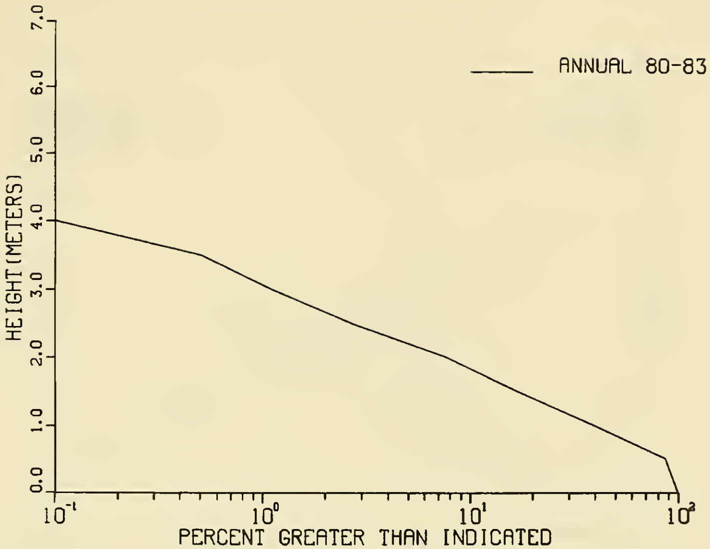


Figure B28. 1980 through 1983 annual cumulative distribution of H_{m_o} for gage 620

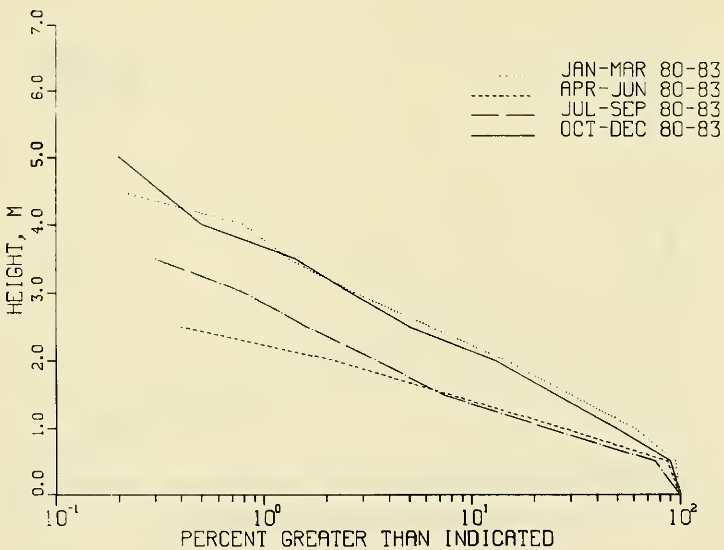
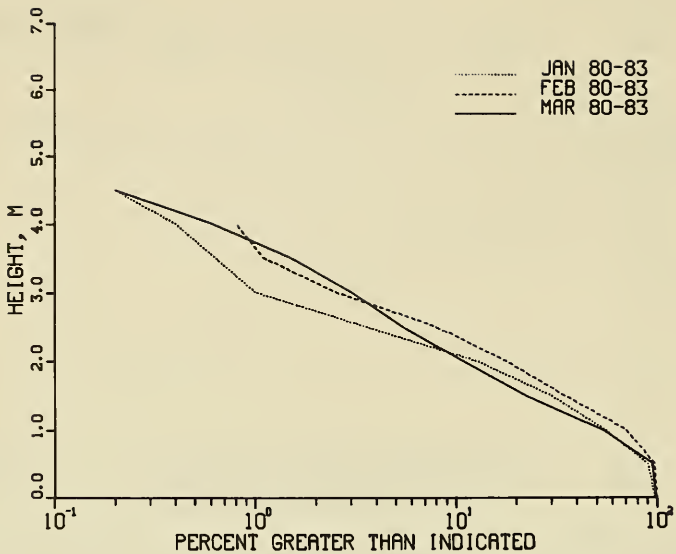


Figure B29. 1980 through 1983 seasonal cumulative distribution of H_{m_o} for gage 620



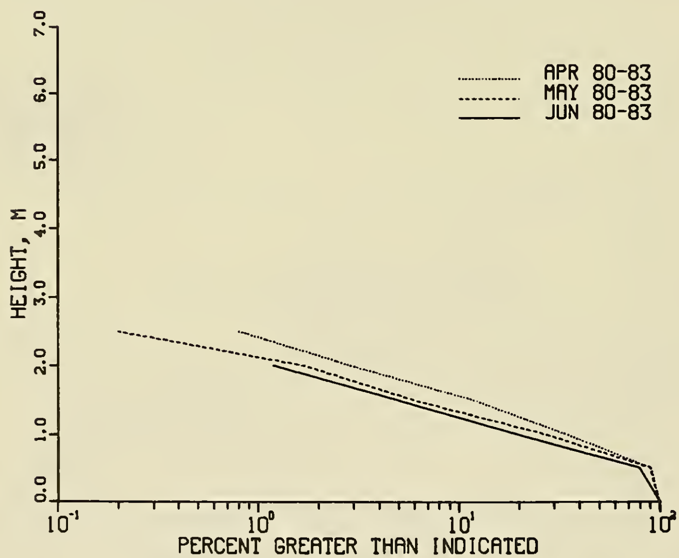
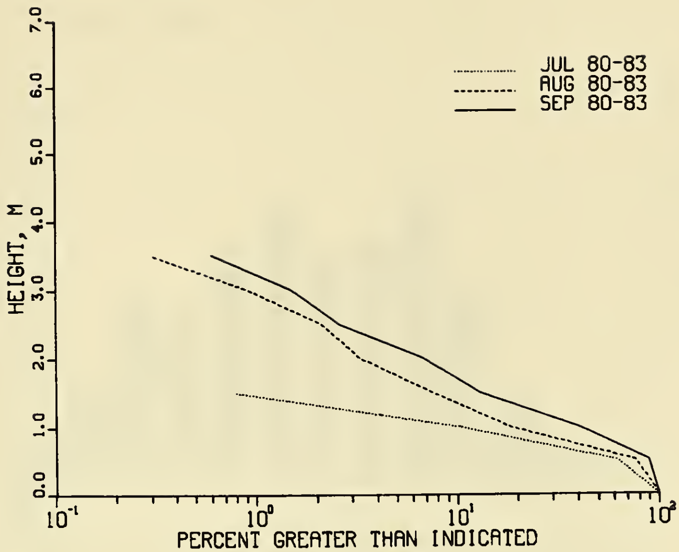


Figure B30. 1980 through 1983 monthly cumulative distribution of H_{m_0} for gage 620 (Continued)



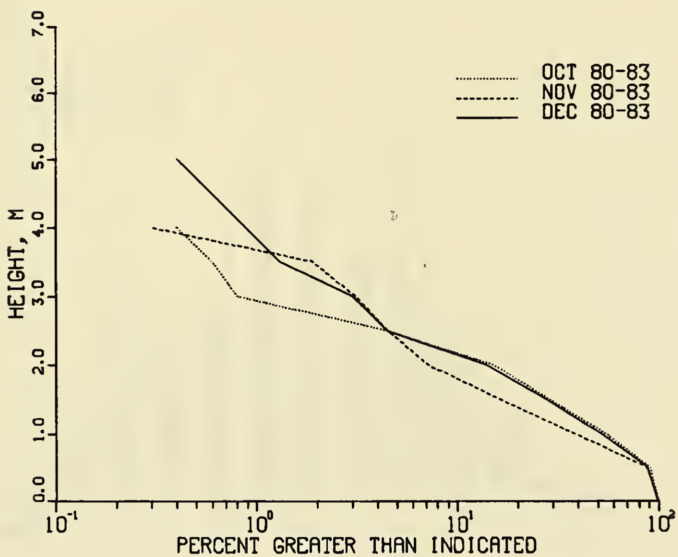


Figure B30. (Concluded)

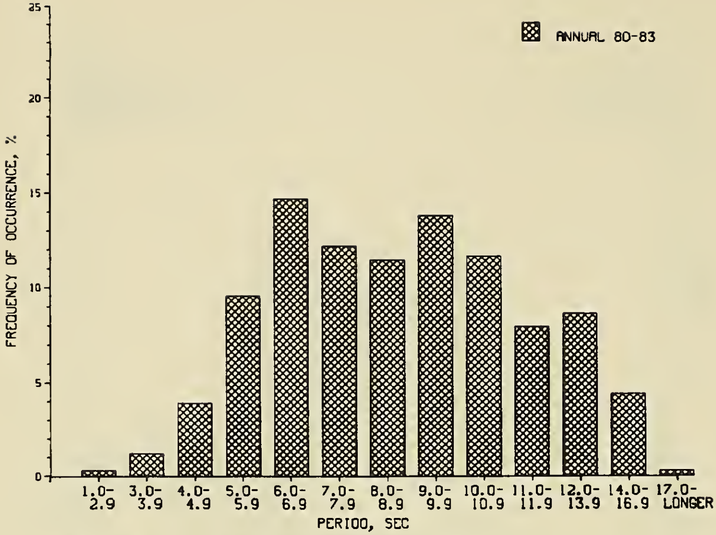


Figure B31. 1980 through 1983 annual distribution of T_p for gage 620

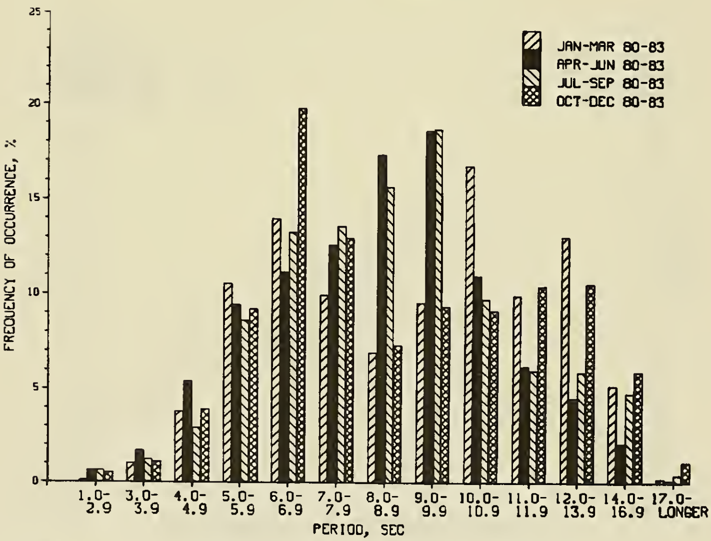
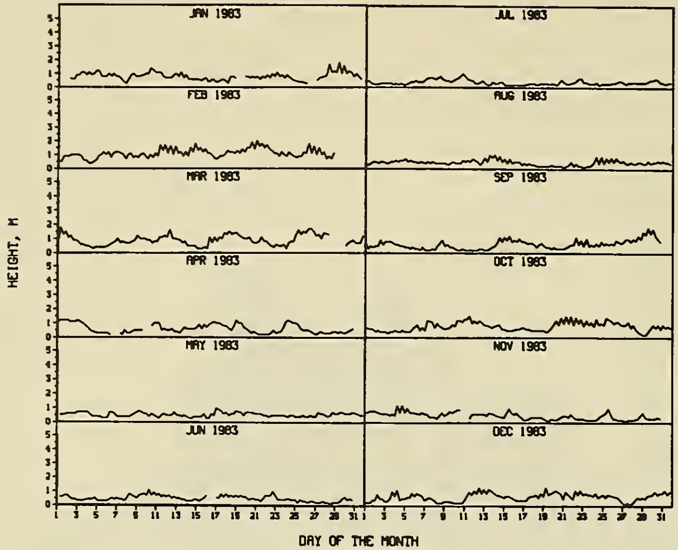


Figure B32. 1980 through 1983 seasonal distribution of T_p for gage 620

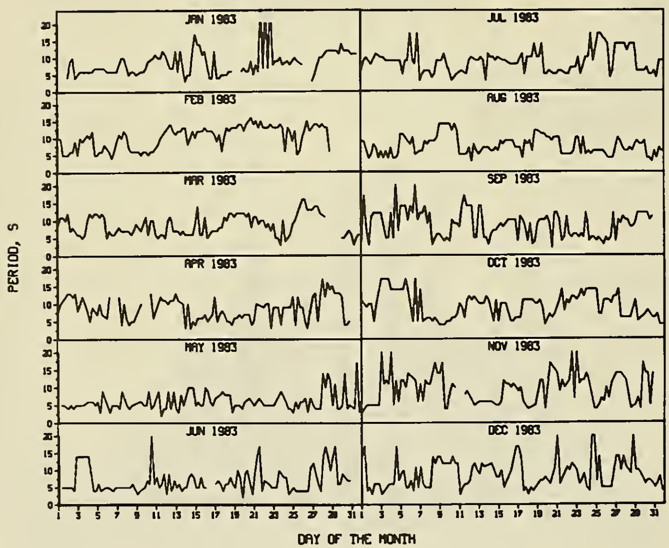
Table B21

1980 Through 1983 Persistence of H_{m_0} for Gage 620

	Consecutive Day(s) or Longer																										
Height, m	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	29	36
0.5	25	22	18	16	12		11			10				8	7	6										3	4
1.0	50	33	25	18	14	10	9	5		4	3						2										
1.5	36	20	12	8	5	4	1																				
2.0	23	12	7	3	2	1																					
2.5	12	5	2	1																							
3.0	6	3		1																							
3.5	4	2	1																								
4.0	2																										



a. H_{m_0}



b. T_p

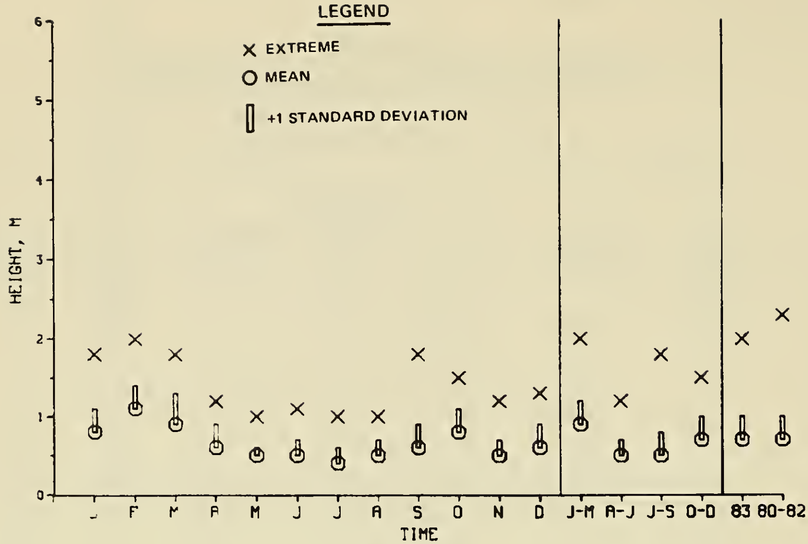
Figure B33. Time-history of H_{m_0} and T_p for gage 615

Table B22

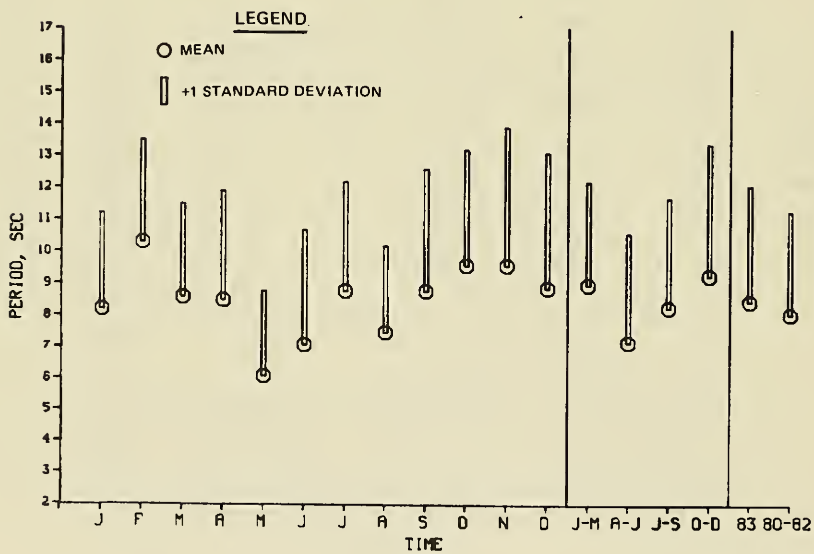
1983 Mean, Standard Deviation, and Extreme

H_{m_o} and T_p for Gage 615

Month	Mean Height, m	Standard Deviation Height, m	Mean Period sec	Standard Deviation Period sec	Extreme Height, m	Date	Number Observations
Jan	0.8	0.3	8.2	3.0	1.8	29	100
Feb	1.1	0.3	10.3	3.2	2.0	21	111
Mar	0.9	0.4	8.6	2.9	1.8	1	115
Apr	0.6	0.3	8.5	3.4	1.2	1	99
May	0.5	0.1	6.1	2.7	1.0	17	103
Jun	0.5	0.2	7.1	3.6	1.1	10	108
Jul	0.4	0.2	8.8	3.4	1.0	10	105
Aug	0.5	0.2	7.5	2.7	1.0	13	120
Sep	0.6	0.3	8.8	3.8	1.8	29	118
Oct	0.8	0.3	9.6	3.6	1.5	11	109
Nov	0.5	0.2	9.6	4.3	1.2	4	97
Dec	0.6	0.3	8.9	4.2	1.3	12	107
Jan-Mar	0.9	0.3	9.0	3.2	2.0	Feb	326
Apr-Jun	0.5	0.2	7.2	3.4	1.2	Apr	310
Jul-Sep	0.5	0.3	8.3	3.4	1.8	Sep	343
Oct-Dec	0.7	0.3	9.3	4.1	1.5	Oct	313
Annual	0.7	0.3	8.5	3.6	2.0	Feb	1,292



a. H_{m_o}



b. T_p

Figure B34. 1983 mean, standard deviation, and extreme H_{m_o} and T_p for gage 615

Table B23

1983 Annual Joint Distribution of H_{m_o} Versus T_p for Gage 615

ANNUAL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	1	7	24	39	22	11	15	41	45	19	33	47	19	323
.50 - .99	2	19	55	101	90	41	21	33	33	31	31	16	11	484
1.00 - 1.49	.	.	2	10	31	22	9	11	14	14	42	12	.	167
1.50 - 1.99	.	.	.	.	1	.	2	1	3	4	11	5	.	27
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	1	.	1
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	26	81	150	144	74	47	86	95	68	117	81	30	

Table B24

1983 Seasonal Joint Distribution of H_{m_o} Versus T_p for Gage 615

SEASONAL JAN-MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	3	3	6	3	3	6	15	15	18	3	.	75
.50 - .99	.	12	18	71	110	55	21	37	43	25	55	9	3	459
1.00 - 1.49	.	.	3	18	71	40	15	21	25	34	107	37	.	371
1.50 - 1.99	.	.	.	.	.	.	6	.	12	12	37	21	.	88
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	3	.	3
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	12	24	92	187	98	45	64	95	86	217	73	3	

(Continued)

SEASONAL APR-JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
	PERIOD(SECONDS)													
0.00 - .49	.	13	61	74	35	19	23	42	39	10	39	39	13	407
.50 - .99	6	35	90	152	71	35	32	32	19	13	13	10	6	514
1.00 - 1.49	.	.	.	6	16	10	6	10	6	.	23	.	.	77
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	6	48	151	232	122	64	61	84	64	23	75	49	19	

SEASONAL JUL-SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
	PERIOD(SECONDS)													
0.00 - .49	3	6	15	55	41	12	32	108	99	20	29	79	20	519
.50 - .99	.	23	67	85	82	44	15	35	17	20	23	3	6	420
1.00 - 1.49	.	.	.	6	3	9	12	3	12	.	9	.	.	54
1.50 - 1.99	.	.	.	.	.	.	.	3	.	.	6	.	.	9
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	29	82	146	126	65	59	149	128	40	67	82	26	

SEASONAL OCT-DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
	PERIOD(SECONDS)													
0.00 - .49	.	10	19	26	6	10	3	3	22	29	45	67	42	282
.50 - .99	.	6	45	102	96	29	16	29	54	67	32	45	29	550
1.00 - 1.49	.	.	3	10	35	29	.	10	13	22	29	10	.	161
1.50 - 1.99	.	.	.	.	3	.	3	.	.	3	.	.	.	9
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	16	67	138	140	68	22	42	89	121	106	122	71	

Table B25

1983 Monthly Joint Distribution of H_{m_o} Versus

T_p for Gage 615

MONTH JAN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	.	10	10	.	.	10	10	30	.	20	.	.	90
.50 - .99	.	20	50	90	130	60	30	60	50	30	60	20	10	610
1.00 - 1.49	.	.	.	.	90	50	10	10	20	20	60	10	.	270
1.50 - 1.99	.	.	.	.	.	.	.	.	.	20	10	.	.	30
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	20	60	100	220	110	50	80	100	70	150	30	10	

MONTH FEB
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	.	.	.	.	.	.	.	9	9	.	.	.	18
.50 - .99	.	.	.	54	63	9	.	27	36	18	99	9	.	315
1.00 - 1.49	.	.	9	27	99	18	9	18	54	27	171	72	.	504
1.50 - 1.99	.	.	.	.	.	.	18	.	.	9	81	45	.	153
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	9	.	9
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	9	81	162	27	27	45	99	63	351	135	0	

MONTH MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	.	.	.	17	9	.	9	9	35	35	9	.	123
.50 - .99	.	17	9	70	139	96	35	26	43	26	9	.	.	470
1.00 - 1.49	.	.	.	26	26	52	26	35	.	52	87	26	.	330
1.50 - 1.99	.	.	.	.	.	.	.	.	35	9	17	17	.	78
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	17	9	96	182	157	61	70	87	122	148	52	0	

(Continued)

(Sheet 1 of 4)

Table B25 (Continued)

MONTH APR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	10	40	30	20	30	10	40	40	20	111	30	10	391
.50 - .99	.	30	51	81	40	40	20	20	51	30	30	.	.	393
1.00 - 1.49	.	.	.	10	40	20	20	30	20	.	71	.	.	211
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	40	91	121	100	90	50	90	111	50	212	30	10	

MONTH MAY
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	19	29	78	58	19	10	49	49	.	.	.	.	311
.50 - .99	10	49	165	233	68	19	39	39	.	10	10	29	10	681
1.00 - 1.49	.	.	.	.	.	10	.	.	.	.	.	.	.	10
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	10	68	194	311	126	48	49	88	49	10	10	29	10	

MONTH JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	9	111	111	28	9	46	37	28	9	9	83	28	508
.50 - .99	9	28	56	139	102	46	37	37	9	.	.	.	9	472
1.00 - 1.49	.	.	.	9	9	.	.	.	.	.	.	.	.	18
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	9	37	167	259	139	55	83	74	37	9	9	83	37	

(Continued)

(Sheet 2 of 4)

Table B25 (Continued)

MONTH JUL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	10	10	76	57	10	48	181	152	38	10	105	38	735
.50 - .99	.	19	19	57	76	29	.	48	.	.	.	.	10	258
1.00 - 1.49	.	.	.	10	.	.	.	.	.	.	.	.	.	10
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	29	29	143	133	39	48	229	152	38	10	105	48	

MONTH AUG
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	.	17	50	67	25	42	108	92	17	25	42	.	485
.50 - .99	.	17	92	92	117	75	33	33	8	17	8	8	.	500
1.00 - 1.49	.	.	.	.	.	17	.	.	.	.	.	.	.	17
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	17	109	142	184	117	75	141	100	34	33	50	0	

MONTH SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	8	8	17	42	.	.	8	42	59	8	51	93	25	361
.50 - .99	.	34	85	102	51	25	8	25	42	42	59	.	8	481
1.00 - 1.49	.	.	.	8	8	8	34	8	34	.	25	.	.	125
1.50 - 1.99	.	.	.	.	.	.	.	8	.	.	17	.	.	25
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	8	42	102	152	59	33	50	83	135	50	152	93	33	

(Continued)

(Sheet 3 of 4)

Table B25 (Concluded)

MONTH OCT
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	.	.	9	9	.	.	.	18	18	.	37	46	137
.50 - .99	.	.	46	83	101	28	9	18	64	92	28	83	9	561
1.00 - 1.49	.	.	.	18	37	46	.	18	28	46	55	28	.	276
1.50 - 1.99	.	.	.	.	9	.	9	.	.	9	.	.	.	27
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	0	46	110	156	74	18	36	110	165	83	148	55	

MONTH NOV
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	.	41	52	10	31	10	10	31	52	82	82	41	442
.50 - .99	.	10	52	82	93	.	.	31	41	72	41	41	41	504
1.00 - 1.49	.	.	.	10	10	10	.	.	.	.	21	.	.	51
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	10	93	144	113	41	10	41	72	124	144	123	82	

MONTH DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	28	19	19	.	.	.	.	19	19	56	84	37	281
.50 - .99	.	9	37	140	93	56	37	37	56	37	28	9	37	576
1.00 - 1.49	.	.	9	.	56	28	.	9	9	19	9	.	.	139
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	37	65	159	149	84	37	46	84	75	93	93	74	

(Sheet 4 of 4)

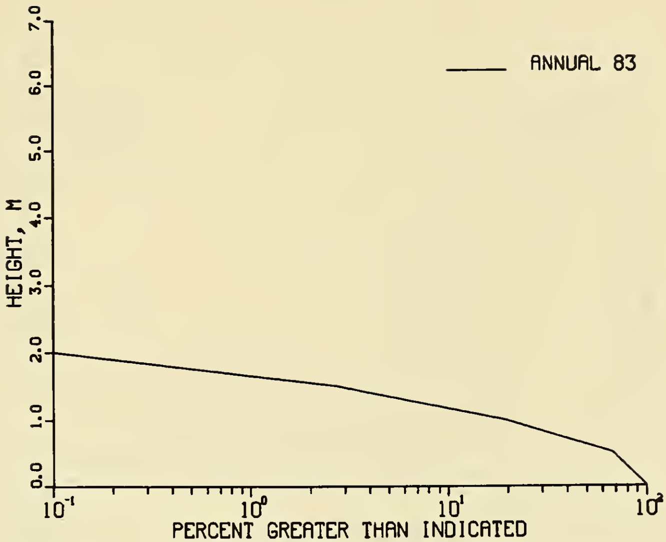


Figure B35. 1983 annual cumulative distribution of H_{m_0} for gage 615

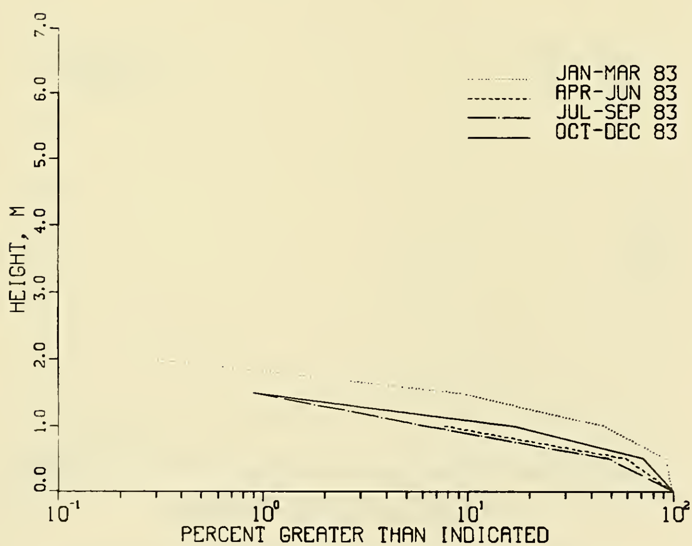
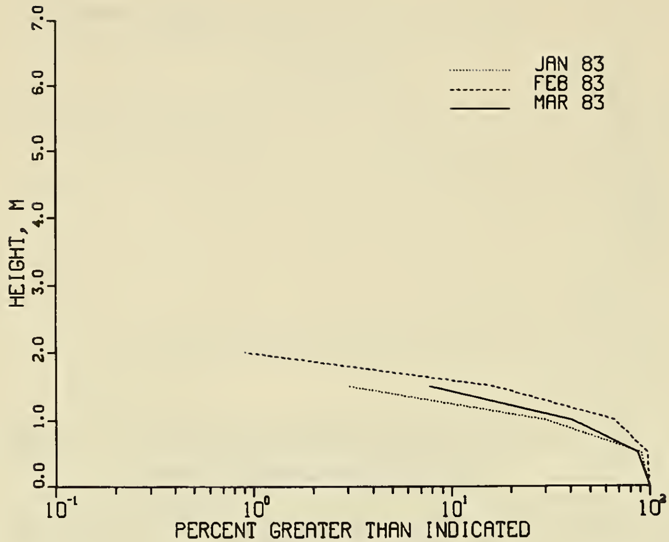


Figure B36. 1983 seasonal cumulative distribution of H_{m_0} for gage 615



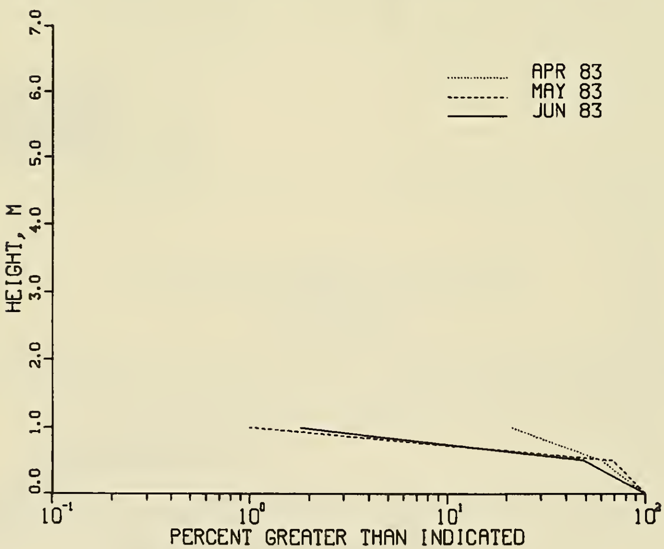
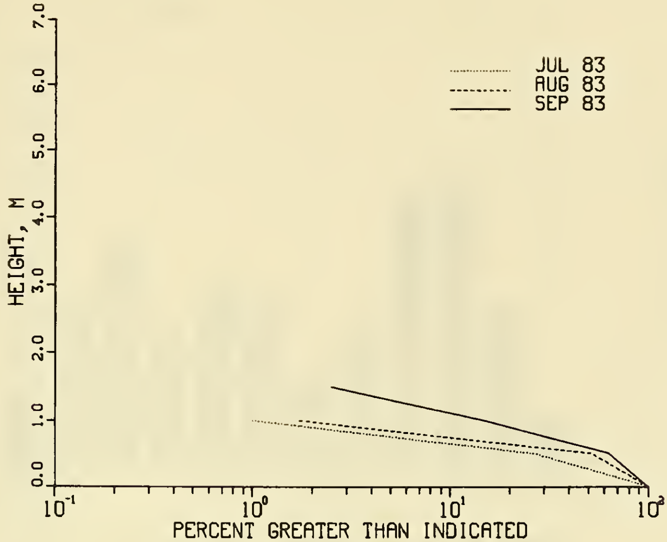


Figure B37. 1983 monthly distribution of H_{m_0} for gage 615 (Continued)



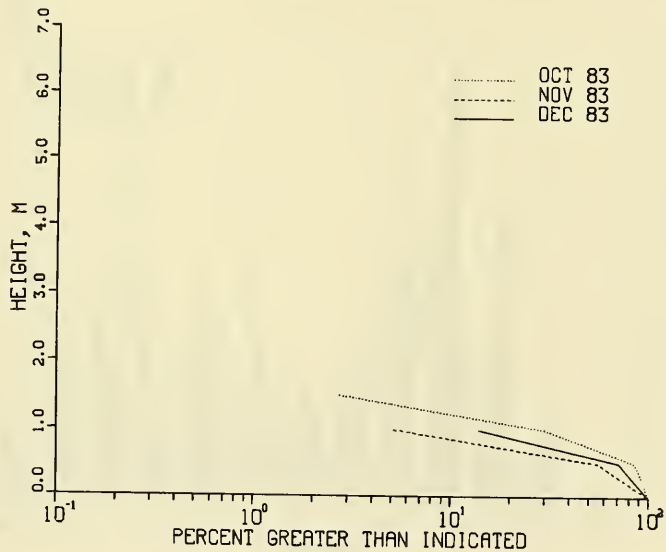


Figure B37. (Concluded)

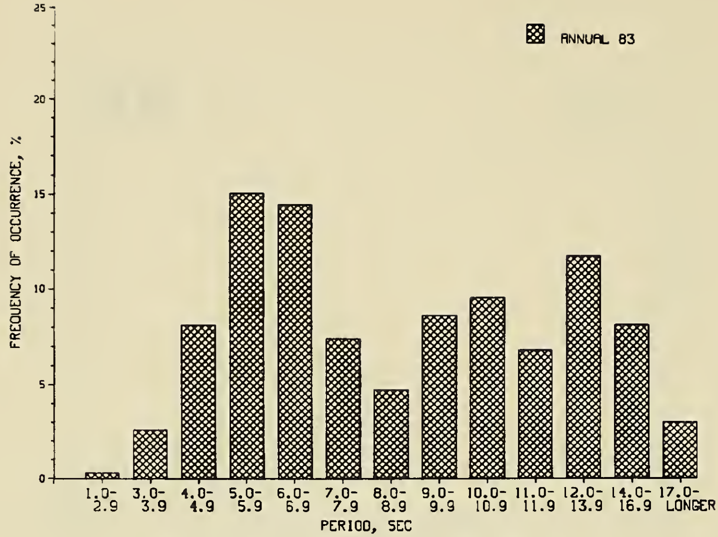


Figure B38. 1983 annual distribution of T_p for gage 615.

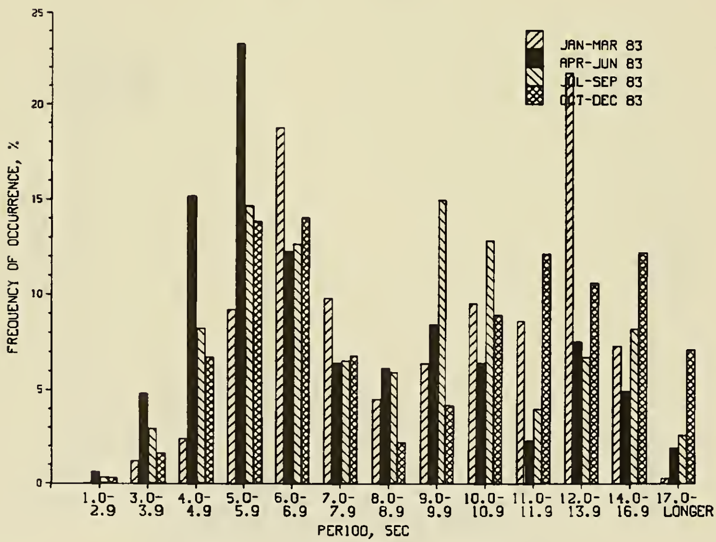


Figure B39. 1983 seasonal distribution of T_p for gage 615

Table B26

1983 Persistence of H_{m_o} for Gage 625

Height, m	Consecutive Day(s) or Longer																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	33
0.5	38	30	26	25	23	20	16	14	12	11		9	7	6				5	4						3	1
1.0	35	26	13	10		4		2																1		
1.5	12	7	1																							
2.0	1																									
2.5																										
3.0																										
3.5																										
4.0																										

Table B27

1980 Through 1983 Mean, Standard Deviation, and Extreme H_{m_0} and T_p for Gage 615

Month	Mean Height, m	Standard Deviation Height, m	Mean Period sec	Standard Deviation Period sec	Extreme Height, m	Date	Number Observations
Jan	0.7	0.4	7.2	3.0	2.0	18	321
Feb	0.9	0.4	9.1	3.2	2.0	21	344
Mar	0.8	0.4	8.7	3.5	2.3	3	409
Apr	0.6	0.3	8.2	3.3	1.4	7	339
May	0.6	0.2	7.6	3.0	1.7	4	421
Jun	0.5	0.2	7.5	3.1	1.3	10	389
Jul	0.5	0.2	7.7	2.9	1.2	1	397
Aug	0.5	0.3	7.6	2.9	1.7	29	395
Sep	0.7	0.3	8.6	3.4	1.8	29	365
Oct	0.8	0.4	9.0	3.4	2.2	11	440
Nov	0.7	0.4	8.7	3.7	2.0	14	416
Dec	0.7	0.3	8.1	3.6	1.7	13	400
Jan-Mar	0.8	0.4	8.4	3.4	2.3	Mar	1,074
Apr-Jun	0.6	0.2	7.8	3.1	1.7	May	1,149
Jul-Sep	0.6	0.3	8.0	3.1	1.8	Sep	1,157
Oct-Dec	0.8	0.4	8.6	3.6	2.2	Oct	1,256
Annual	0.7	0.3	8.2	3.3	2.3	Mar	4,636

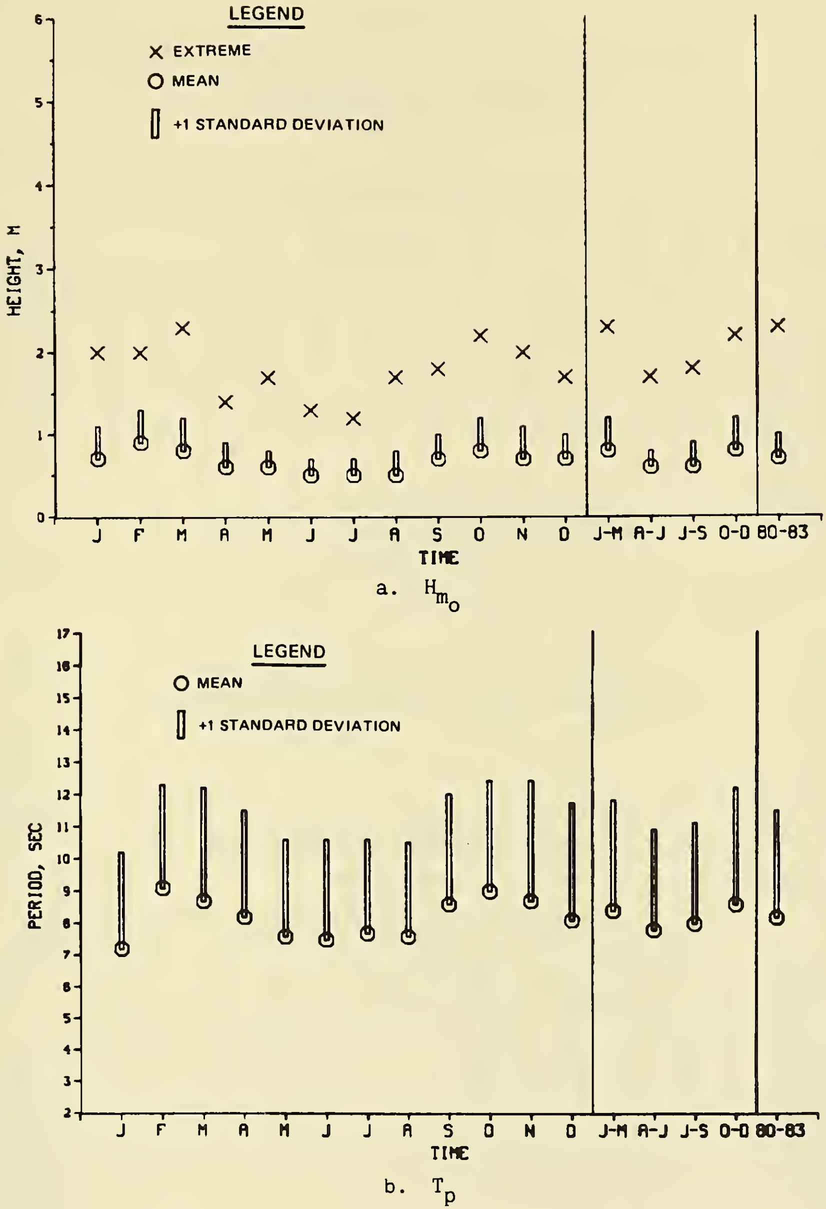


Figure B40. 1980 through 1983 mean, standard deviation, and extreme H_{m_o} and T_p for gage 615

Table B28

1980 Through 1983 Annual Joint Distribution of H_{m_o} Versus T_p for Gage 615

ANNUAL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
	PERIOD(SECONDS)													
0.00 - .49	2	6	17	35	27	28	36	39	35	19	30	37	10	321
.50 - .99	2	15	49	95	84	43	31	36	41	26	30	21	5	478
1.00 - 1.49	.	.	3	23	42	24	8	9	10	13	23	12	1	168
1.50 - 1.99	.	.	.	1	3	3	1	2	2	5	8	5	1	31
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	1	1	.	2
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	4	21	69	154	156	98	76	86	88	63	92	76	17	

Table B29

1980 Through 1983 Seasonal Joint Distribution of H_{m_o} Versus T_p for Gage 615

SEASONAL JAN-MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
	PERIOD(SECONDS)													
0.00 - .49	3	4	9	28	18	13	17	11	25	16	19	20	1	184
.50 - .99	3	17	35	105	82	36	25	28	49	22	47	39	1	489
1.00 - 1.49	.	.	6	32	58	34	12	12	15	21	44	28	.	262
1.50 - 1.99	.	.	.	1	4	7	3	5	5	8	16	13	.	62
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	1	3	.	4
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	6	21	50	166	162	90	57	56	94	67	127	103	2	

(Continued)

Table B29 (Concluded)

SEASONAL APR-JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	1	10	25	46	30	40	52	51	35	12	33	40	12	387
.50 - .99	3	18	67	113	76	44	50	47	48	31	10	10	5	522
1.00 - 1.49	.	.	1	11	17	8	10	8	11	7	13	1	.	87
1.50 - 1.99	.	.	.	.	1	.	.	.	1	.	1	1	.	4
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	4	28	93	170	124	92	112	106	95	50	57	52	17	

SEASONAL JUL-SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	3	9	22	46	44	43	65	74	62	27	31	44	11	481
.50 - .99	.	15	53	80	72	48	24	35	24	16	28	11	3	409
1.00 - 1.49	.	.	1	20	29	15	7	5	6	5	10	3	2	103
1.50 - 1.99	.	.	.	1	2	3	.	1	.	1	2	1	.	11
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	24	76	147	147	109	96	115	92	49	71	59	16	

SEASONAL OCT-DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	2	2	12	19	16	15	10	18	18	21	37	44	16	230
.50 - .99	1	11	42	84	105	44	27	32	42	34	33	25	11	491
1.00 - 1.49	.	.	3	30	63	37	4	13	8	18	28	18	2	224
1.50 - 1.99	.	.	.	1	6	3	1	2	2	9	14	7	3	48
2.00 - 2.49	.	.	.	.	.	1	.	.	1	.	2	2	.	6
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	13	57	134	190	100	42	65	71	82	114	96	32	

Table B30

1980 Through 1983 Monthly Joint Distribution

of H_{m_o} Versus T_p for Gage 615

MONTH JAN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	9	9	12	53	31	22	28	16	28	.	19	28	.	255
.50 - .99	3	22	50	131	100	40	16	25	28	12	31	16	3	477
1.00 - 1.49	.	.	6	47	72	40	9	6	16	12	19	6	.	233
1.50 - 1.99	.	.	.	.	3	3	.	3	3	16	3	.	.	31
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	3	.	3
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	12	31	68	231	206	105	53	50	75	40	72	53	3	

MONTH FEB
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	.	3	12	3	12	12	3	26	20	12	6	3	112
.50 - .99	3	9	20	90	61	17	38	35	78	35	70	38	.	494
1.00 - 1.49	.	.	3	26	61	32	12	17	23	23	67	29	.	293
1.50 - 1.99	.	.	.	.	9	17	6	6	.	6	38	17	.	99
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	3	.	3
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	9	26	128	134	78	69	61	127	84	187	93	3	

MONTH MAR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	
0.00 - .49	.	2	12	22	20	7	12	15	22	24	24	24	.	184
.50 - .99	2	20	37	98	86	49	22	24	42	20	42	59	.	501
1.00 - 1.49	.	.	7	24	44	32	15	12	7	27	44	44	.	256
1.50 - 1.99	.	.	.	2	.	2	2	5	10	5	7	20	.	53
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	2	2	.	4
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	2	22	56	146	150	90	51	56	81	76	119	149	0	

(Continued)

MONTH APR
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	3	12	18	35	29	44	35	32	24	15	59	53	9	368
.50 - .99	3	15	44	106	80	27	35	32	50	59	18	12	3	484
1.00 - 1.49	.	.	.	12	32	18	15	15	18	6	32	.	.	148
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	6	27	62	153	141	89	85	79	92	80	109	65	12	

MONTH MAY
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	10	21	45	21	24	48	55	48	17	40	24	5	358
.50 - .99	2	21	76	124	78	50	52	52	50	21	14	19	5	564
1.00 - 1.49	.	.	2	14	14	5	10	7	10	.	5	2	.	69
1.50 - 1.99	.	.	.	.	2	.	.	.	2	.	2	2	.	8
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	2	31	99	183	115	79	110	114	110	38	61	47	10	

MONTH JUN
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS) 1.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-13.9	14.0-16.9	17.0-LONGER	TOTAL
0.00 - .49	.	8	36	57	41	54	72	64	31	5	3	46	23	440
.50 - .99	3	18	77	108	69	51	59	54	44	18	.	.	8	509
1.00 - 1.49	.	.	.	8	5	3	5	3	8	15	5	.	.	52
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	26	113	173	115	108	136	121	83	38	8	46	31	

(Continued)

MONTH JUL
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	5	10	35	48	55	40	111	116	83	38	20	45	13	619
.50 - .99	.	15	45	88	68	38	35	33	10	.	3	5	3	343
1.00 - 1.49	.	.	3	15	8	5	5	.	3	.	.	.	.	39
1.50 - 1.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	5	25	83	151	131	83	151	149	96	38	23	50	16	

MONTH AUG
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	.	13	18	68	56	61	63	73	58	18	35	46	5	514
.50 - .99	.	15	61	84	78	56	23	25	23	23	13	3	.	404
1.00 - 1.49	.	.	.	3	25	18	3	5	3	8	5	5	.	75
1.50 - 1.99	.	.	.	.	.	5	.	.	.	3	.	3	.	11
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	28	79	155	159	140	89	103	84	52	53	57	5	

MONTH SEP
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	PERIOD(SECONDS)													TOTAL
	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	
0.00 - .49	3	3	11	19	19	27	16	30	44	25	38	41	16	292
.50 - .99	.	14	52	66	68	52	14	49	41	25	71	27	5	484
1.00 - 1.49	.	.	.	44	55	22	14	11	14	8	25	5	5	203
1.50 - 1.99	.	.	.	3	5	3	.	3	.	.	5	.	.	19
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	3	17	63	132	147	104	44	93	99	58	139	73	26	

(Continued)

Table B30 (Concluded)

MONTH OCT
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	TOTAL
	PERIOD(SECONDS)													
0.00 - .49	2	.	2	14	11	14	14	18	18	16	39	30	14	192
.50 - .99	.	7	25	61	80	23	23	32	70	45	48	36	7	457
1.00 - 1.49	.	.	.	41	66	52	7	18	9	34	27	14	.	268
1.50 - 1.99	.	.	.	2	16	5	2	2	2	11	11	11	9	71
2.00 - 2.49	.	.	.	.	.	2	.	.	.	.	5	5	.	12
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	2	7	27	118	173	96	46	70	99	106	130	96	30	

MONTH NOV
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	TOTAL
	PERIOD(SECONDS)													
0.00 - .49	5	.	22	19	17	17	10	22	17	29	48	38	10	254
.50 - .99	2	7	50	96	101	65	31	31	22	34	17	31	12	499
1.00 - 1.49	.	.	.	17	46	29	5	2	5	10	36	36	7	193
1.50 - 1.99	.	.	.	.	2	5	.	2	5	10	19	10	.	53
2.00 - 2.49	.	.	.	.	.	.	.	.	2	.	.	.	.	2
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	7	7	72	132	166	116	46	57	51	83	120	115	29	

MONTH DEC
PERCENT OCCURRENCE(X10) OF HEIGHT AND PERIOD

HEIGHT(METERS)	1.0- 2.9	3.0- 3.9	4.0- 4.9	5.0- 5.9	6.0- 6.9	7.0- 7.9	8.0- 8.9	9.0- 9.9	10.0- 10.9	11.0- 11.9	12.0- 13.9	14.0- 16.9	17.0- LONGER	TOTAL
	PERIOD(SECONDS)													
0.00 - .49	.	7	12	25	20	15	7	15	20	20	22	65	25	253
.50 - .99	.	20	52	95	137	45	27	32	32	22	37	5	15	519
1.00 - 1.49	.	.	10	32	77	27	.	17	10	10	20	2	.	205
1.50 - 1.99	.	.	.	.	.	.	.	2	.	5	10	.	.	17
2.00 - 2.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
2.50 - 2.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.00 - 3.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
3.50 - 3.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.00 - 4.49	.	.	.	.	.	.	.	.	.	.	.	.	.	0
4.50 - 4.99	.	.	.	.	.	.	.	.	.	.	.	.	.	0
5.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	0	27	74	152	234	87	34	66	62	57	89	72	40	

(Sheet 4 of 4)

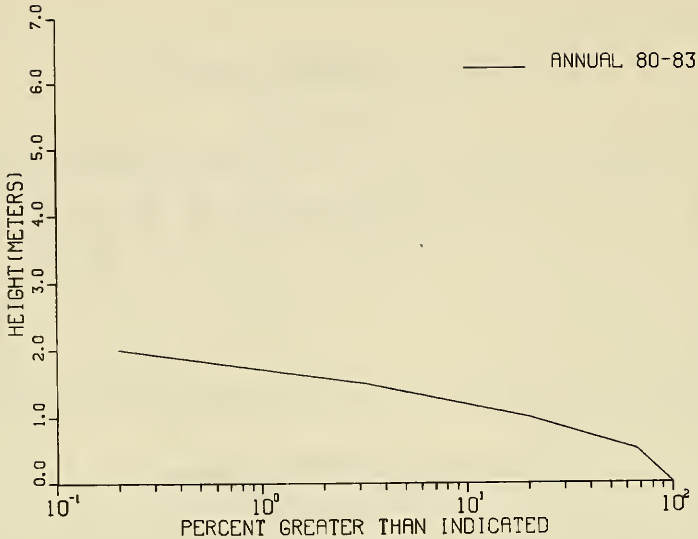


Figure B41. 1980 through 1983 annual cumulative distribution of H_{m_o} for gage 615

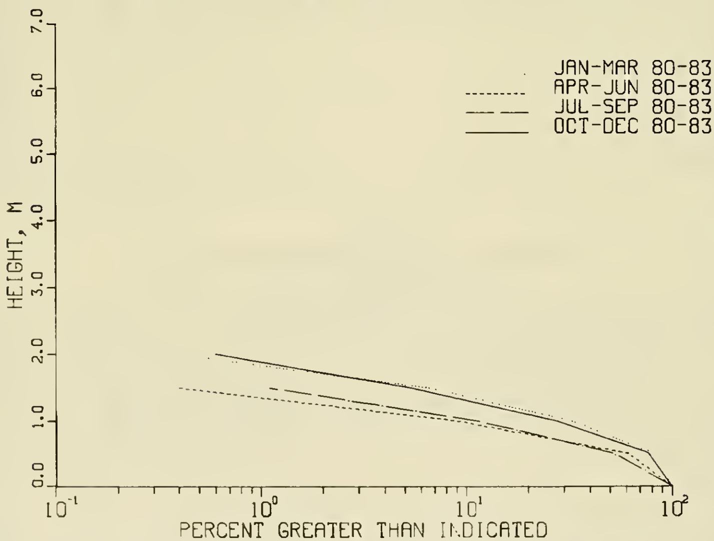
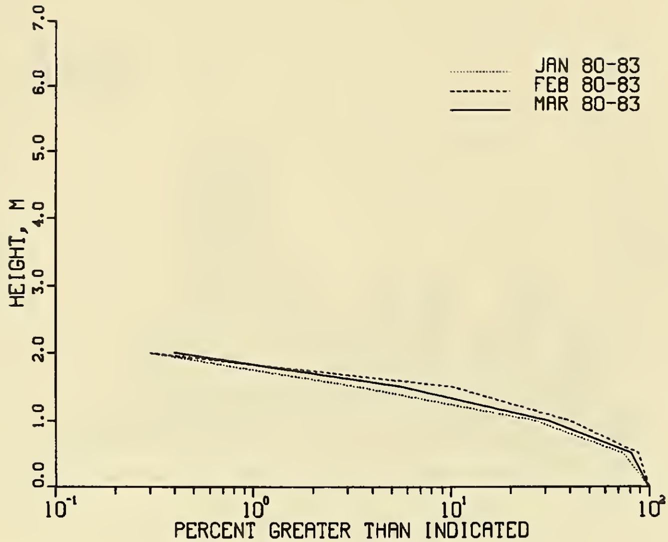


Figure B42. 1980 through 1983 seasonal cumulative distribution of H_{m_o} for gage 615



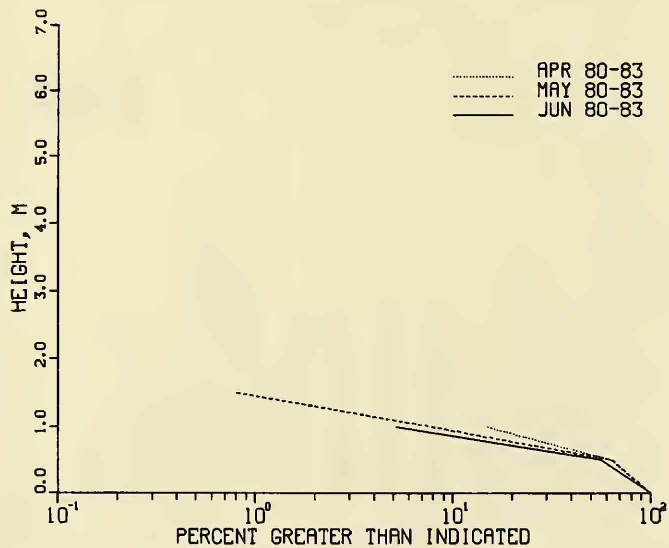
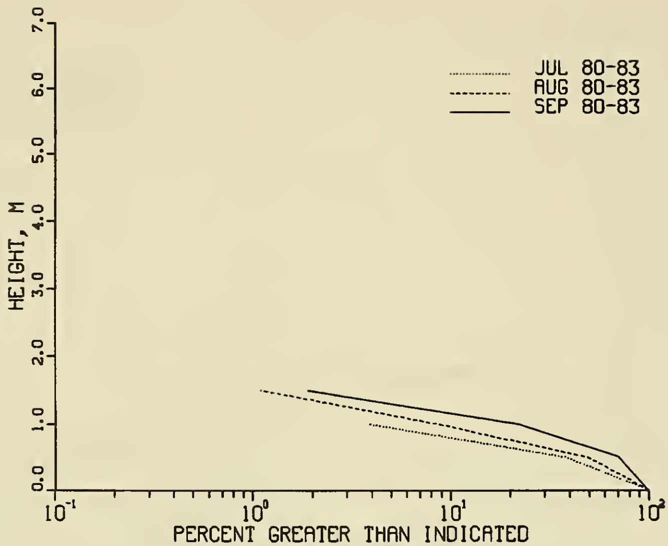


Figure B43. 1980 through 1983 monthly cumulative distribution of H_{m_o} for gage 615 (Continued)



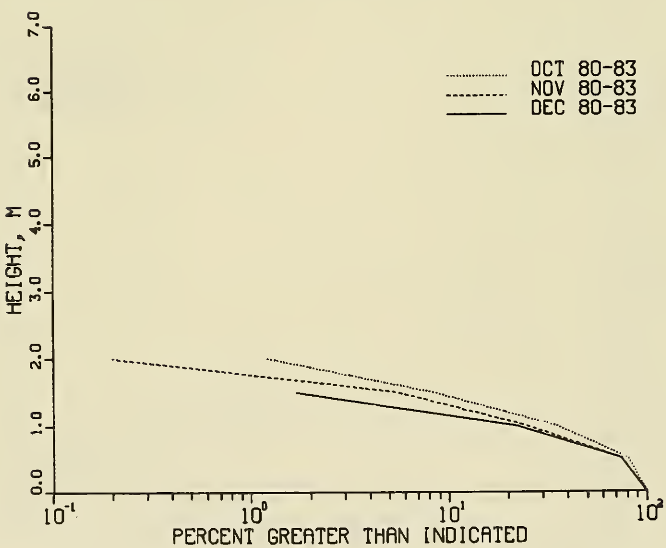


Figure B43. (Concluded)

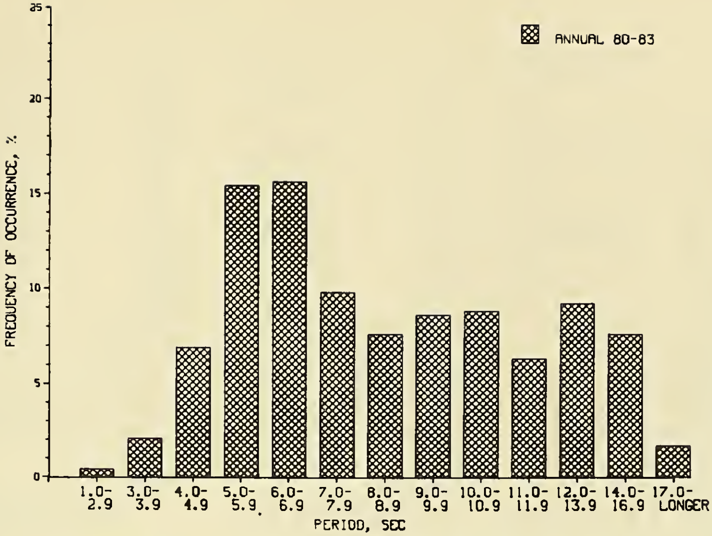


Figure B44. 1980 through 1983 annual distribution of T_p for gage 615

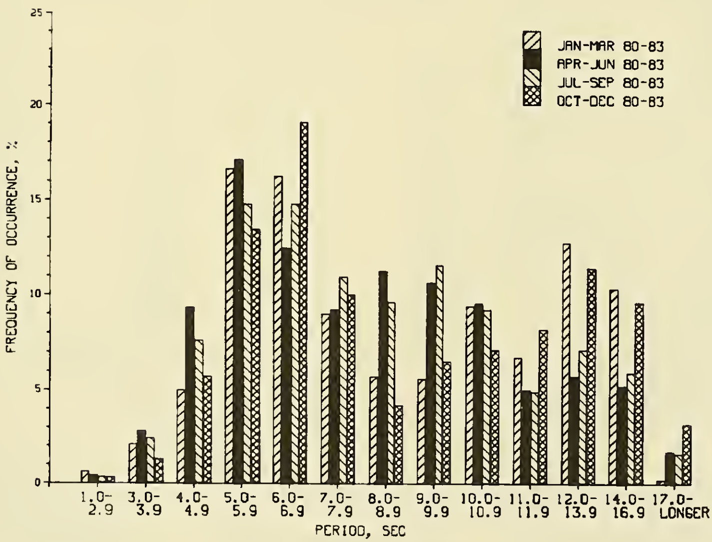


Figure B45. 1980 through 1983 seasonal distribution of T_p for gage 615

Table B31

1980 Through 1983 Persistence of H_{m_o} for Gage 615

	Consecutive Day(s) or Longer																									
Height, m	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	33
0.5	41	34	29	24	20	15	10	13	10	9			6						3							2
1.0	41	25	15	9	6			3																		
1.5	12	6		3	1																					
2.0	2																									
2.5																										
3.0																										
3.5																										
4.0																										

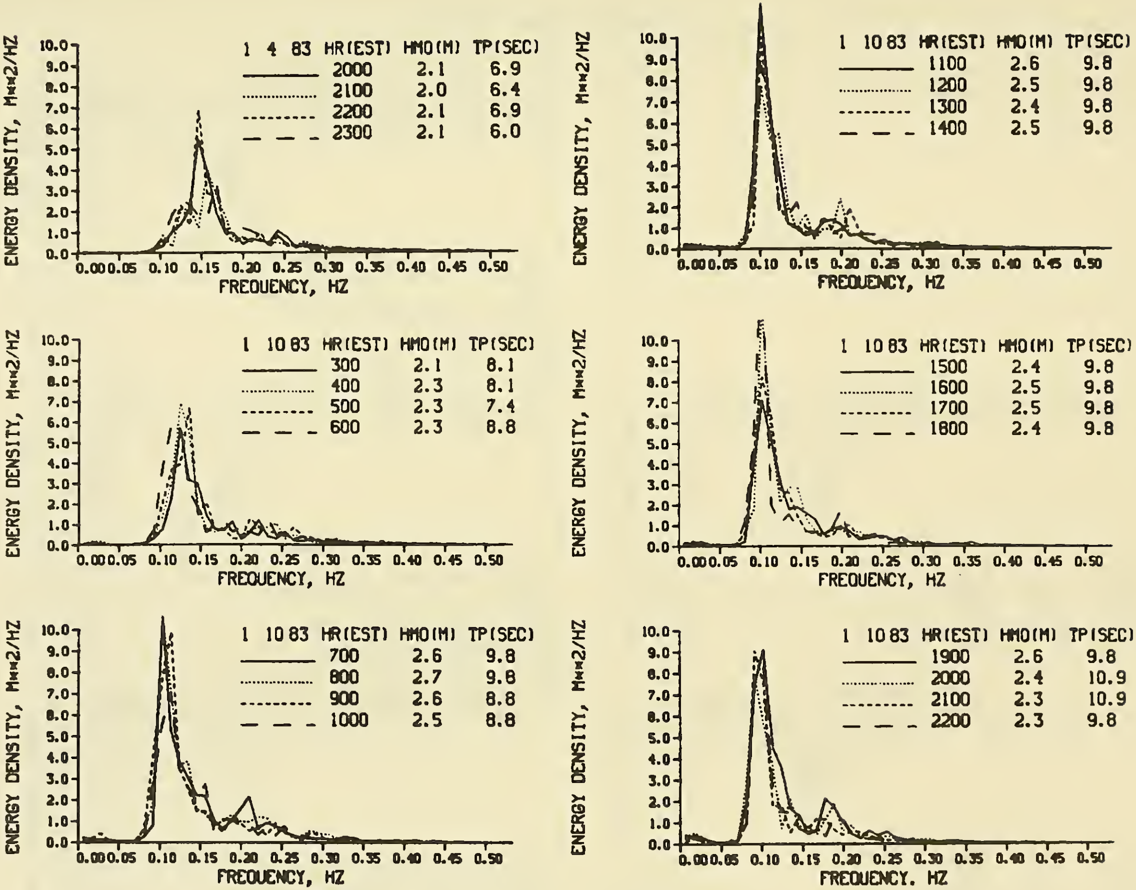


Figure B46. 1983 wave spectra for wave heights greater than 2 m at gage 625 in consecutive order (Sheet 1 of 34)

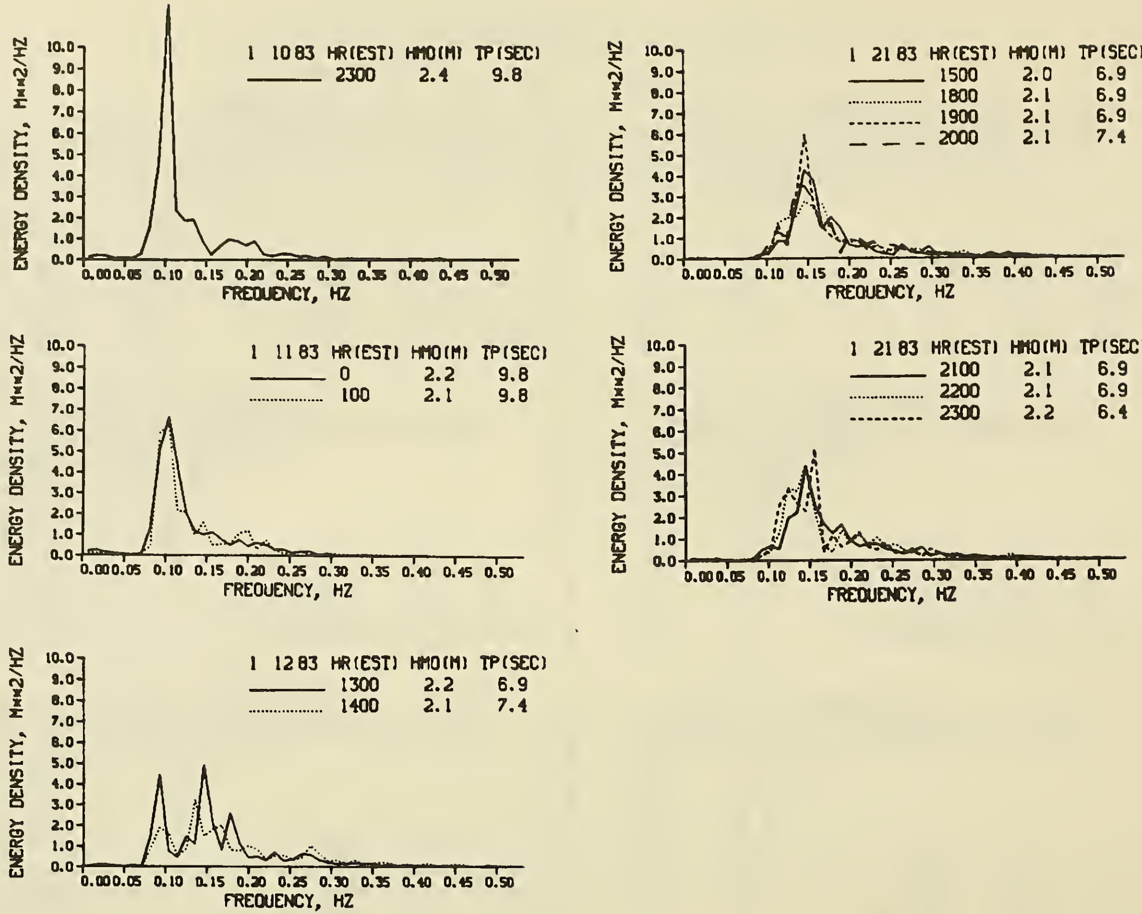


Figure B46. (Sheet 2 of 34)

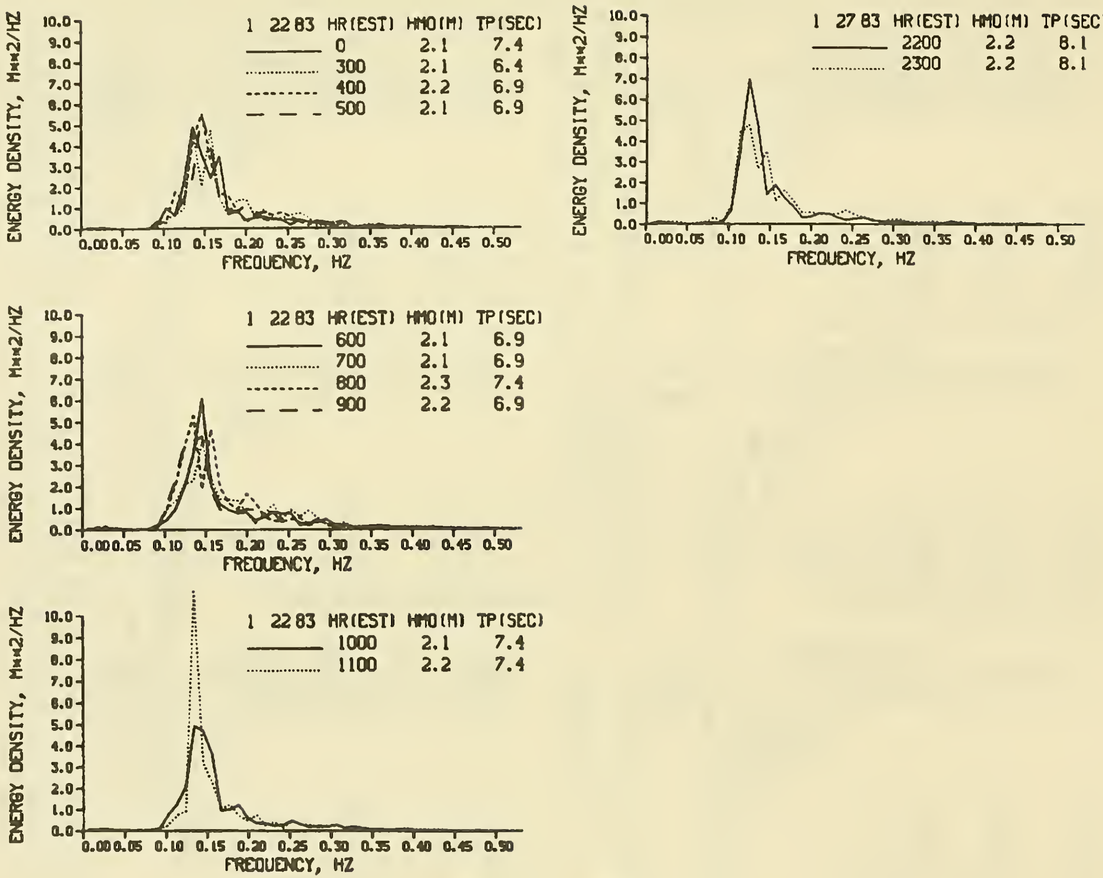


Figure B46. (Sheet 3 of 34)

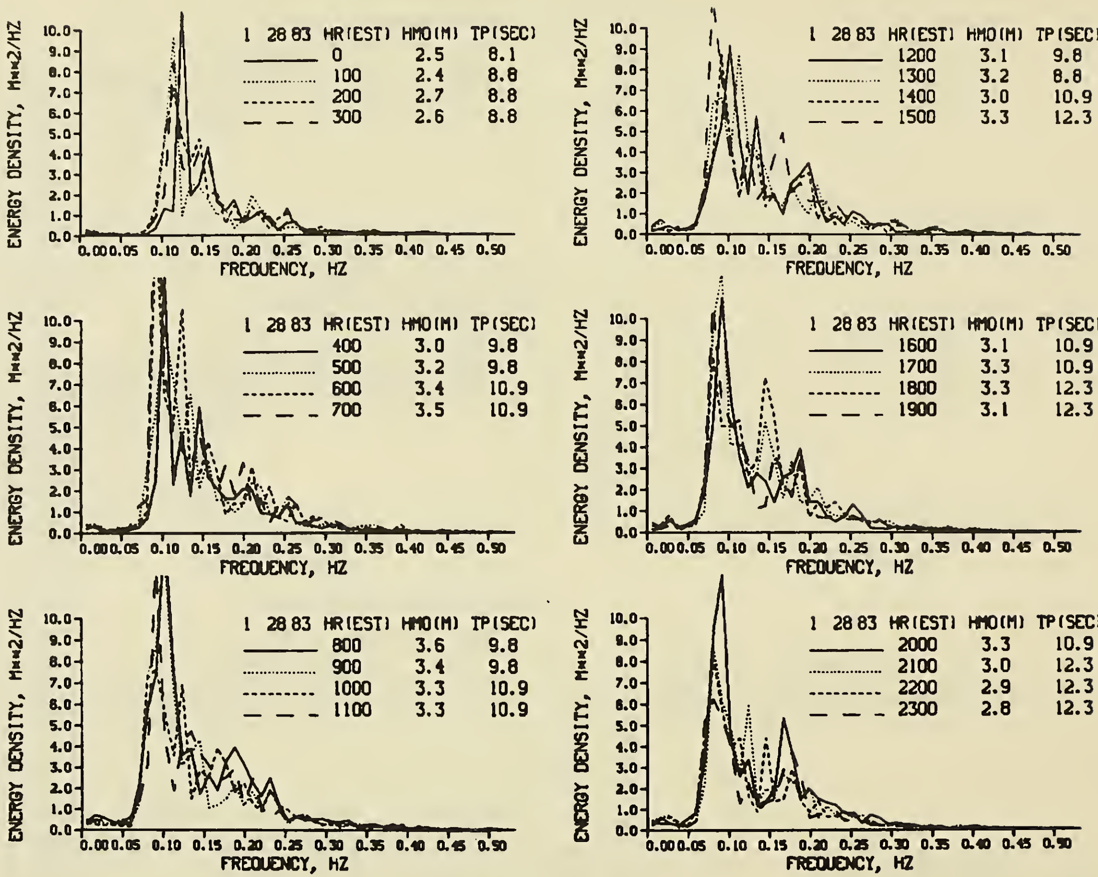


Figure B46. (Sheet 4 of 34)

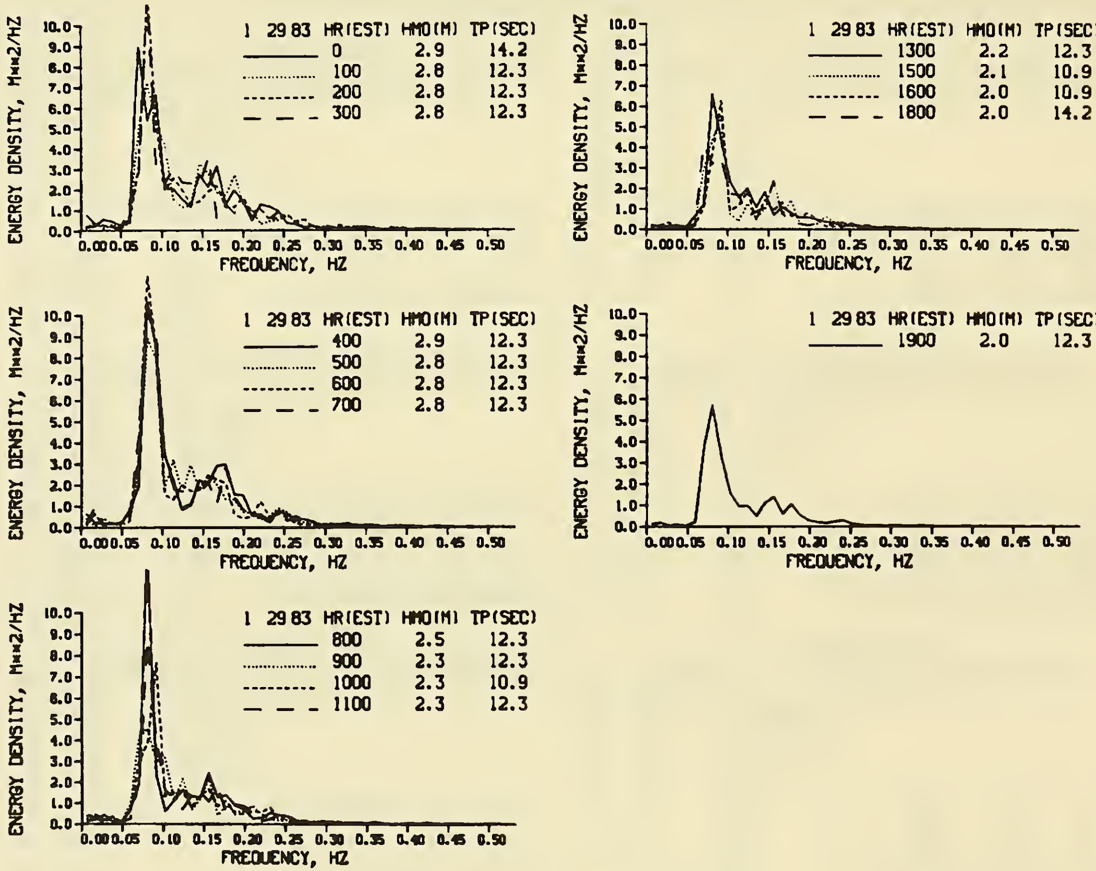


Figure B46. (Sheet 5 of 34)

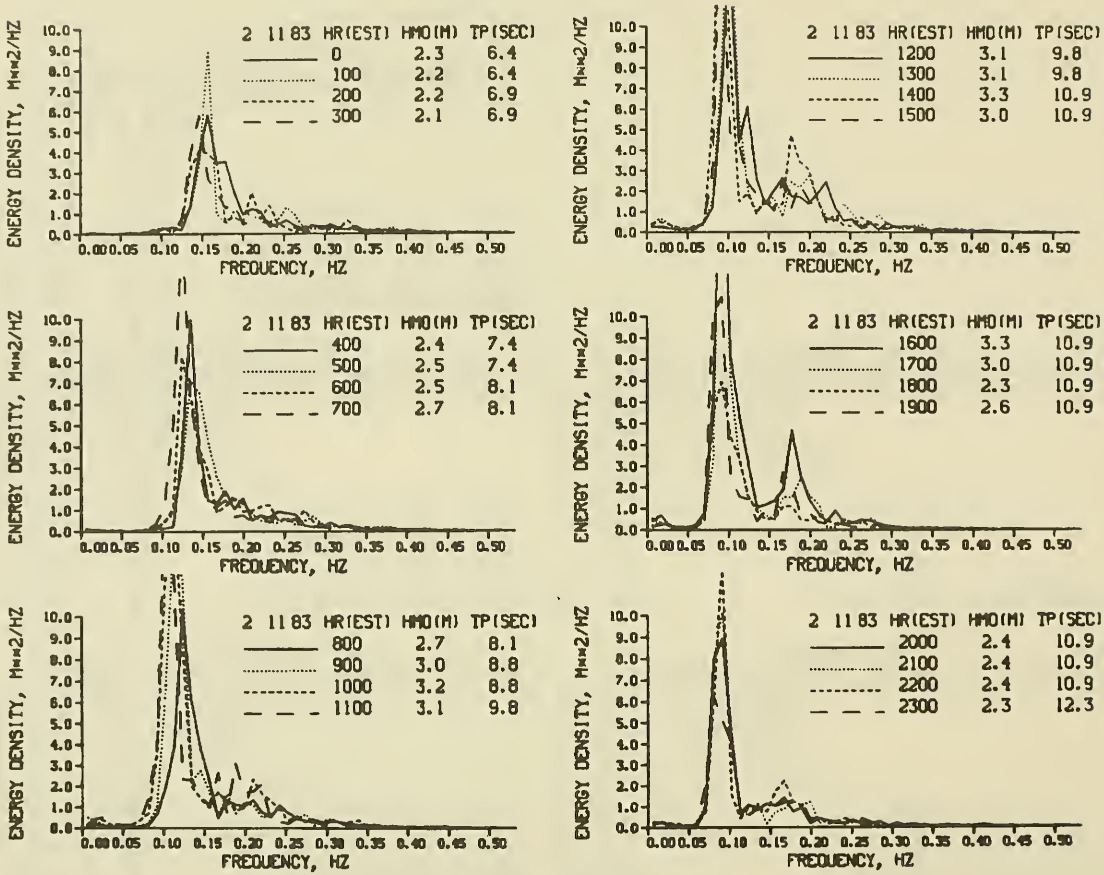


Figure B46. (Sheet 6 of 34)

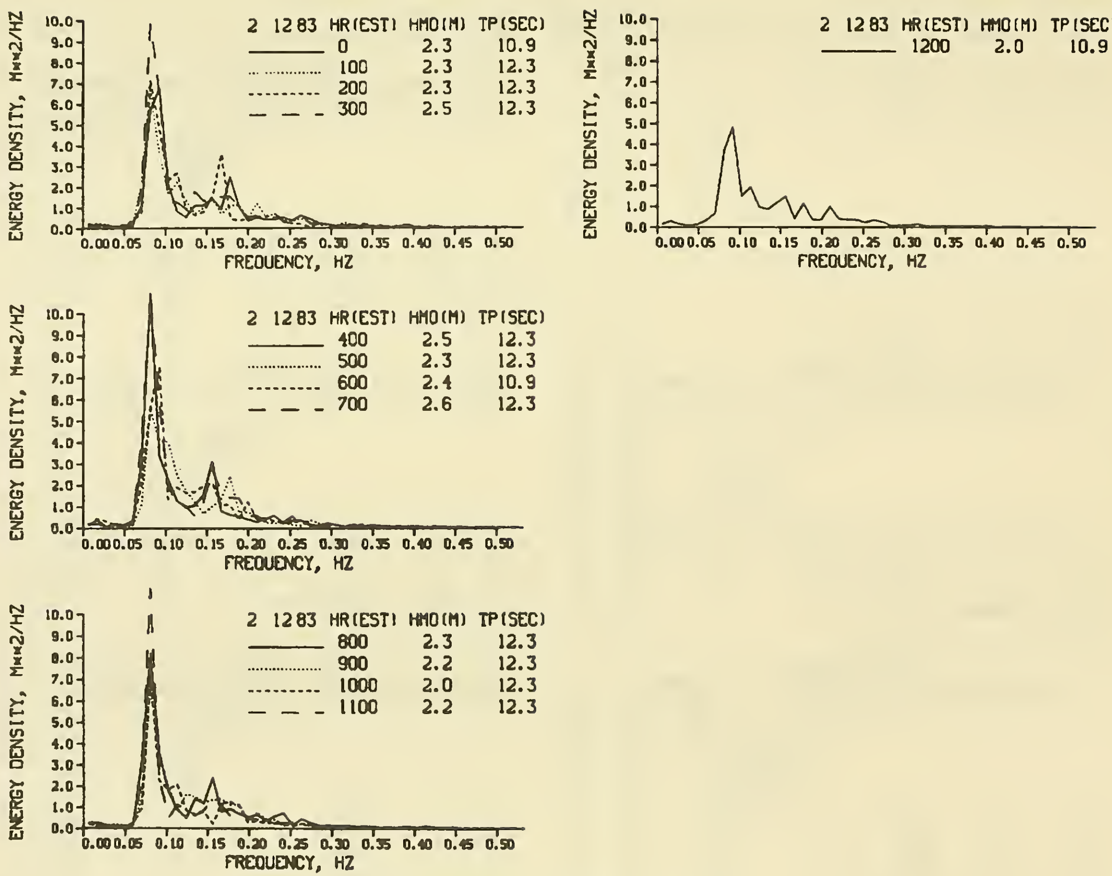
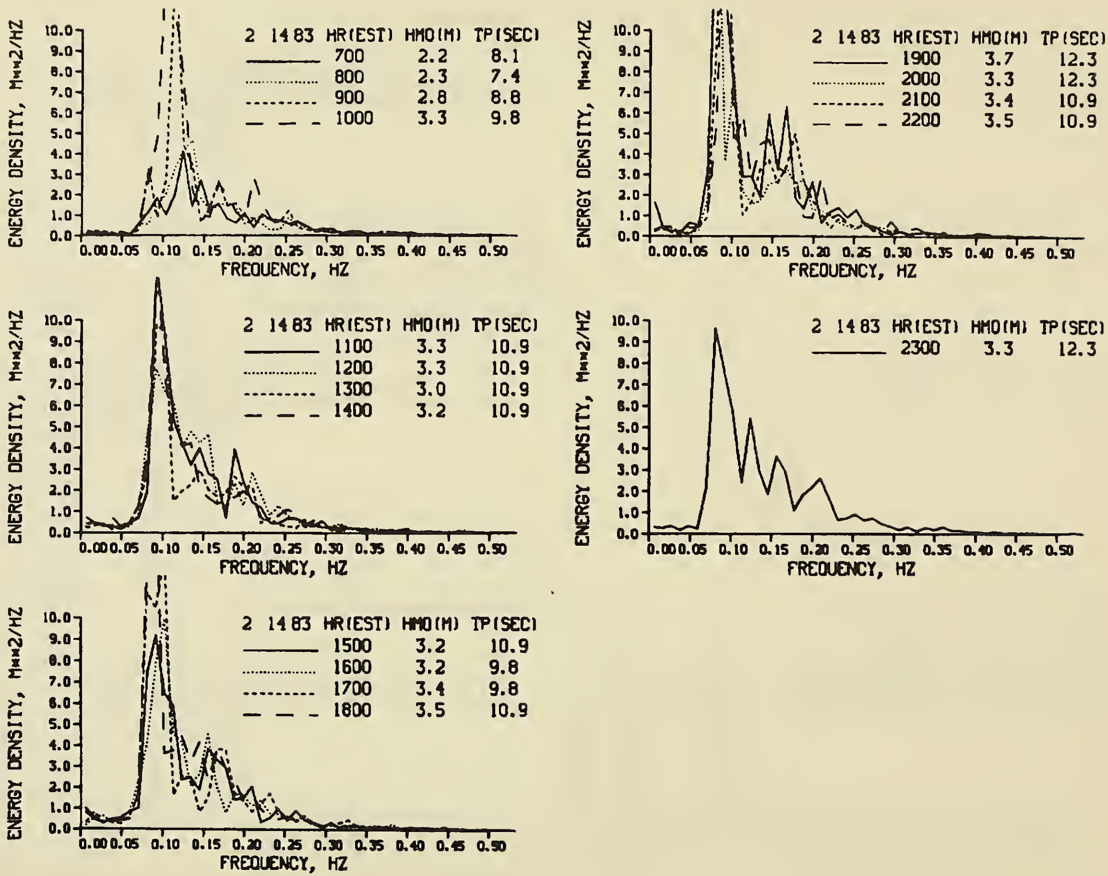


Figure B46. (Sheet 7 of 34)



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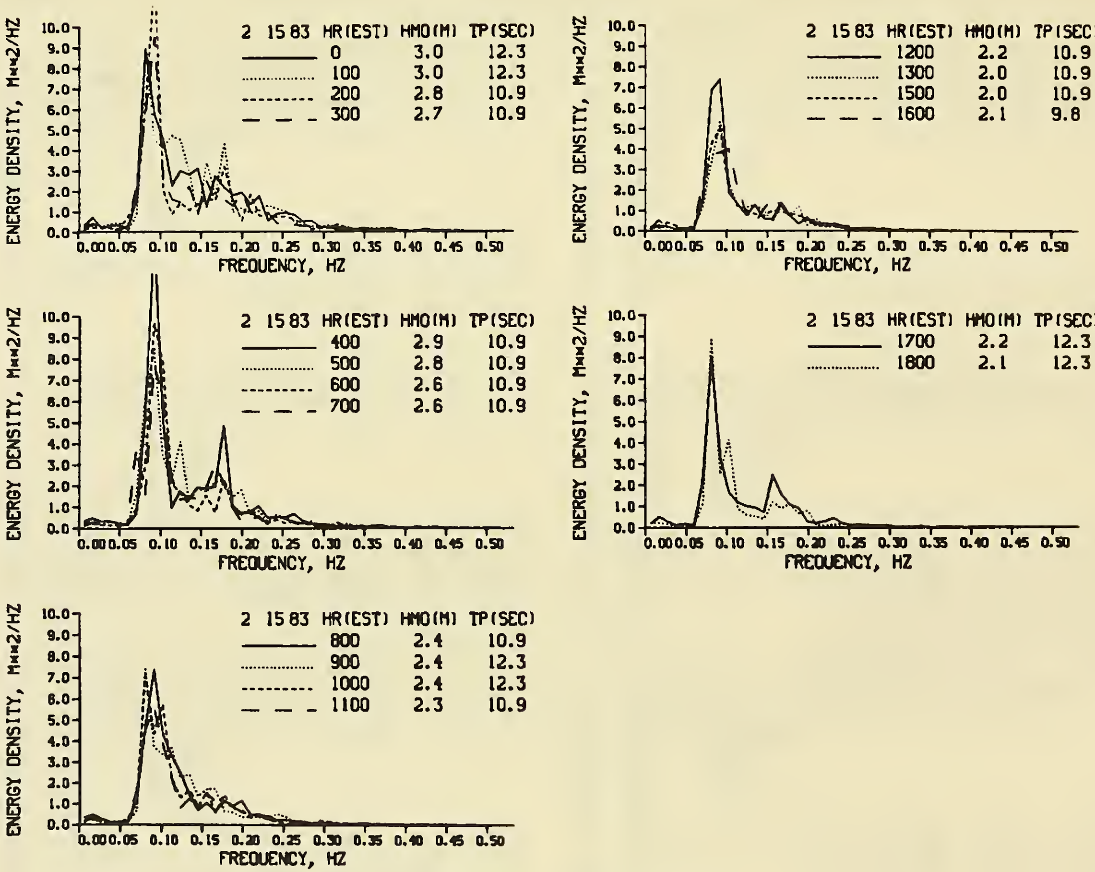

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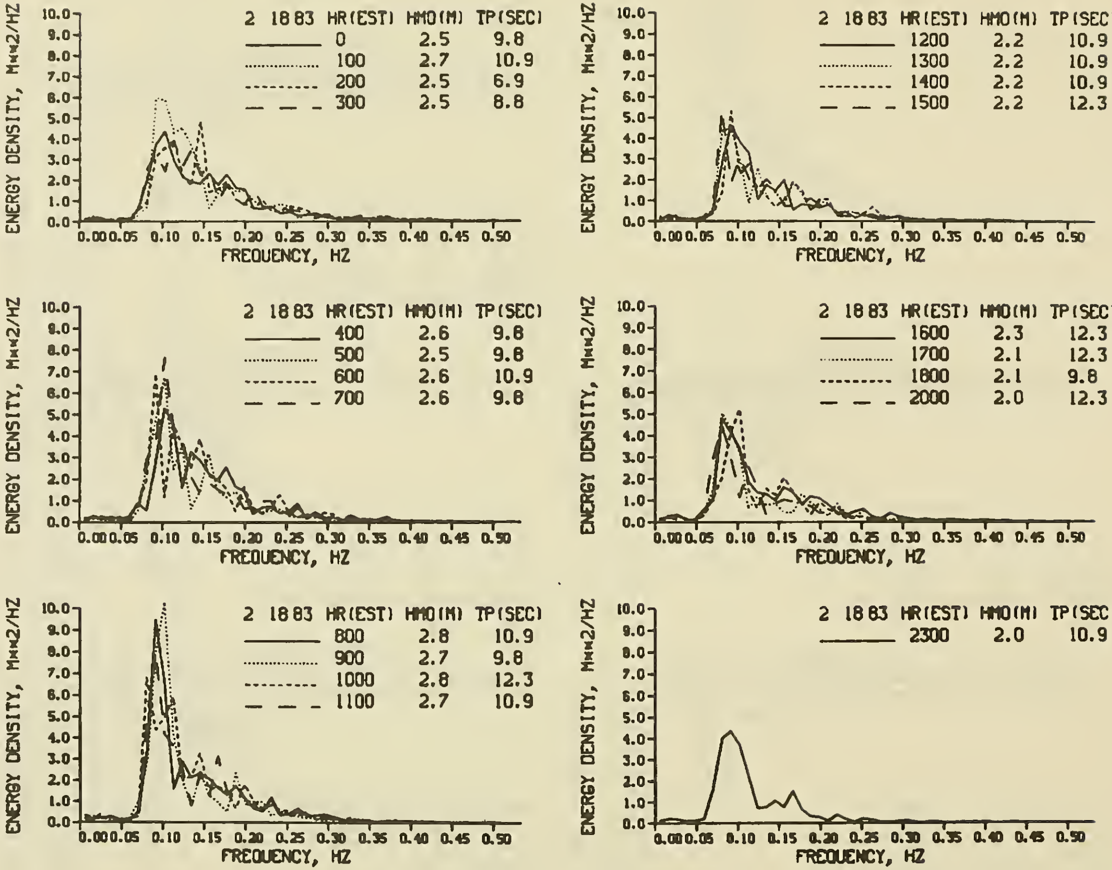

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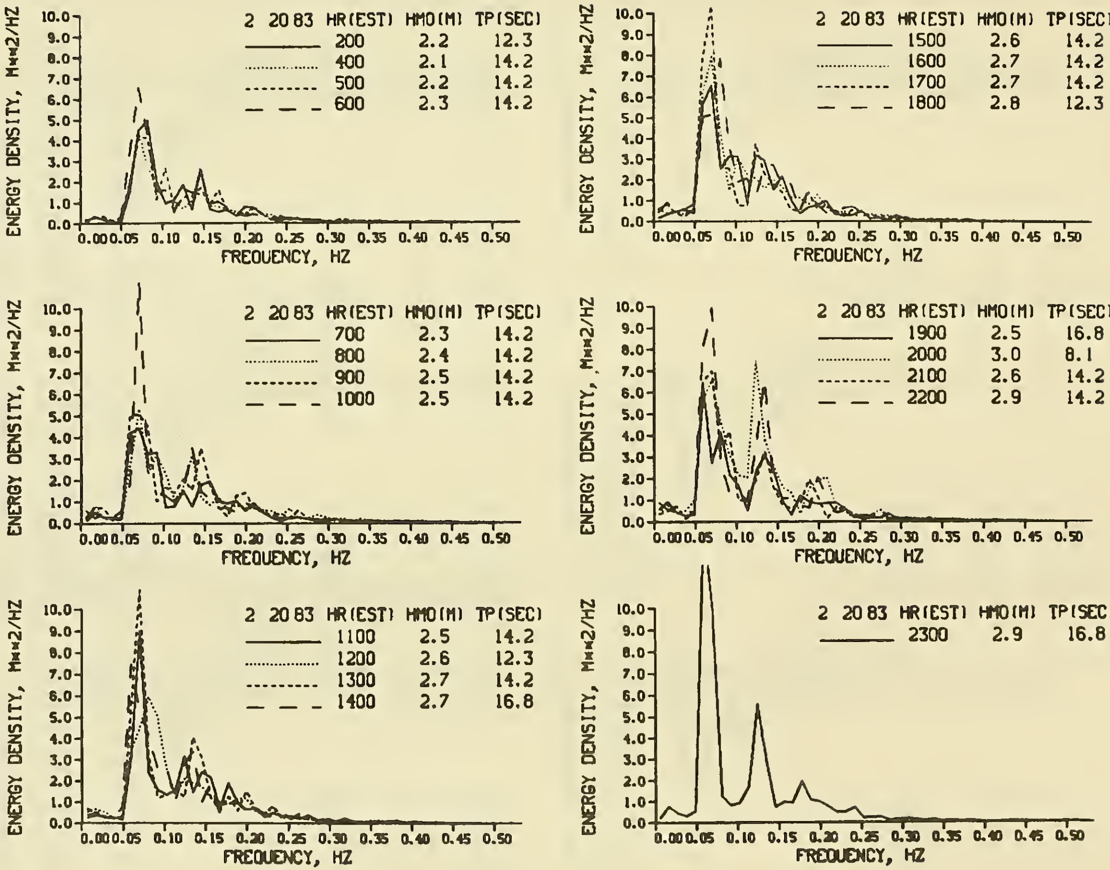

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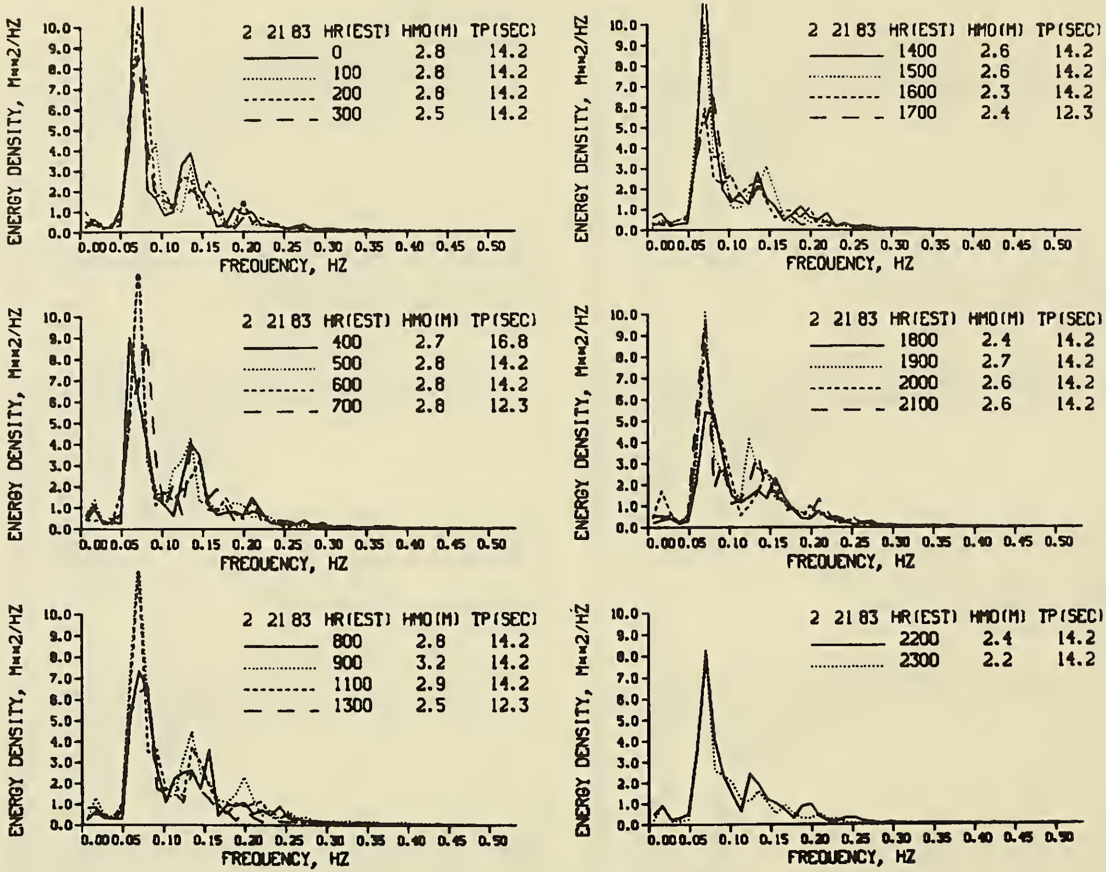

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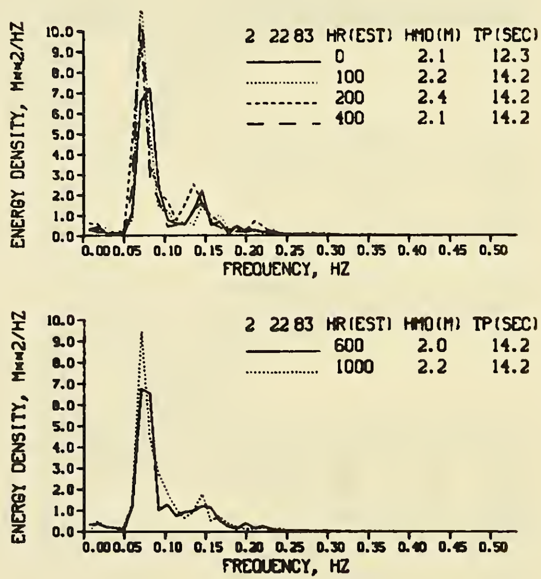

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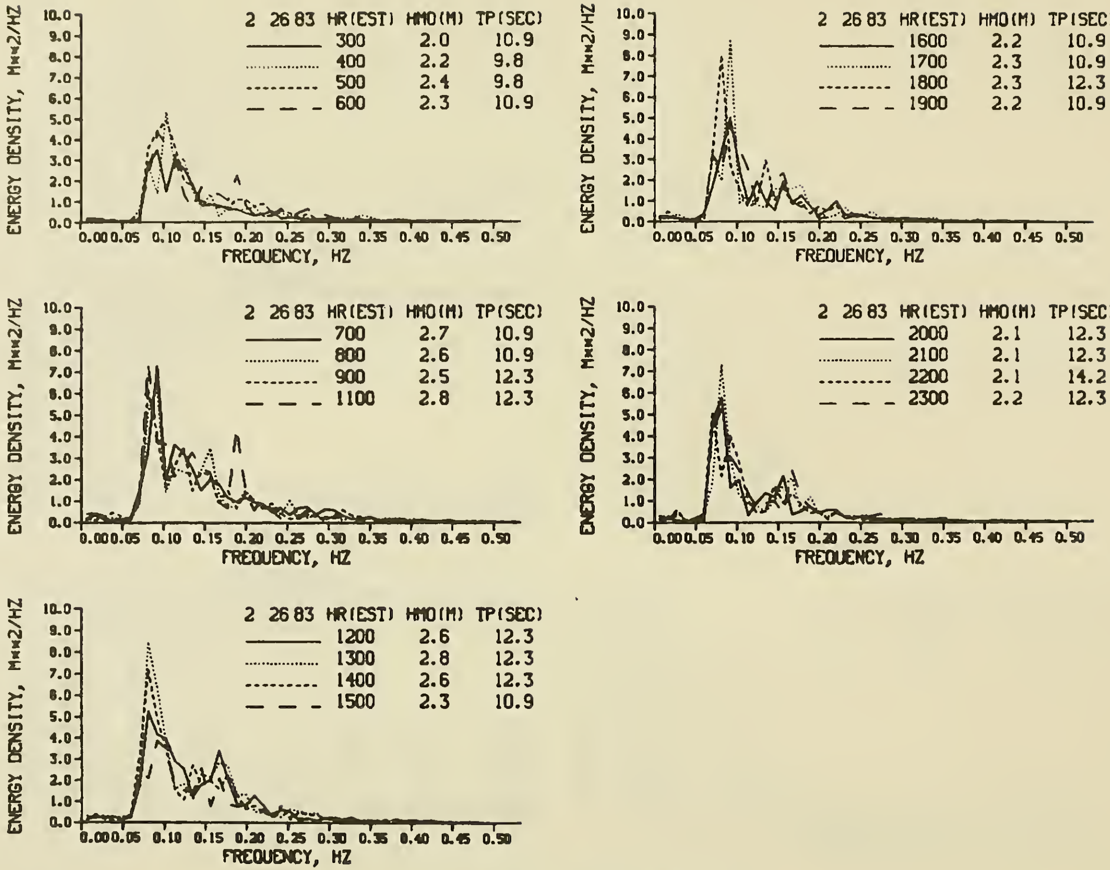

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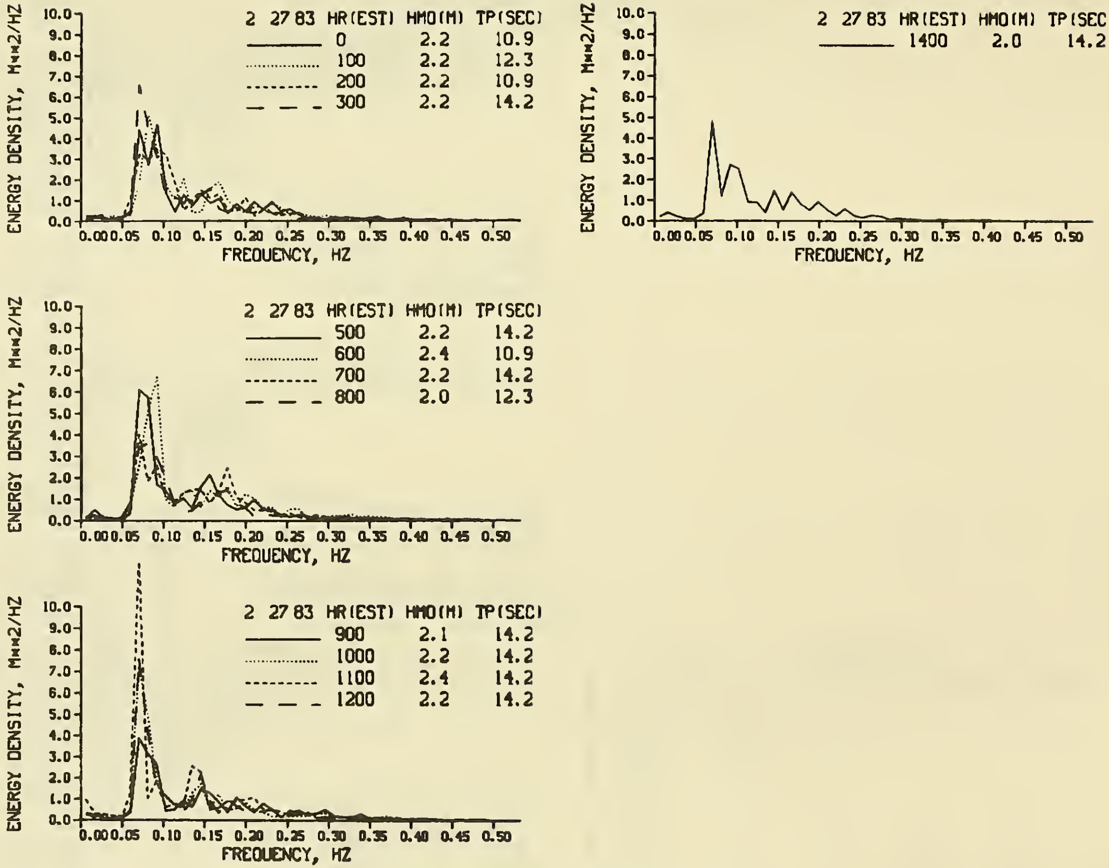

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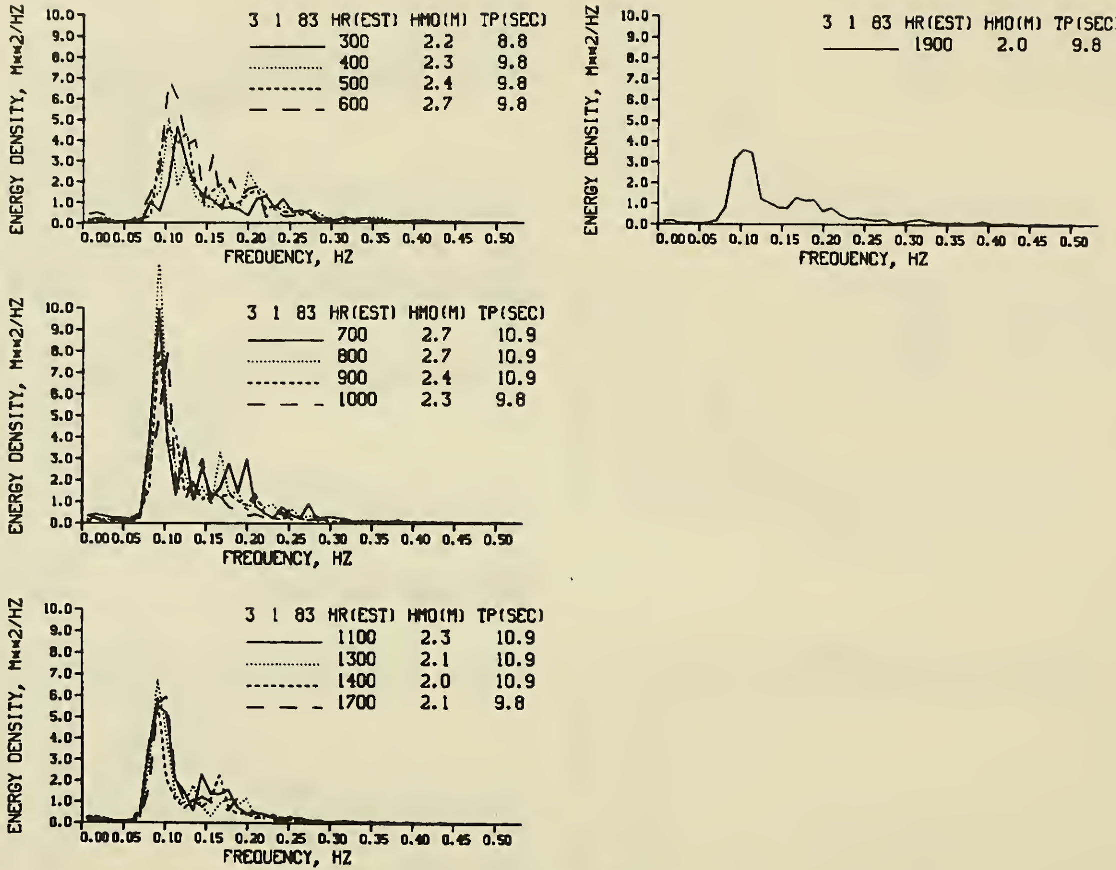

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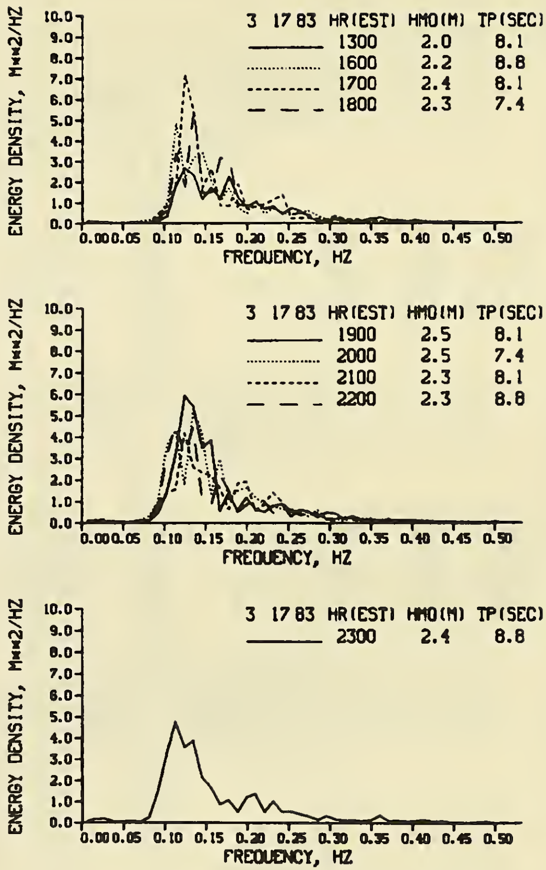

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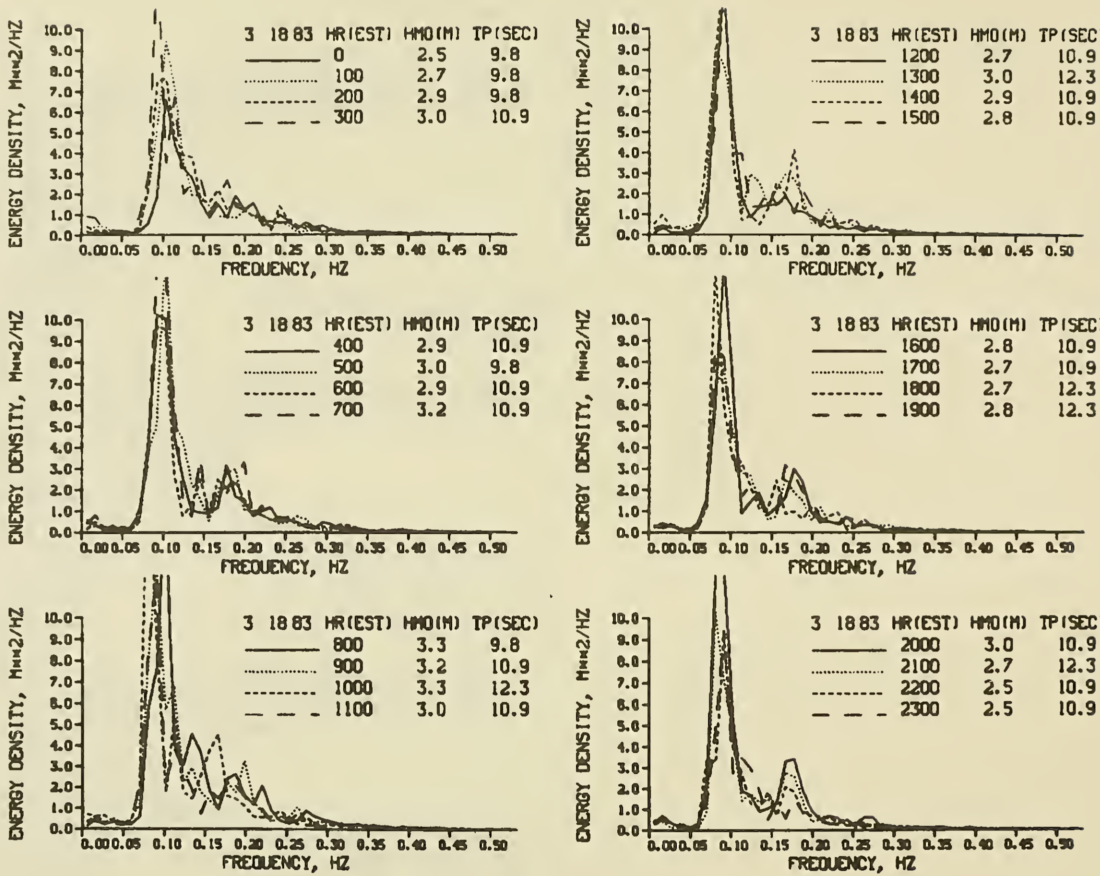

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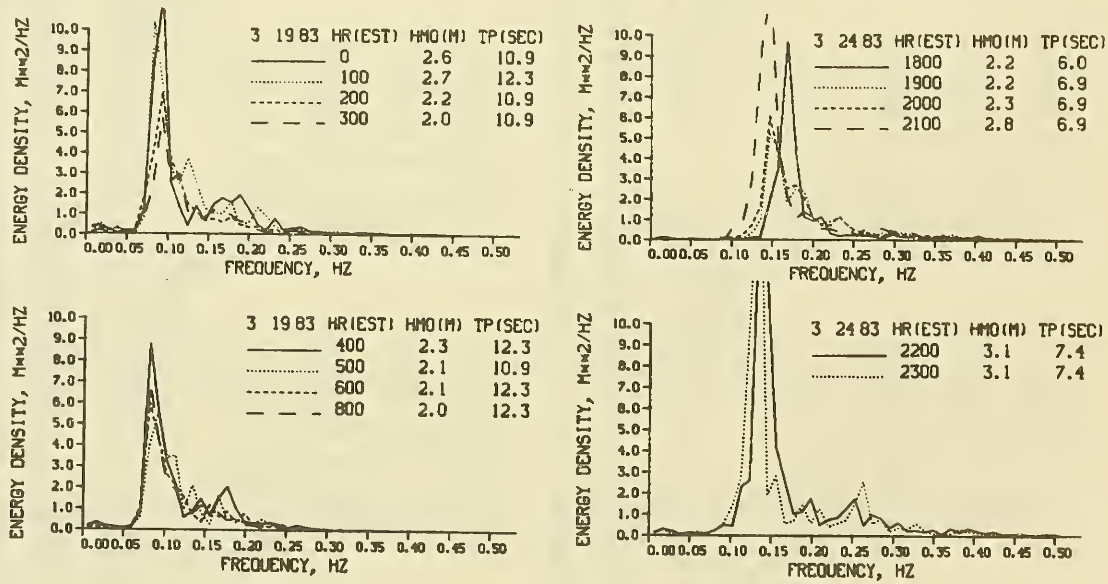

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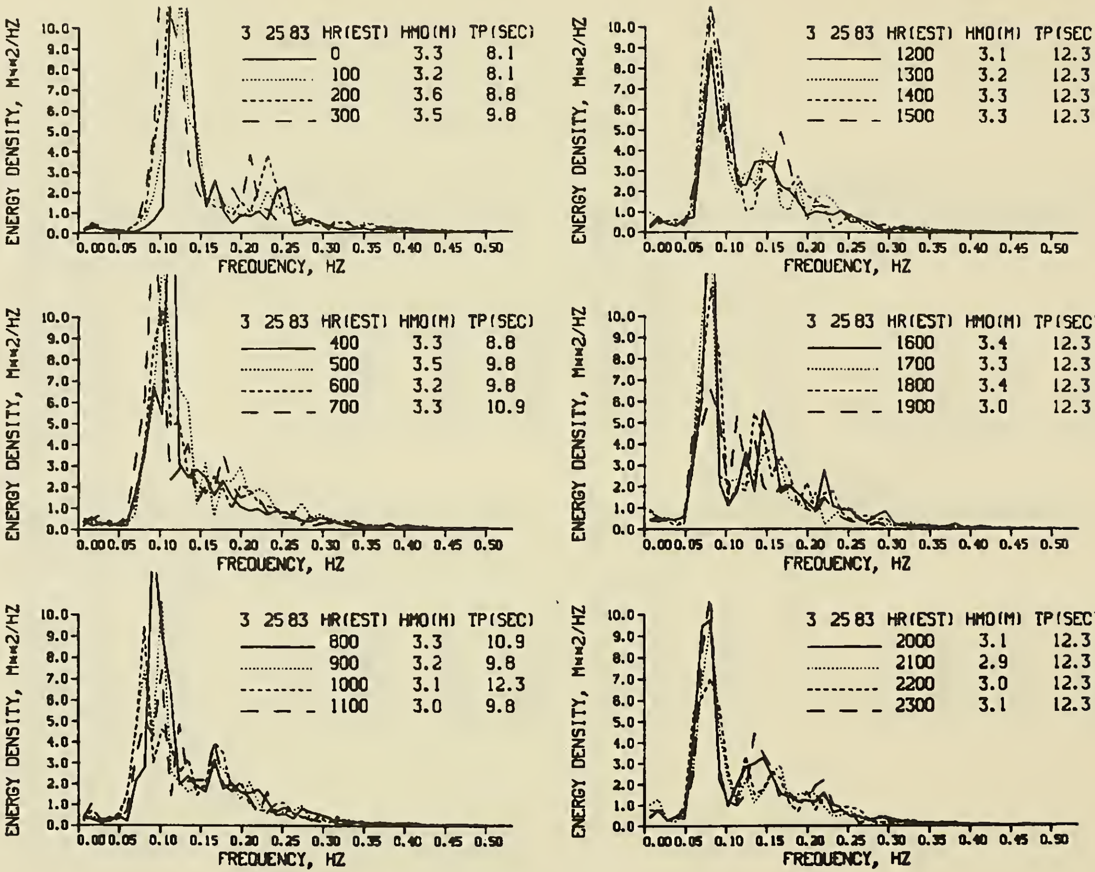

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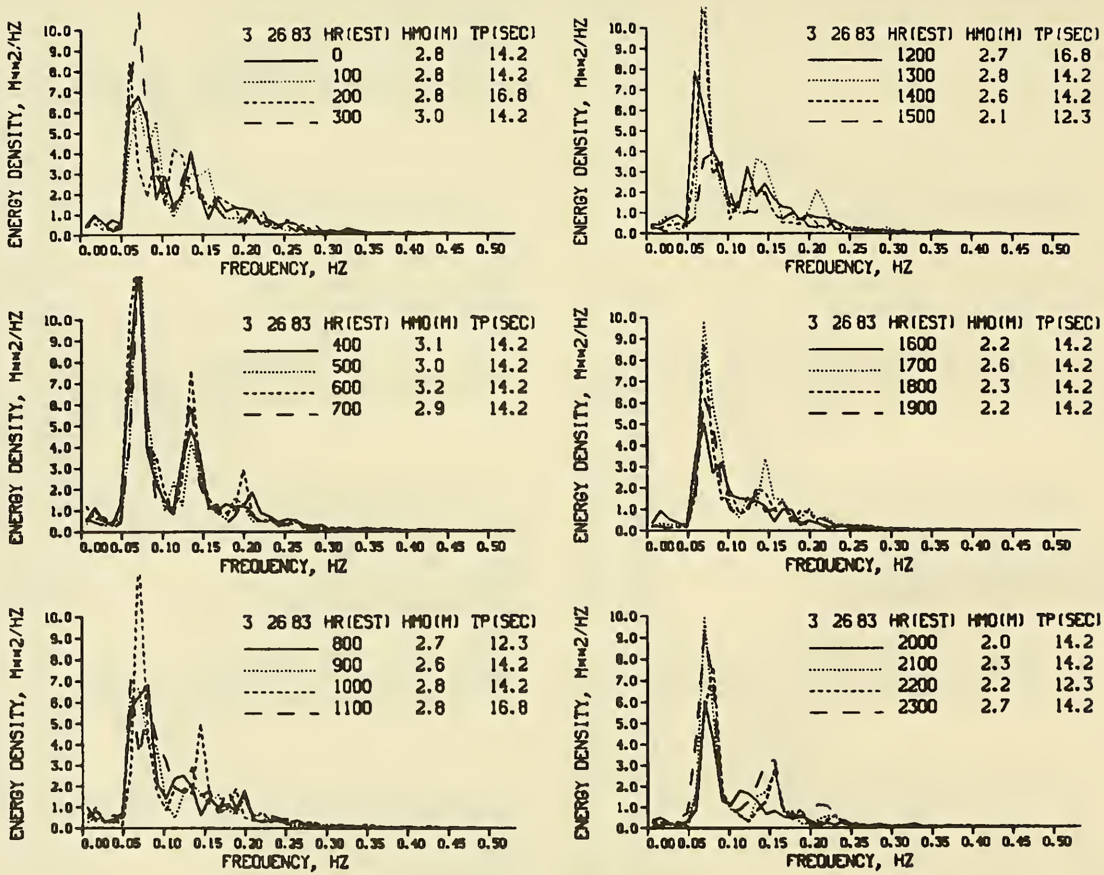

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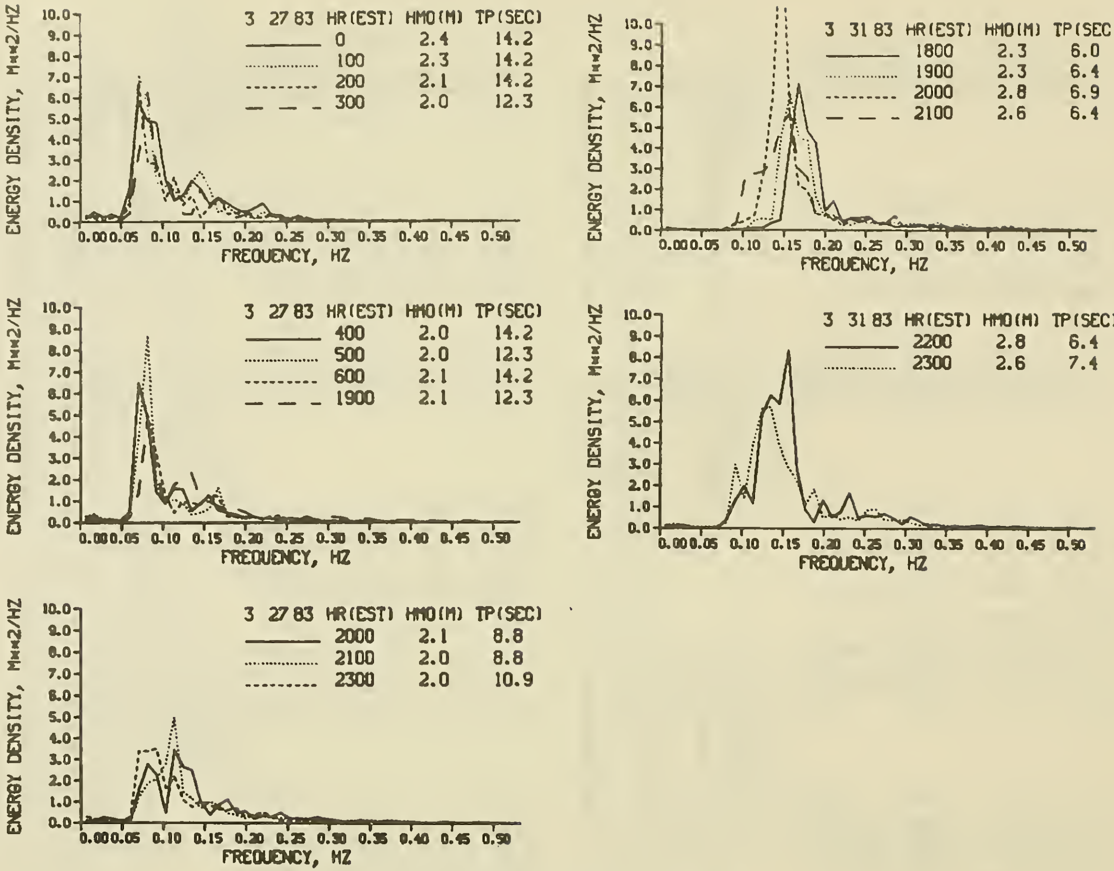

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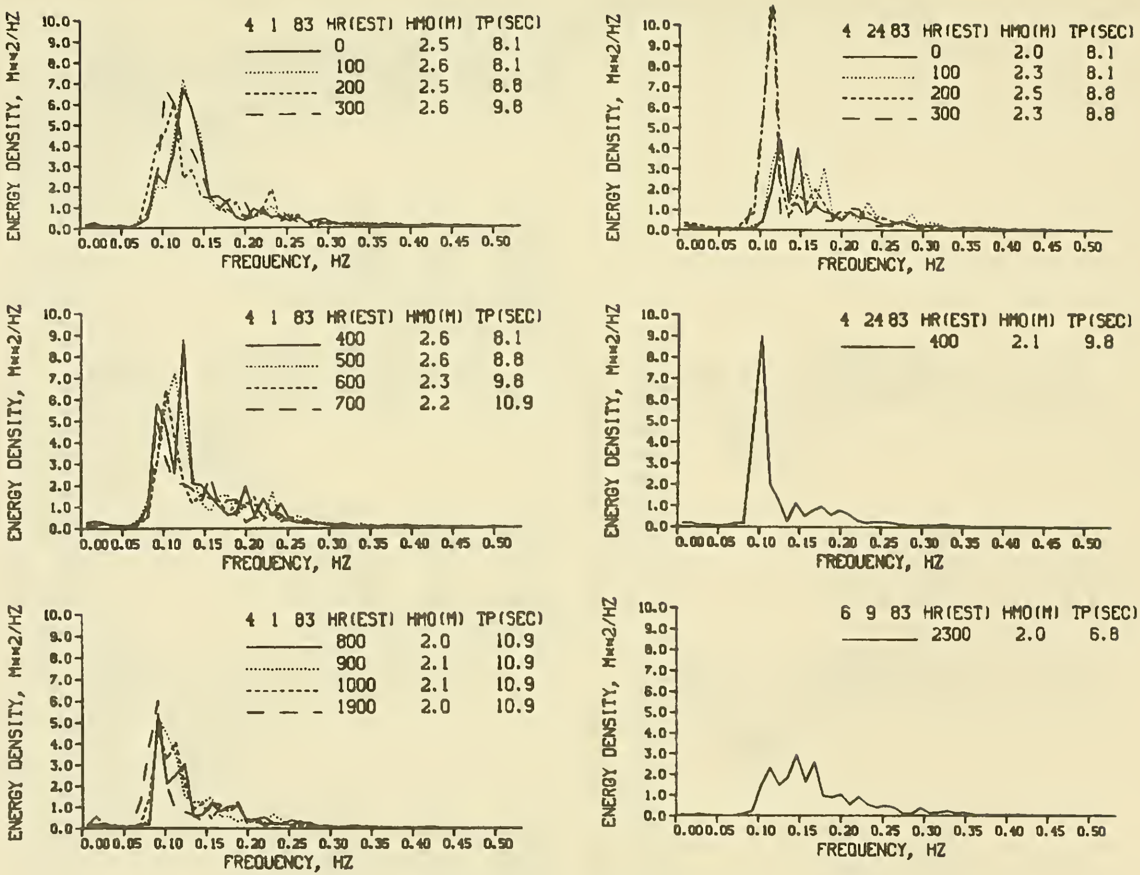

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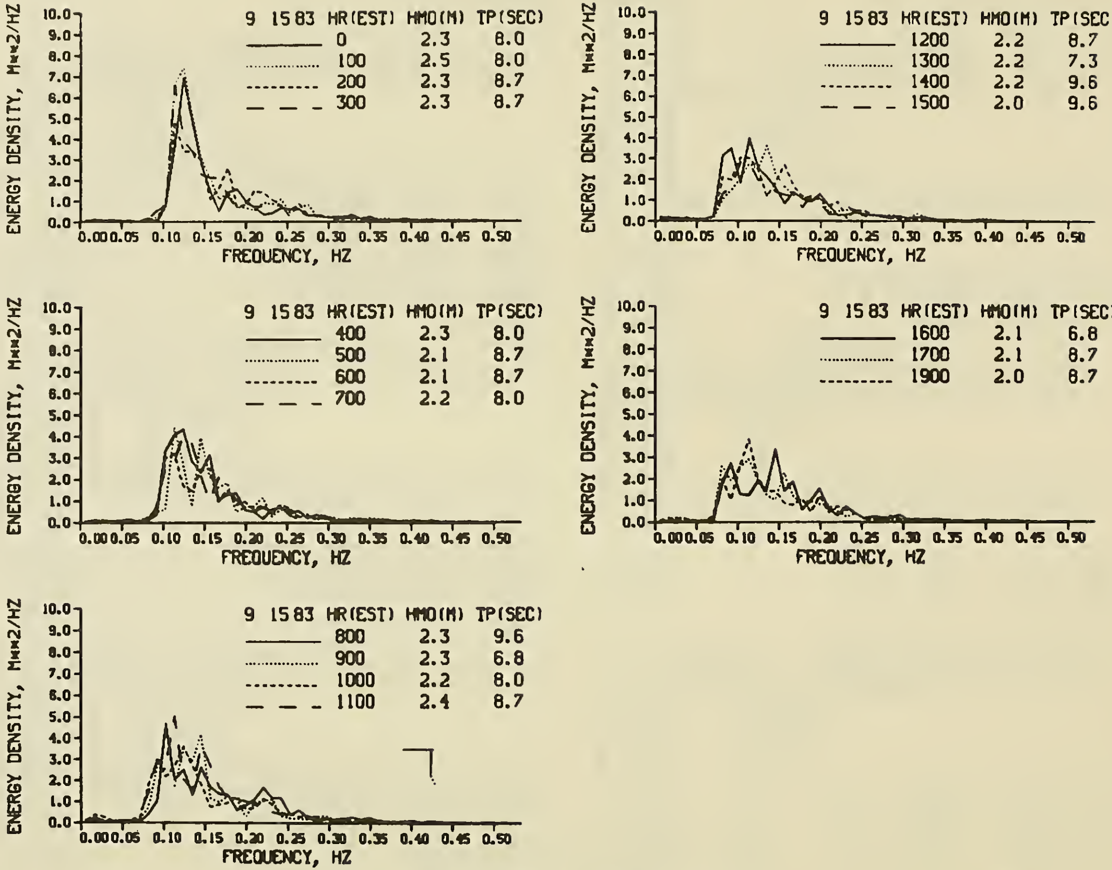

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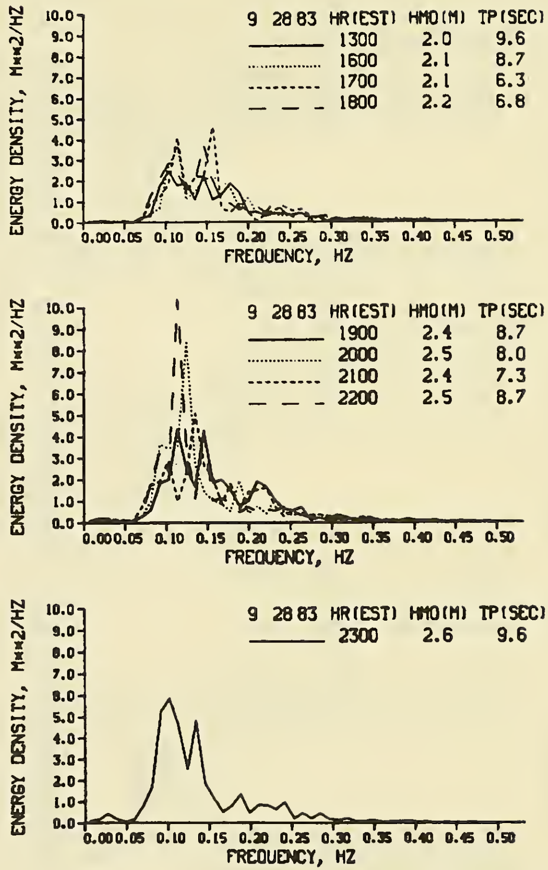

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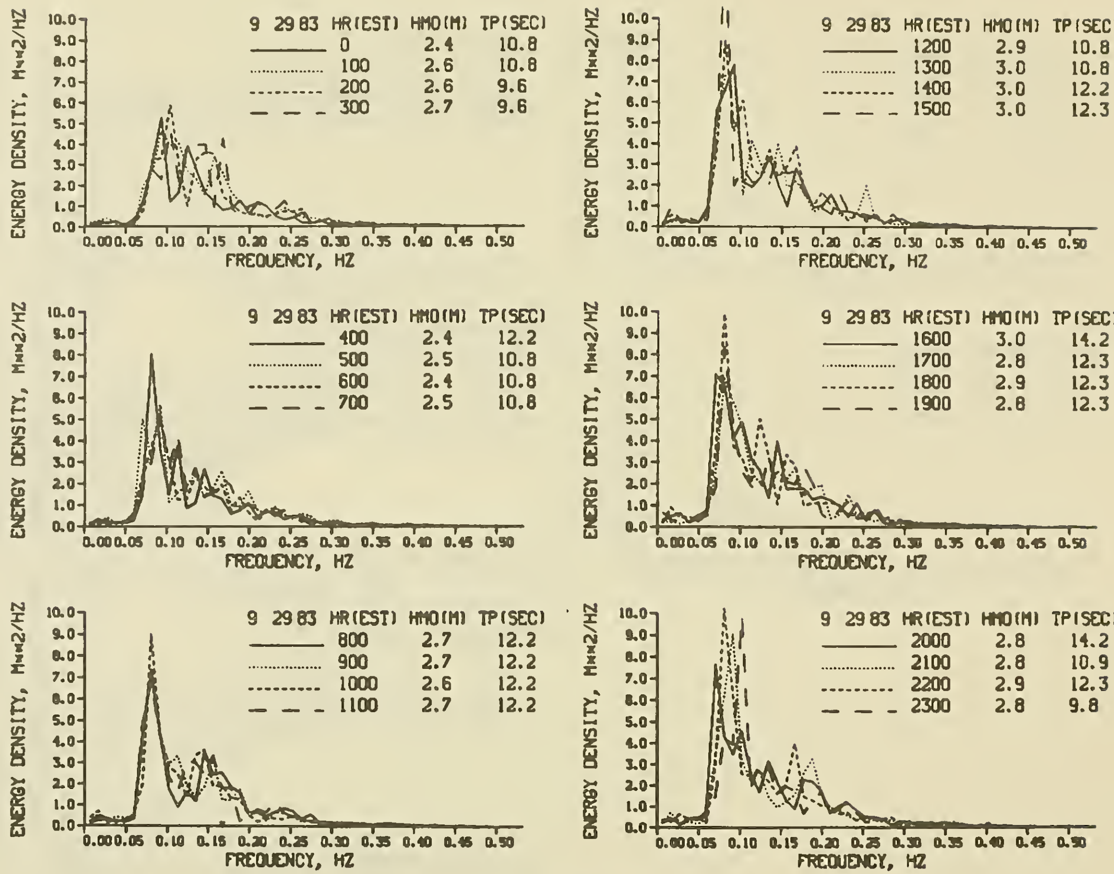

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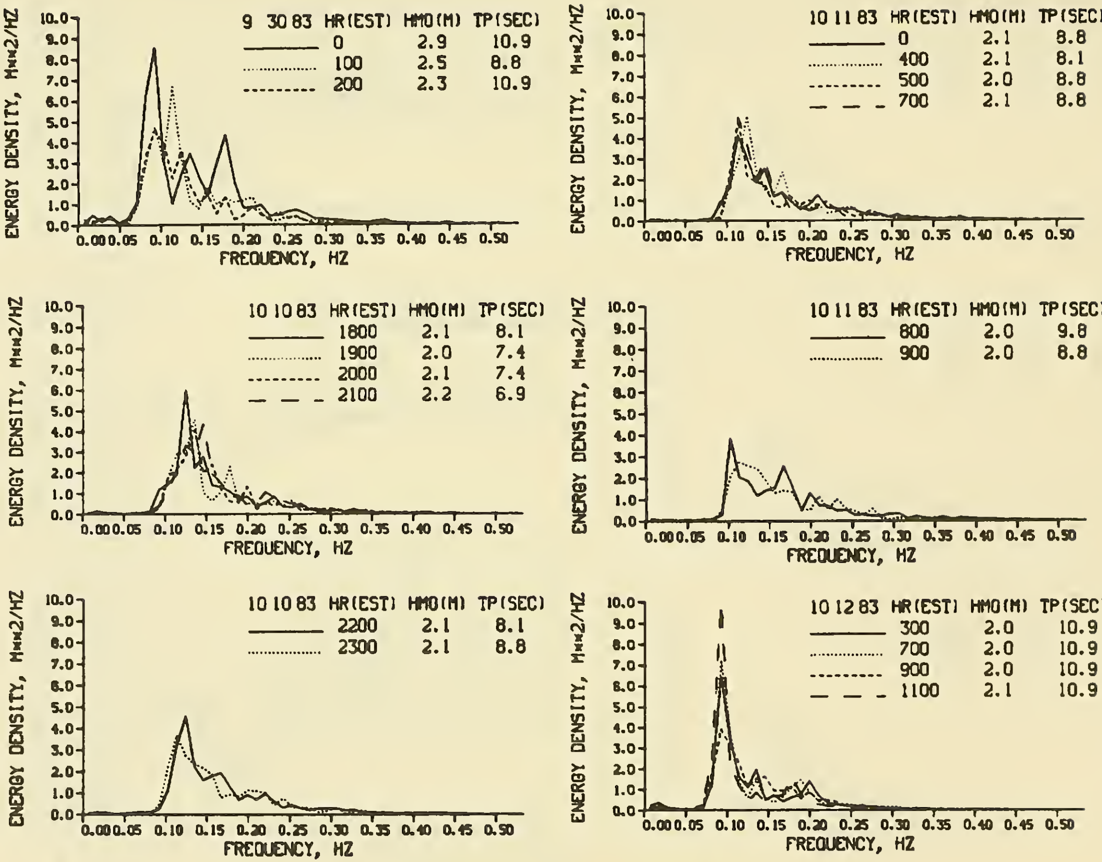

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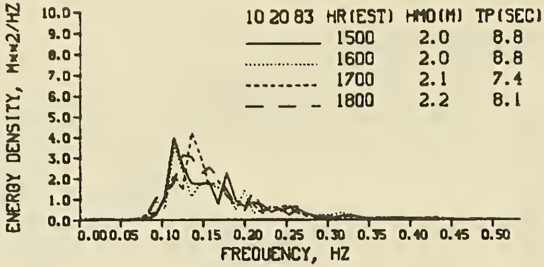

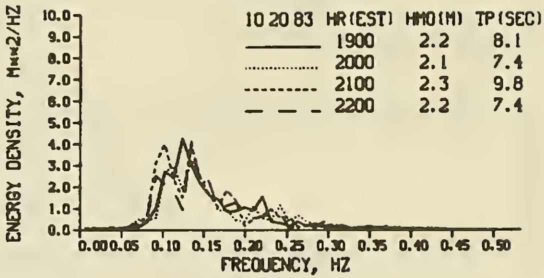

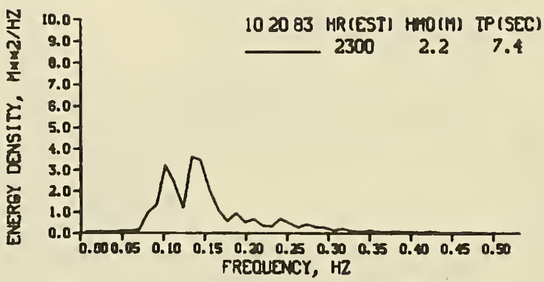

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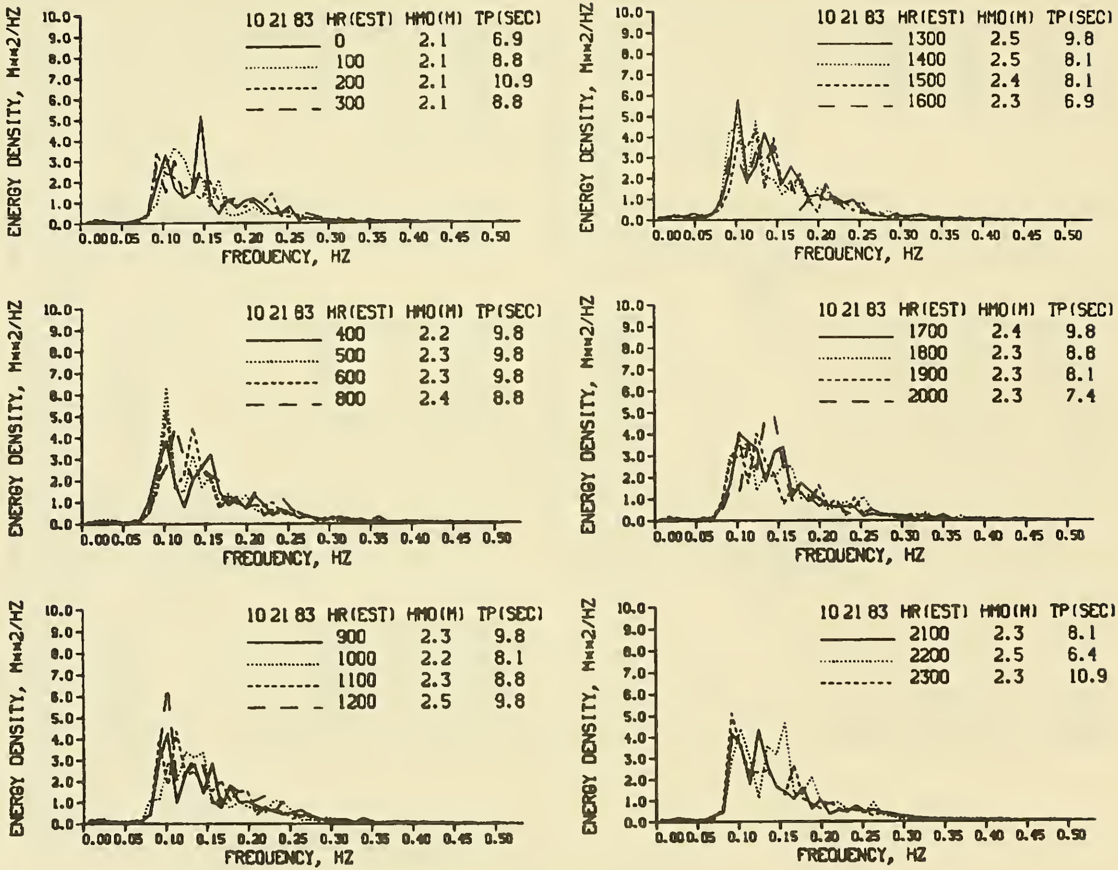

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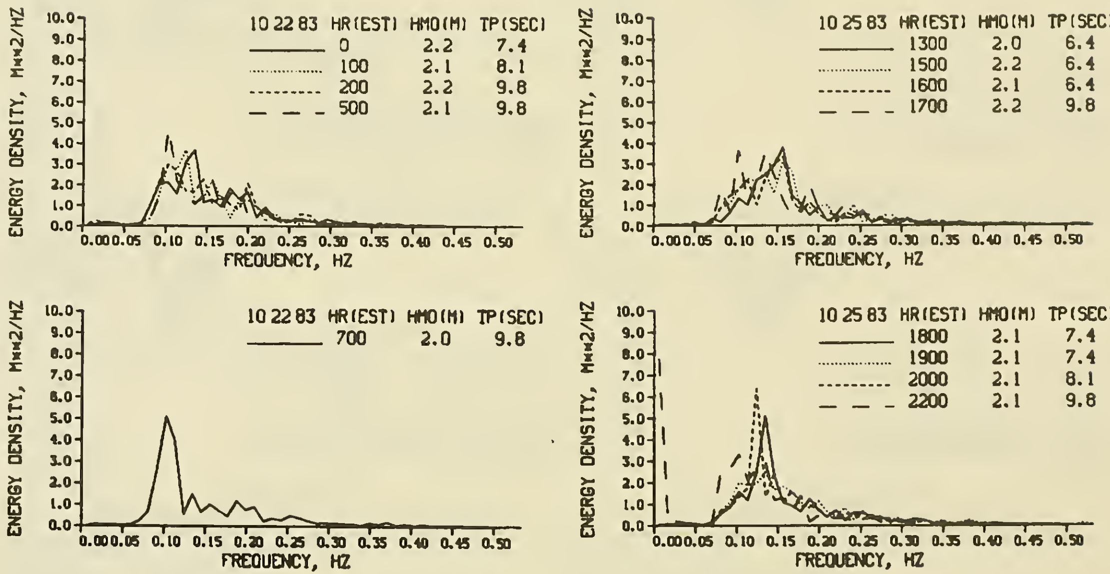

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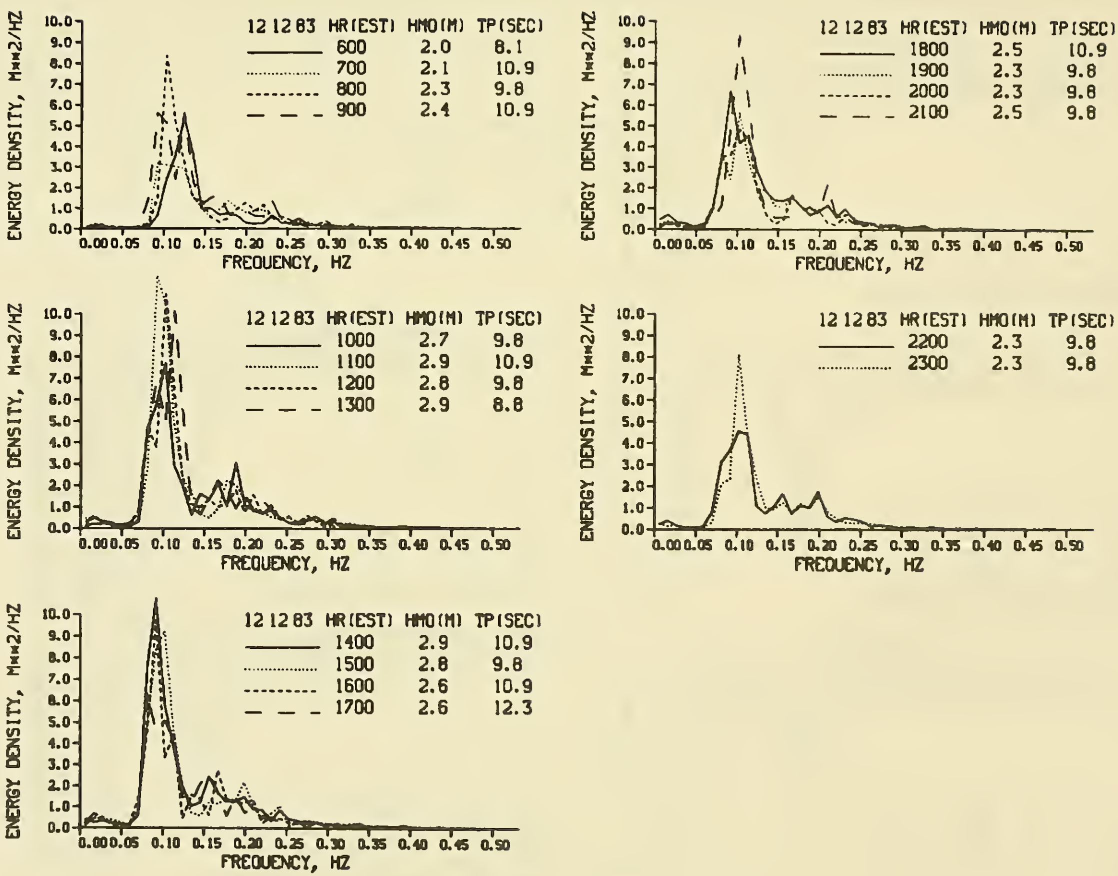

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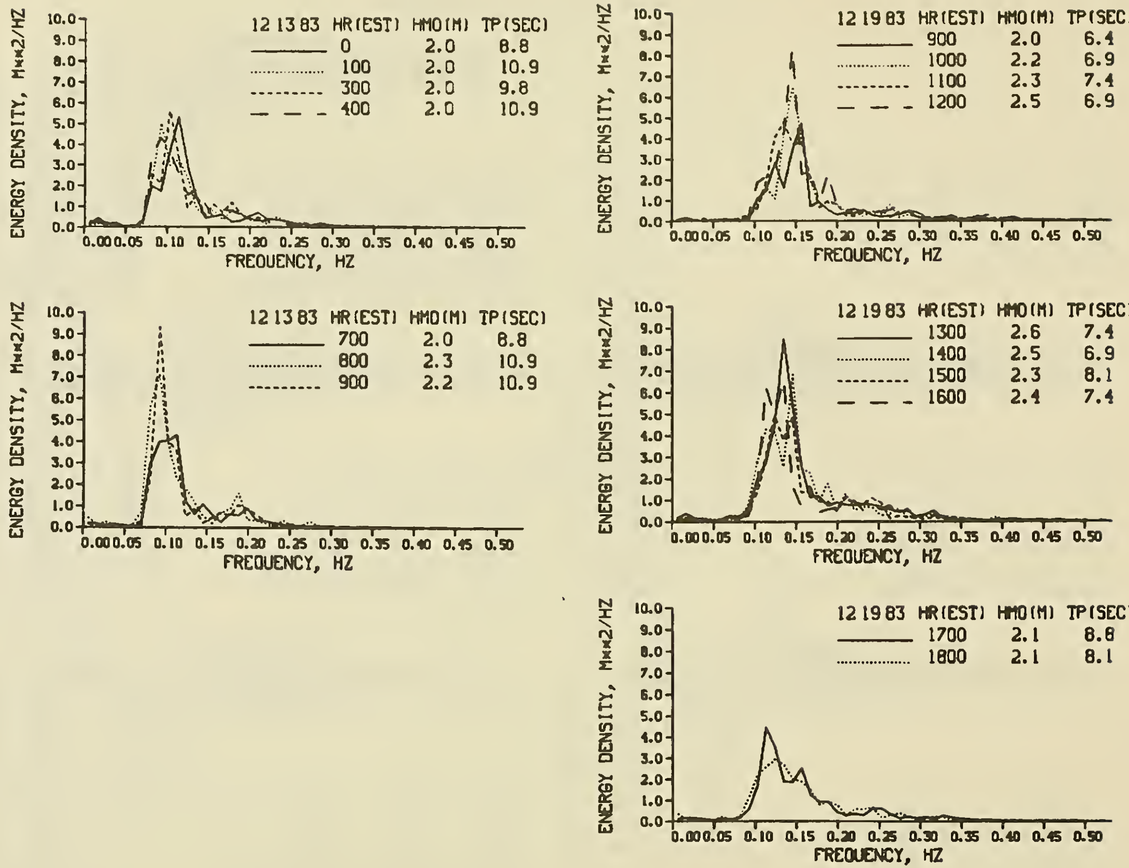

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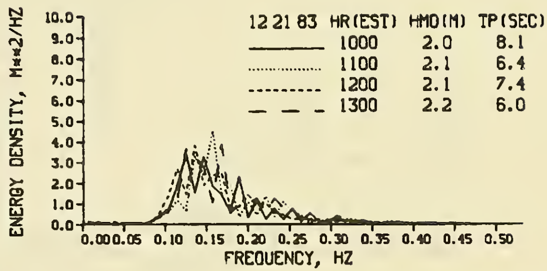

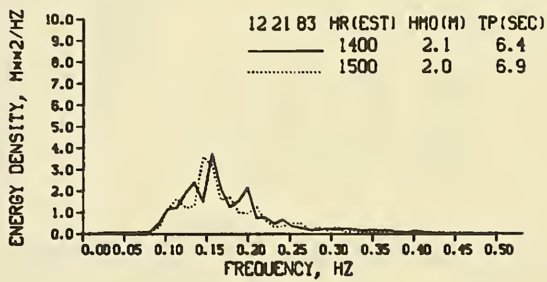

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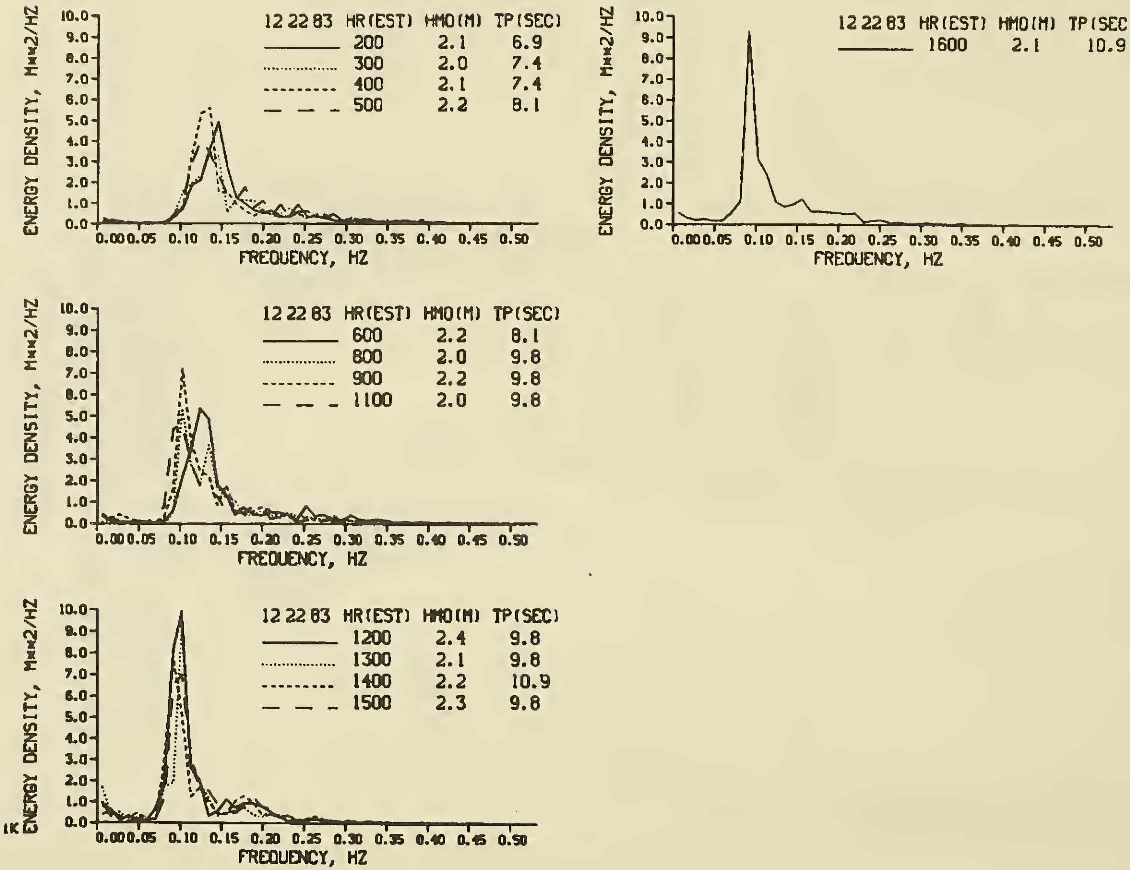

Figure B46. (Sheet 34 of 34)

APPENDIX C: SURVEY DATA

Contour diagrams constructed from the bathymetric survey data are presented in this appendix. The profile lines surveyed are identified on each diagram. Contours are in half metres referenced to National Geodetic Vertical Datum. The distance offshore is referenced to the Field Research Facility (FRF) monumentation baseline behind the dune.

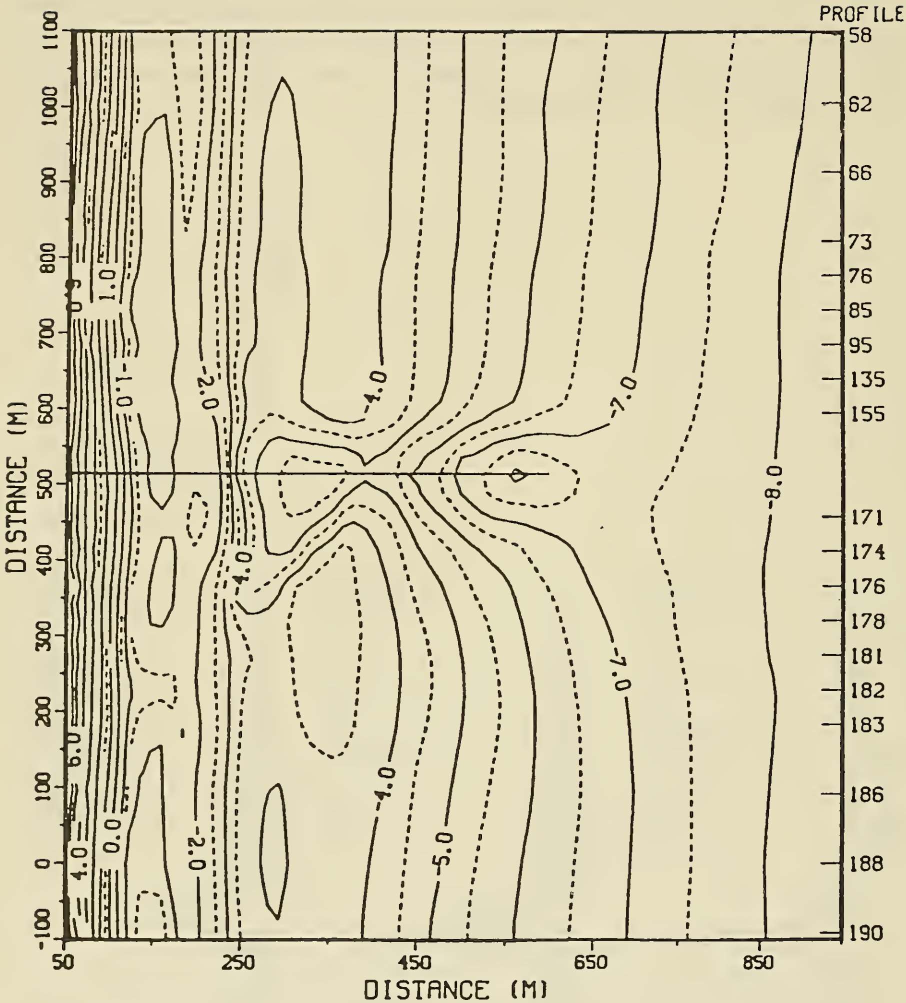

Figure C1. FRF bathymetry, 13 January 1983
(contours in metres)

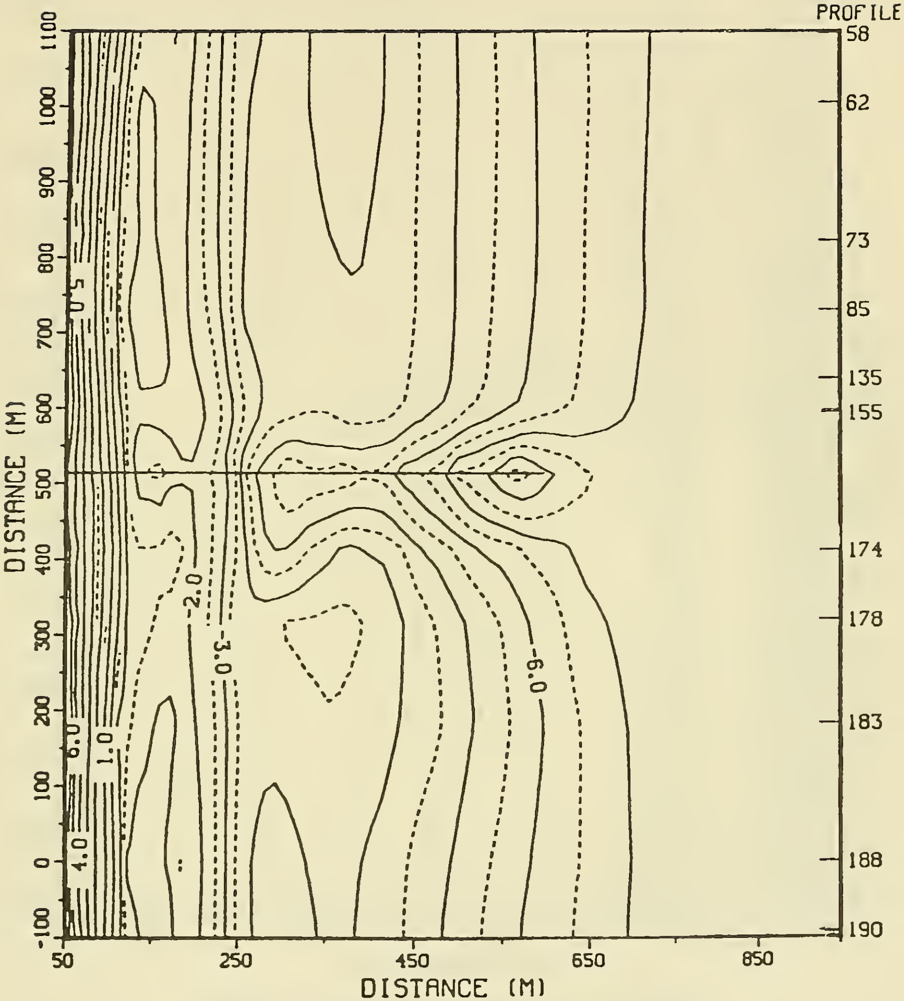

Figure C2. FRF bathymetry, 8 February 1983
(contours in metres)

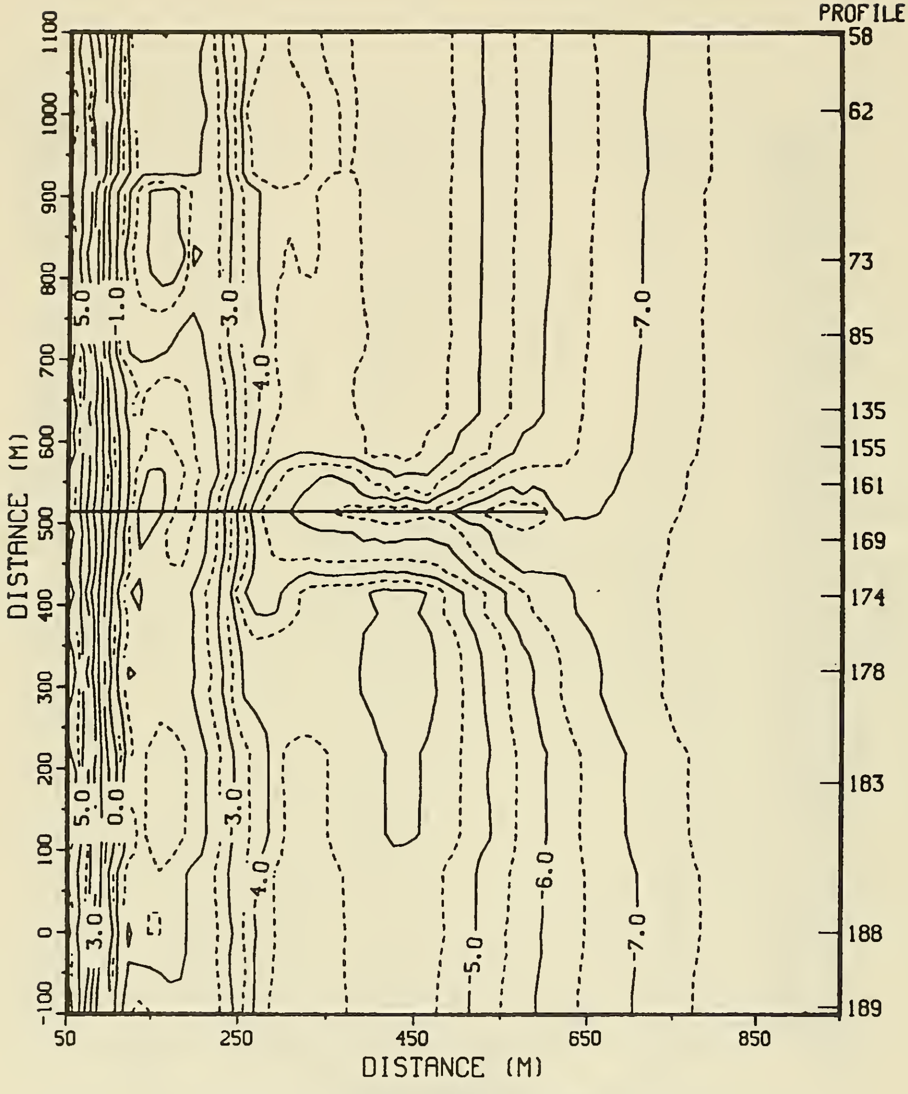

Figure C3. FRF bathymetry, 28 March 1983
(contours in metres)

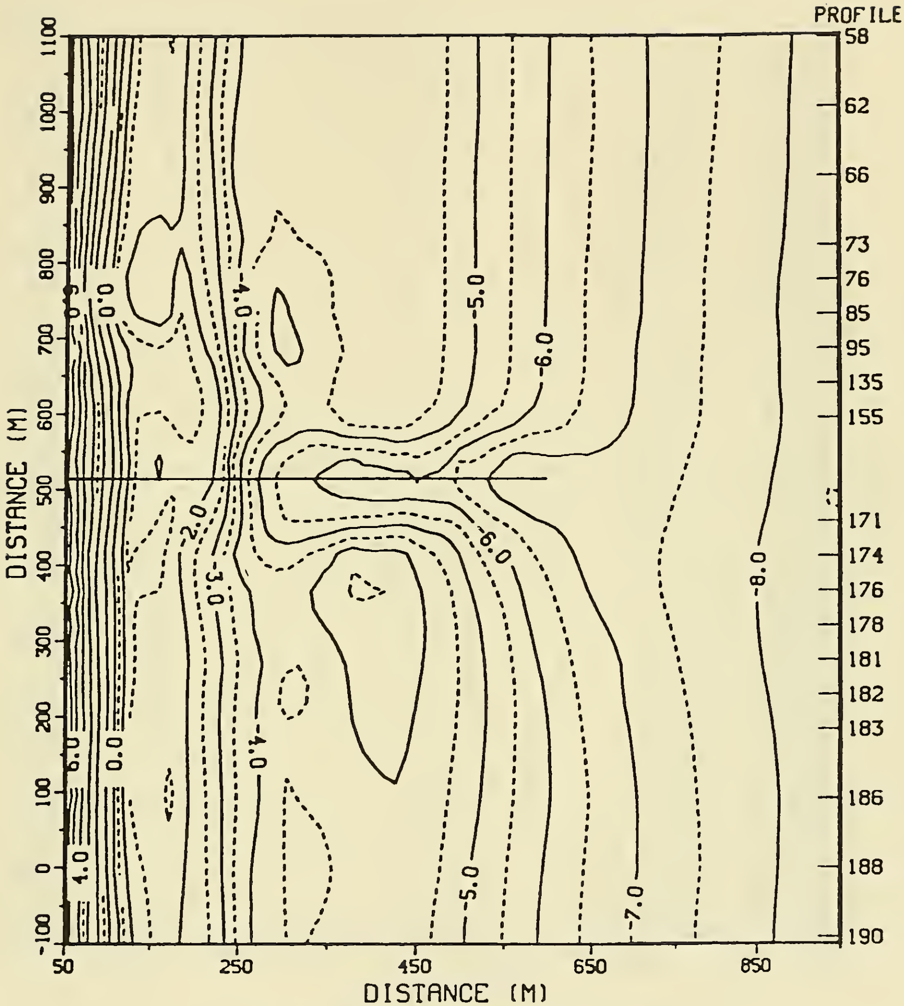

Figure C4. FRF bathymetry, 5 May 1983
(contours in metres)

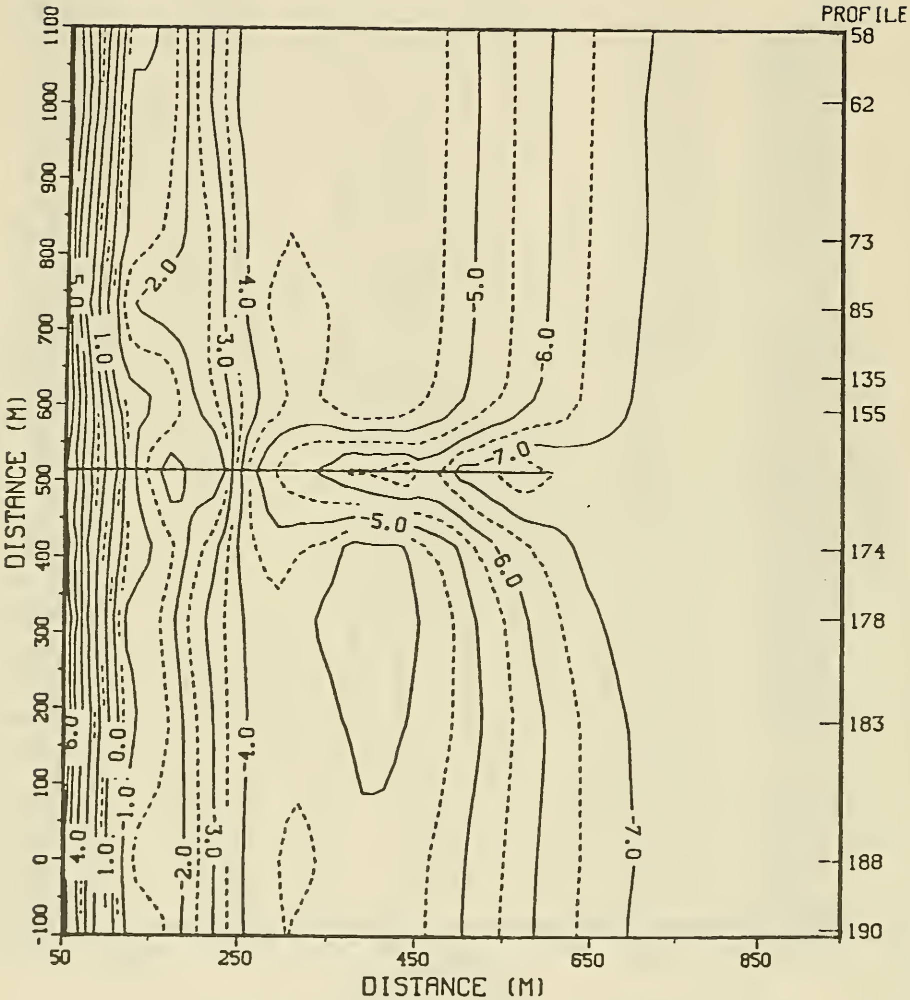

Figure C5. FRF bathymetry, 14 June 1983
(contours in metres)

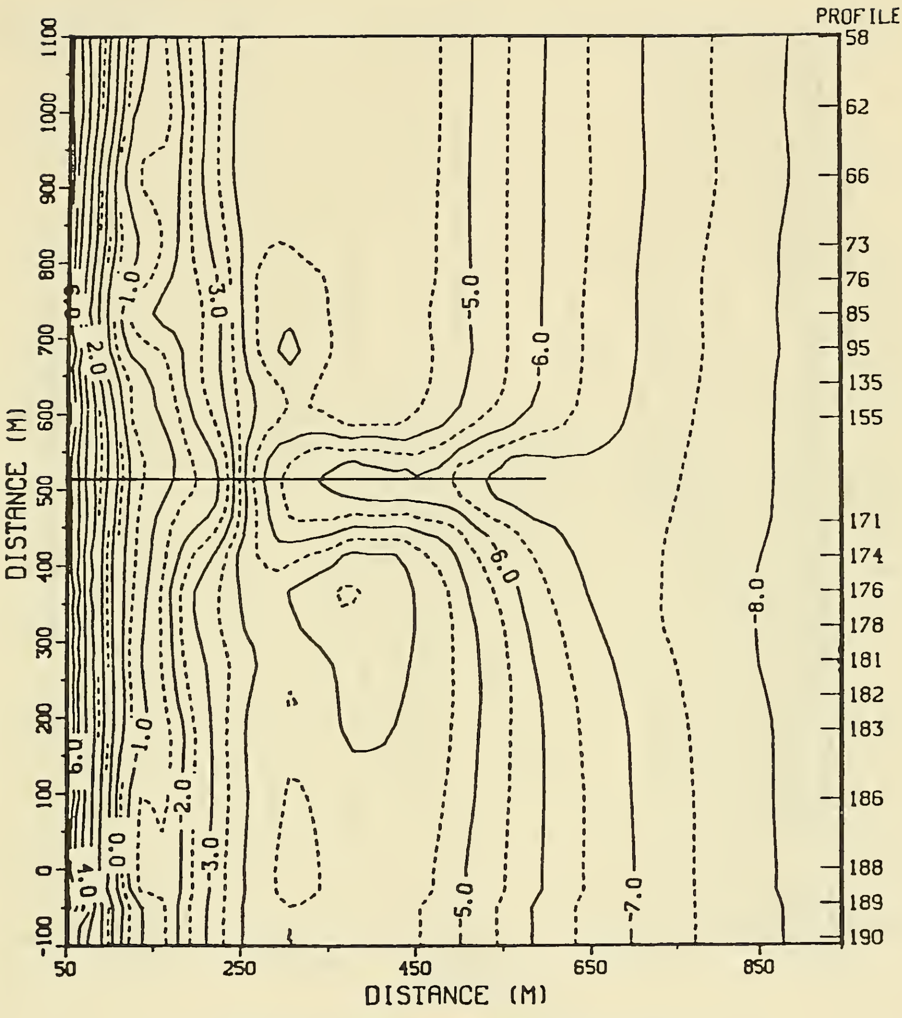

Figure C6. FRF bathymetry, 12 July 1983
(contours in metres)

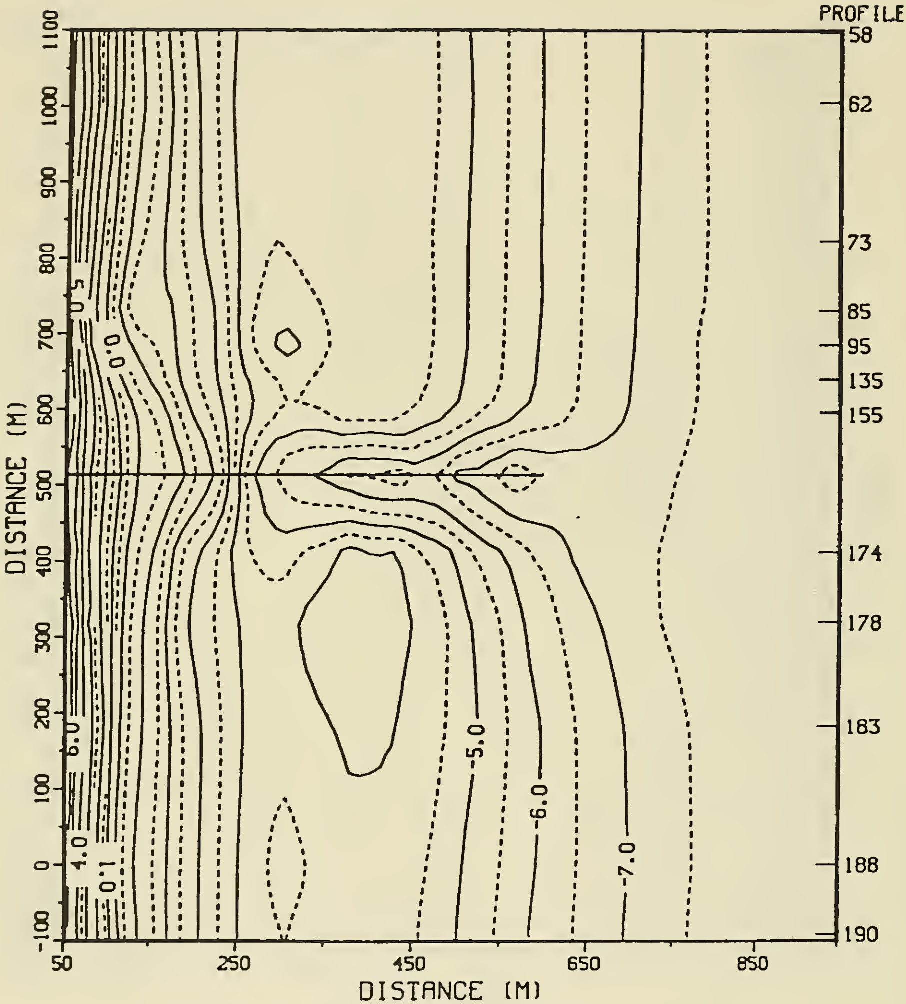

Figure C7. FRF bathymetry, 8 August 1983
(contours in metres)

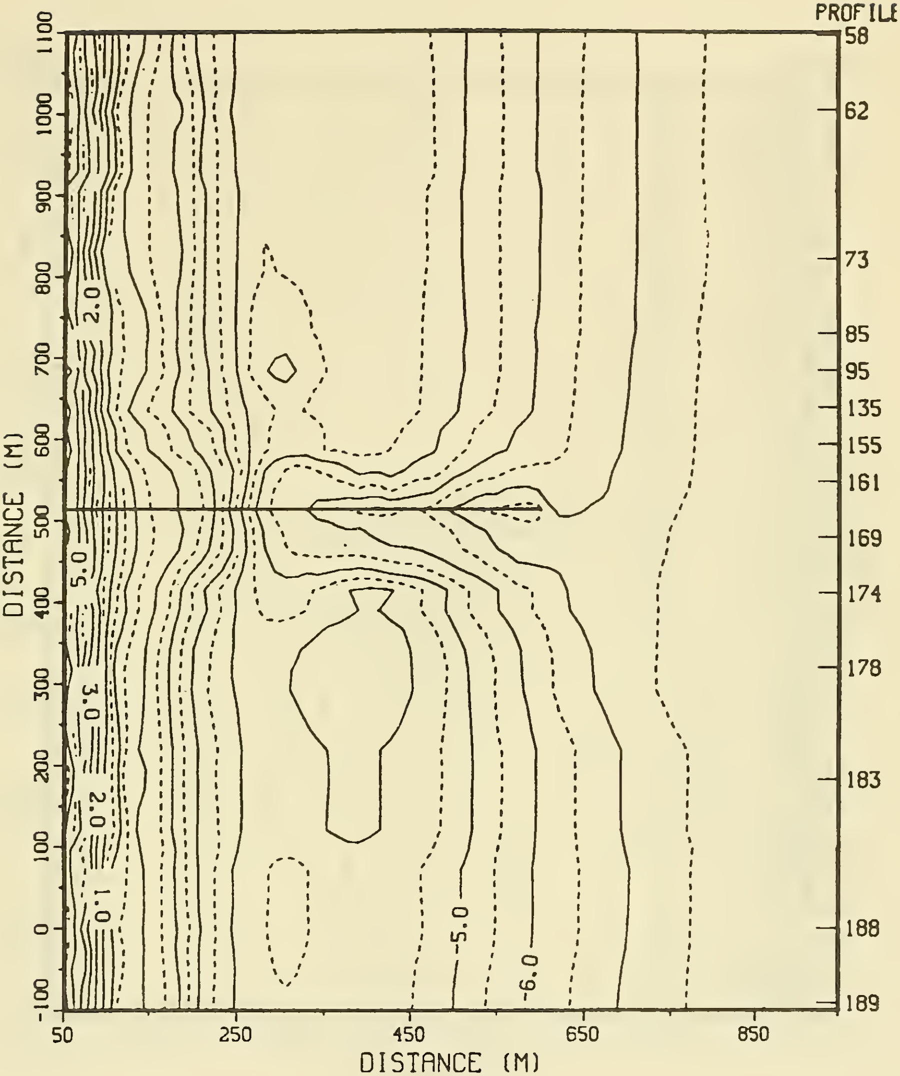

Figure C8. FRF bathymetry, 6 September 1983
(contours in metres)

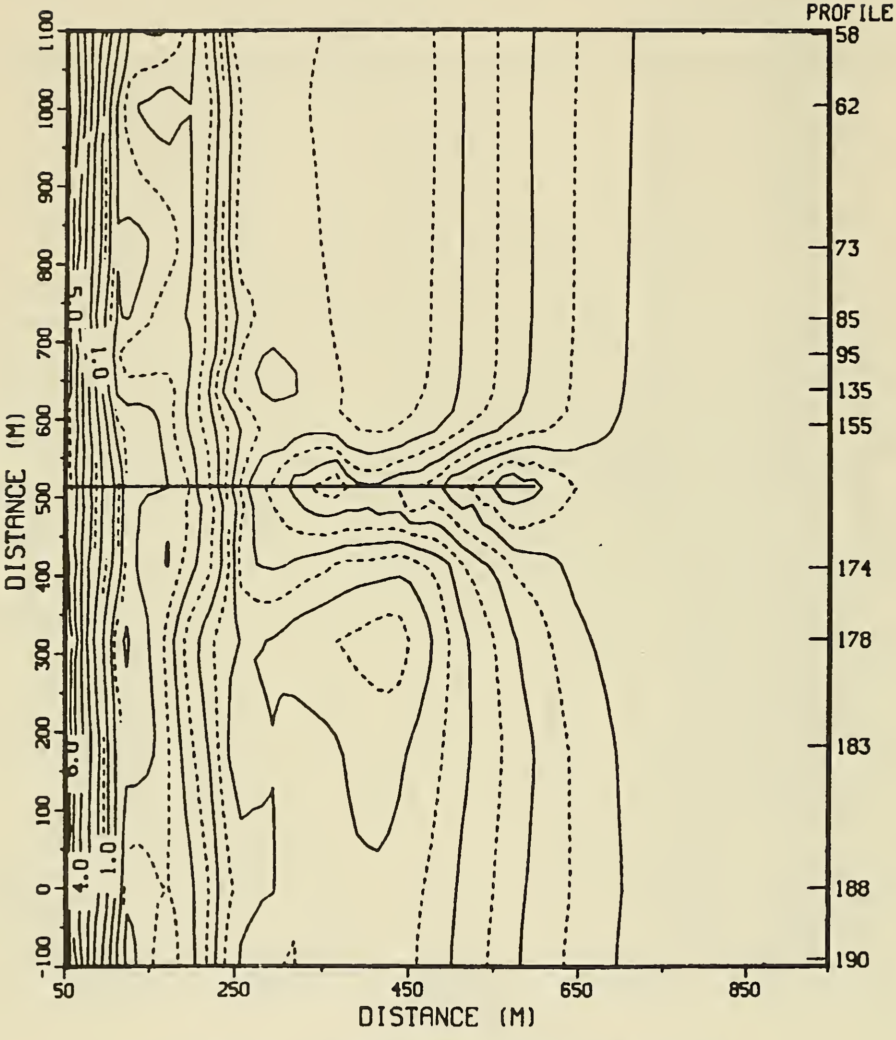

Figure C9. FRF bathymetry, 1 October 1983
(contours in metres)

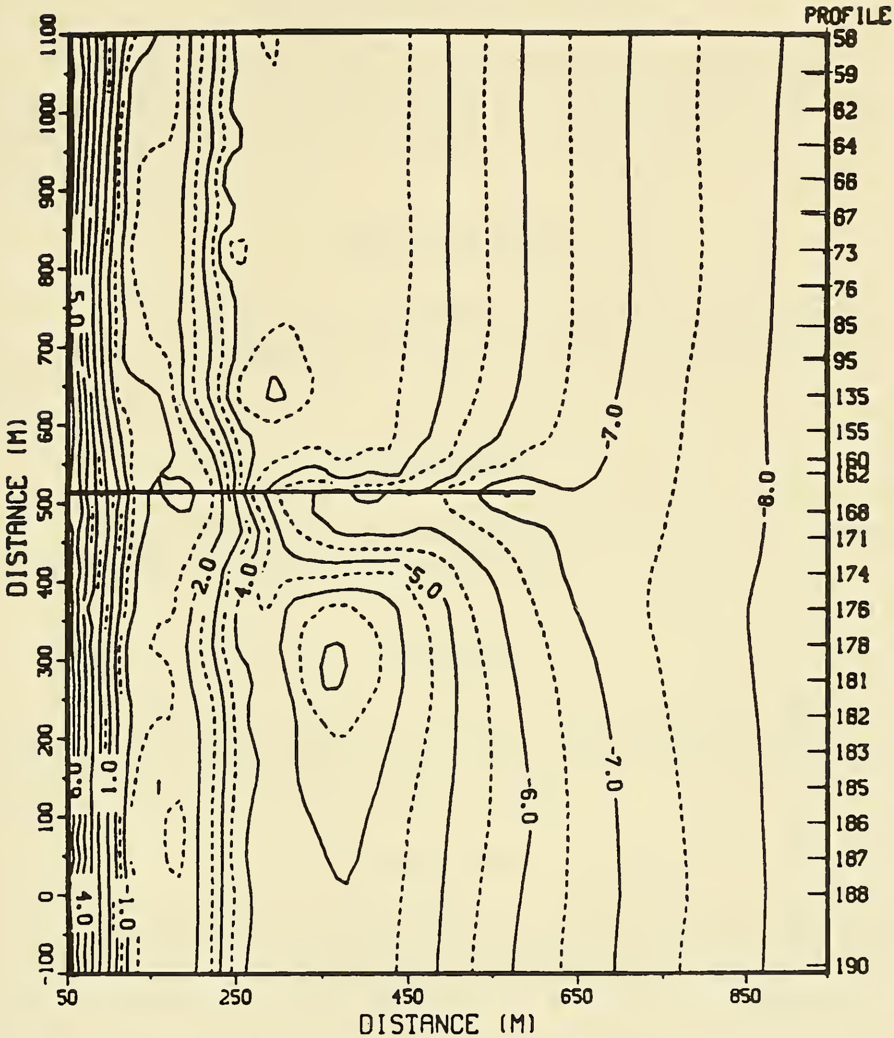

Figure C10. FRF bathymetry, 21 November 1983 (contours in metres)

APPENDIX D: STORM DATA

Explanation of Storm Data Displays

1. Whenever the wave height H_{m_o} exceeded 2.0 m at the seaward end of the Field Research Facility (FRF) pier, data were collected hourly. The available data for the 24 storms (reported in Part VI of the main text) are presented in Figures D1-D24.

Atmospheric Pressure

2. Reported in millibars, these data are useful for documenting the type of storm, the passage of fronts, and the intensity of the atmospheric pressure system.

Wind Speed

3. Local winds are generally responsible for the wave conditions at the FRF. Wind speed is reported in metres per second.

Wind Direction

4. Referenced to true (star) north, the wind direction indicates the direction from which the winds are blowing, e.g., winds blowing from west to east are referred to as having an angle of 270 deg.

Wave Direction

5. Referenced to true (star) north, the wave direction measurements are taken at the seaward end of the FRF pier. The pier axis (considered perpendicular to the beach at the FRF) is oriented 70 deg east of true north; consequently, wave angles greater than 70 deg imply the waves were coming from the south side of the pier.

Gage 625 H_{m_o}

6. The wave height, measured in metres, was that obtained from the Baylor wave staff located at the seaward end of the FRF pier.

Wave Period

7. The peak spectral wave period, in seconds, from gage 625 is reported.

Wave Levels

8. Reported in centimetres and referenced to the local National Geodic Vertical Datum, the water levels were obtained from the National Ocean Service primary tide station numbers 865-1370 at the seaward end of the FRF pier.

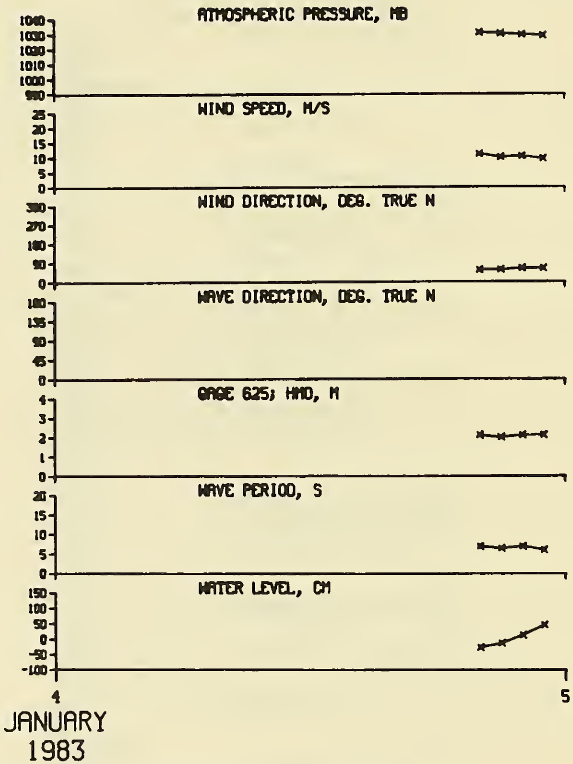

Figure D1. Storm data for 4 January 1983

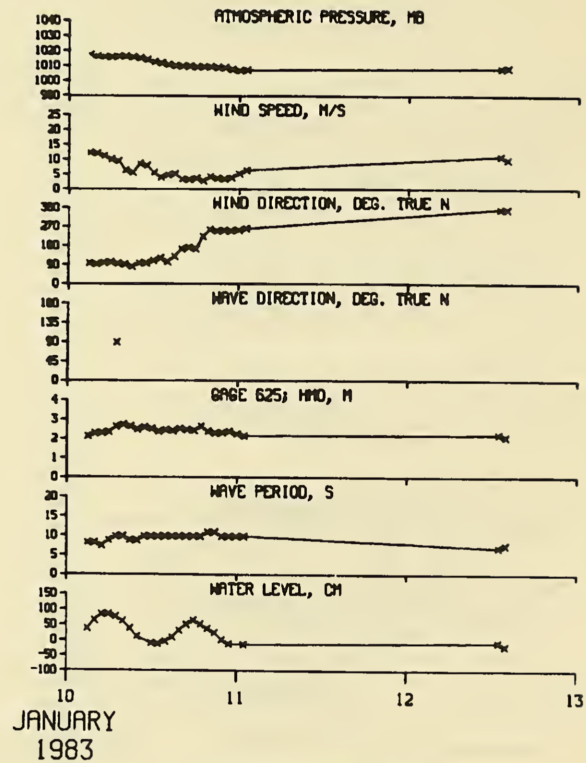

Figure D2. Storm data for 10-12 January 1983

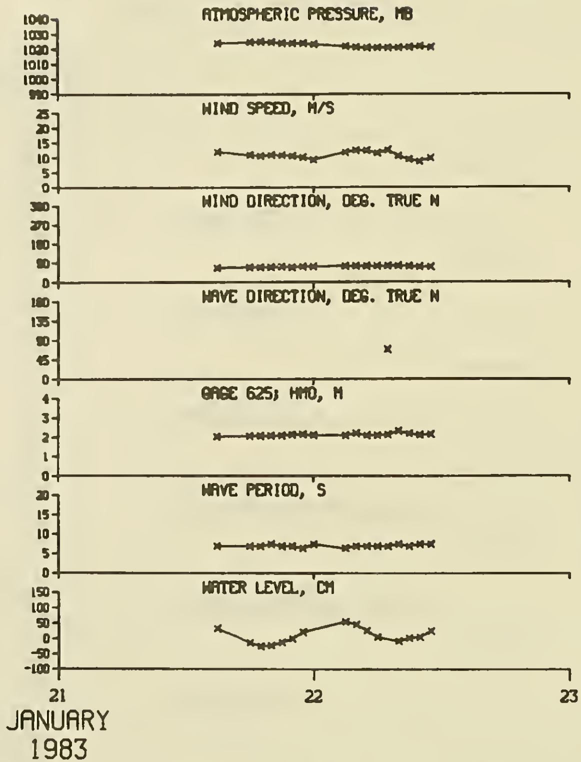

Figure D3. Storm data for
21 and 22 January 1983

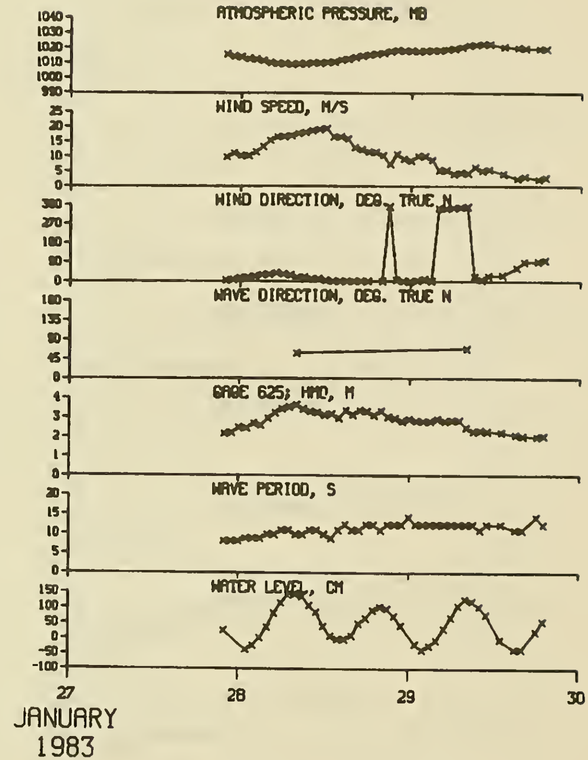

Figure D4. Storm data for
27-29 January 1983

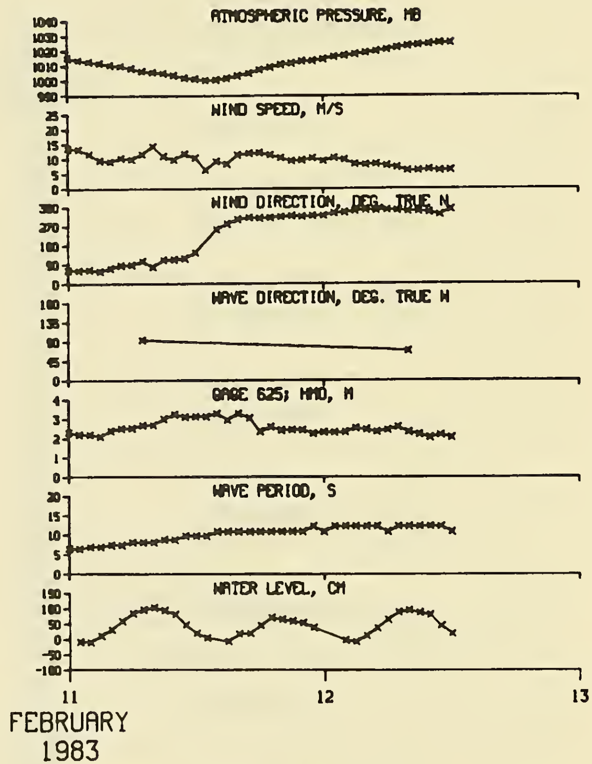

Figure D5. Storm data for
11 and 12 February 1983

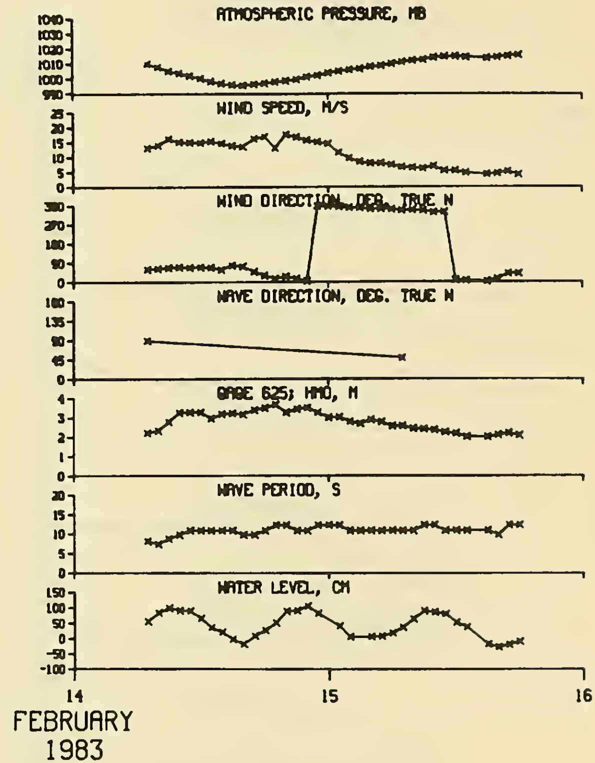

Figure D6. Storm data for
14 and 15 February 1983

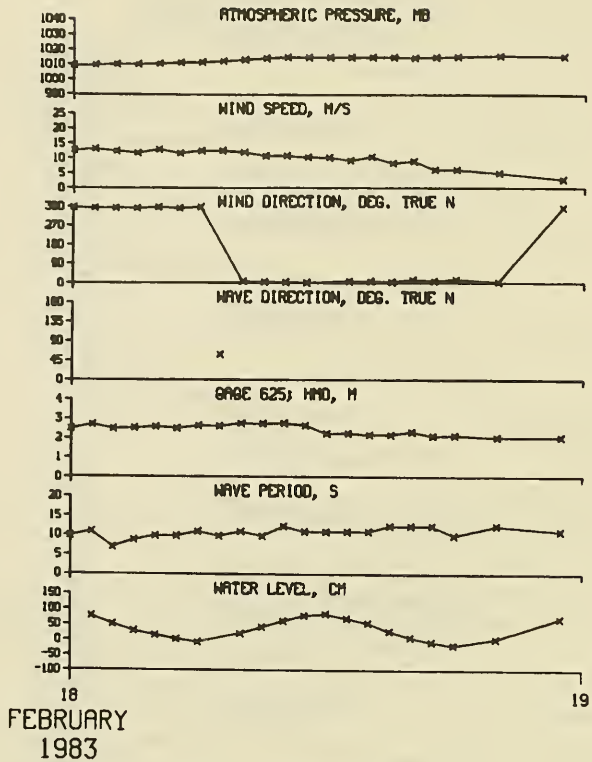

Figure D7. Storm data for 18 February 1983

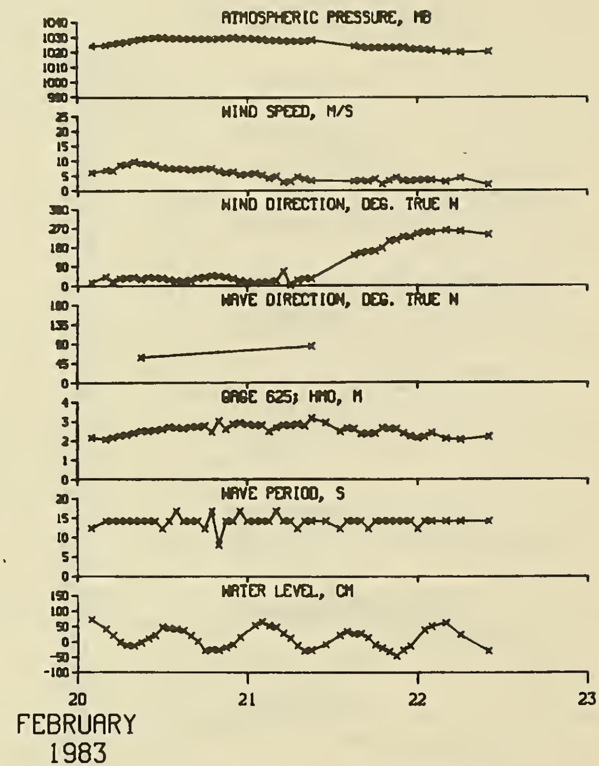

Figure D8. Storm data for 20-22 February 1983

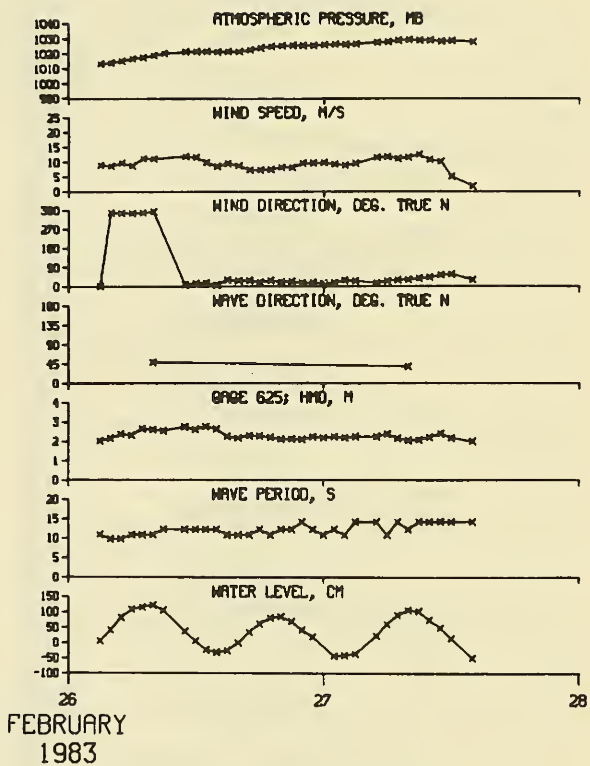

Figure D9. Storm data for 26 and 27 February 1983

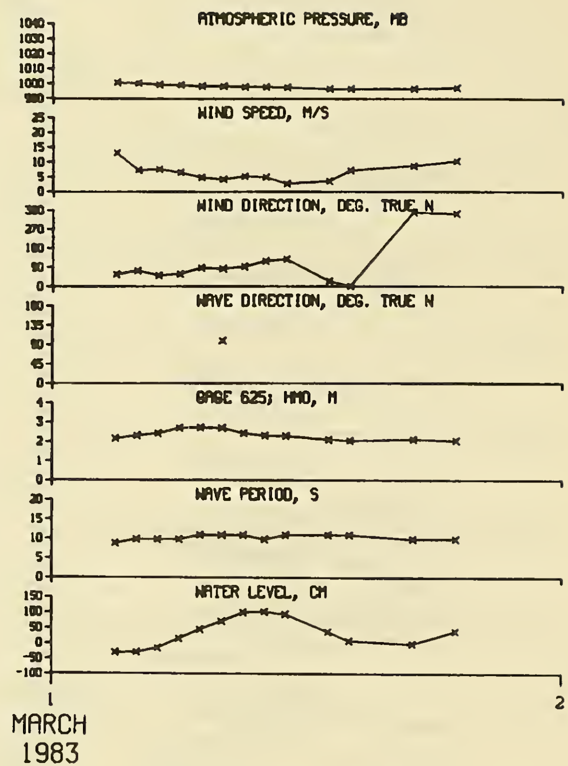

Figure D10. Storm data for 1 March 1983

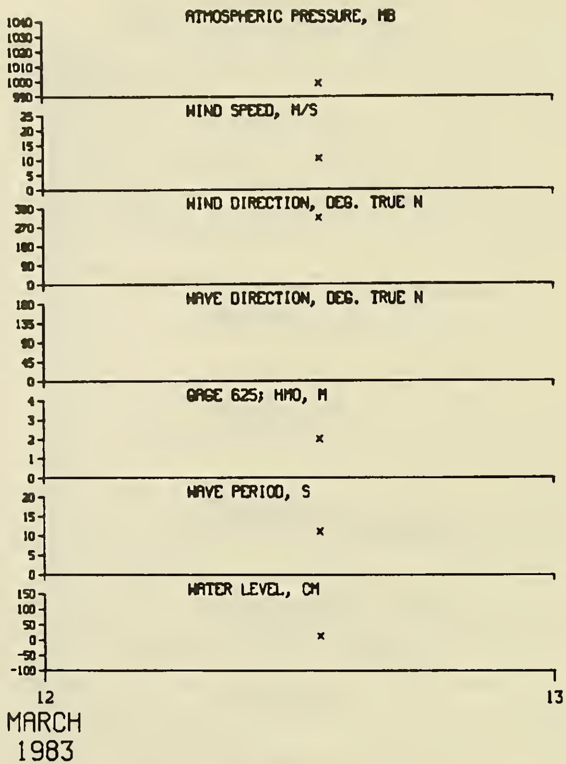

Figure D11. Storm data for 12 March 1983

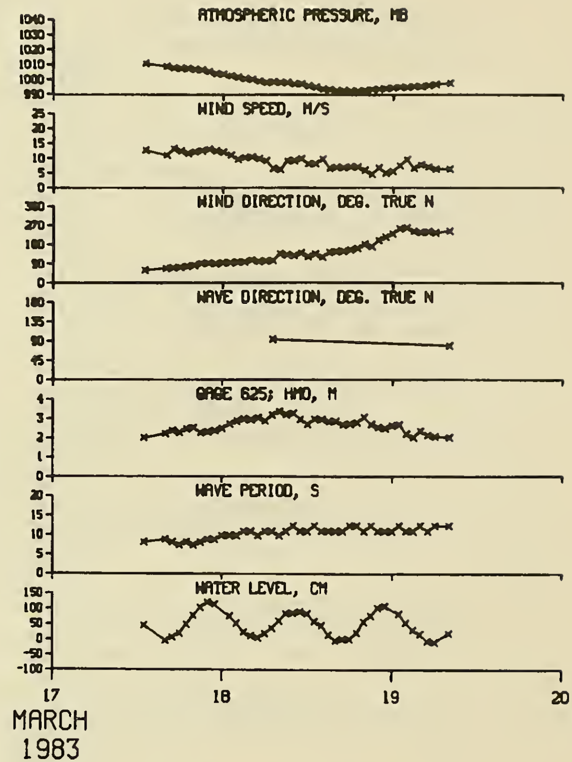

Figure D12. Storm data for 17-19 March 1983

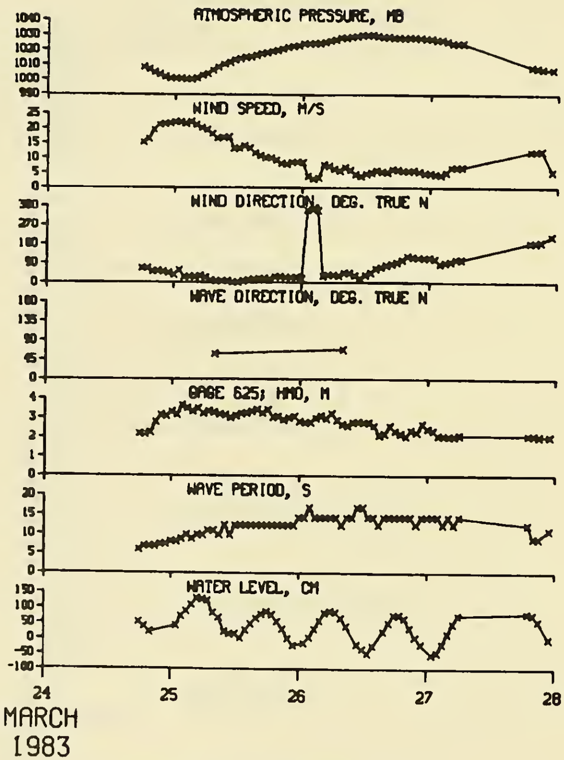

Figure D13. Storm data for
24-27 March 1983

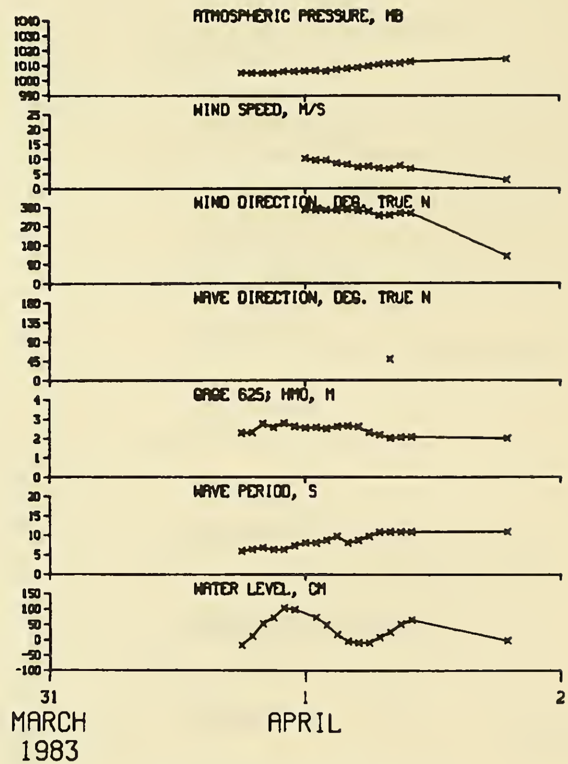

Figure D14. Storm data for
31 March and 1 April 1983

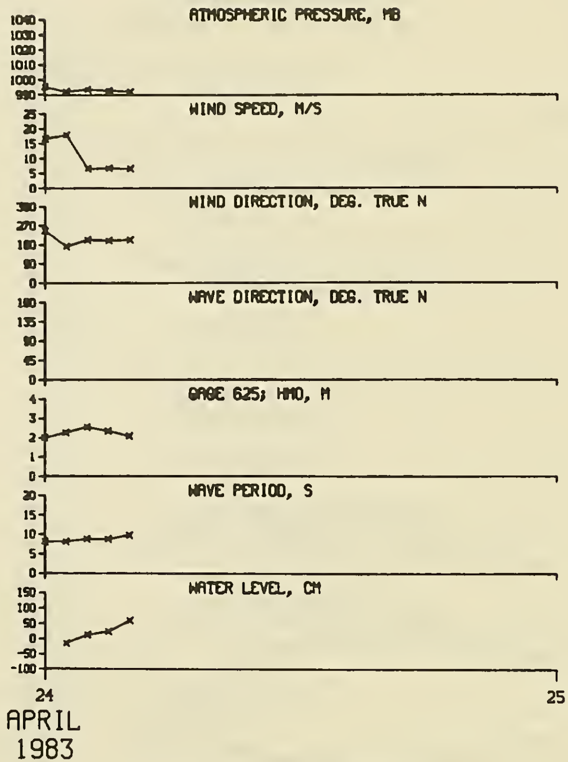

Figure D15. Storm data for 24 April 1983

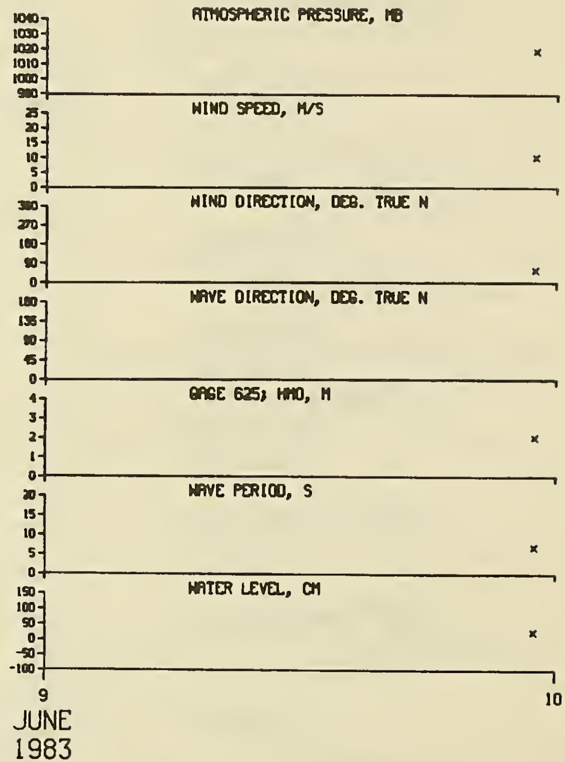

Figure D16. Storm data for 9 June 1983

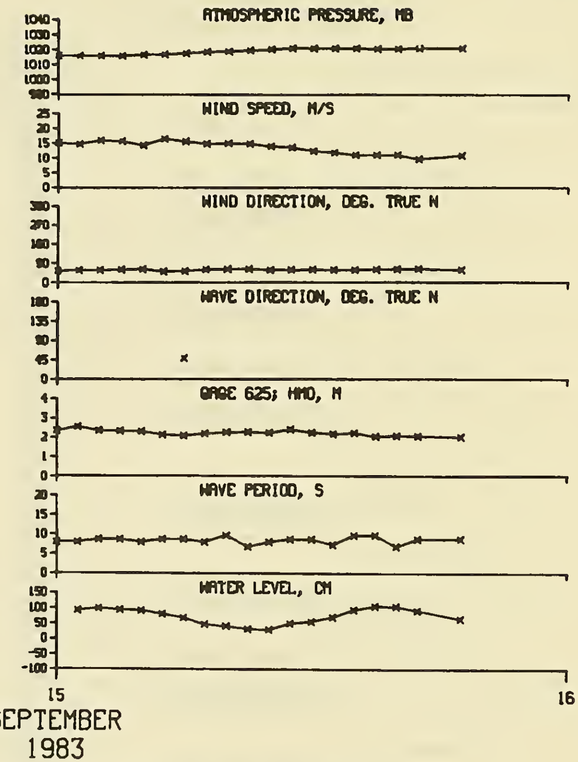

Figure D17. Storm data for
15 September 1983

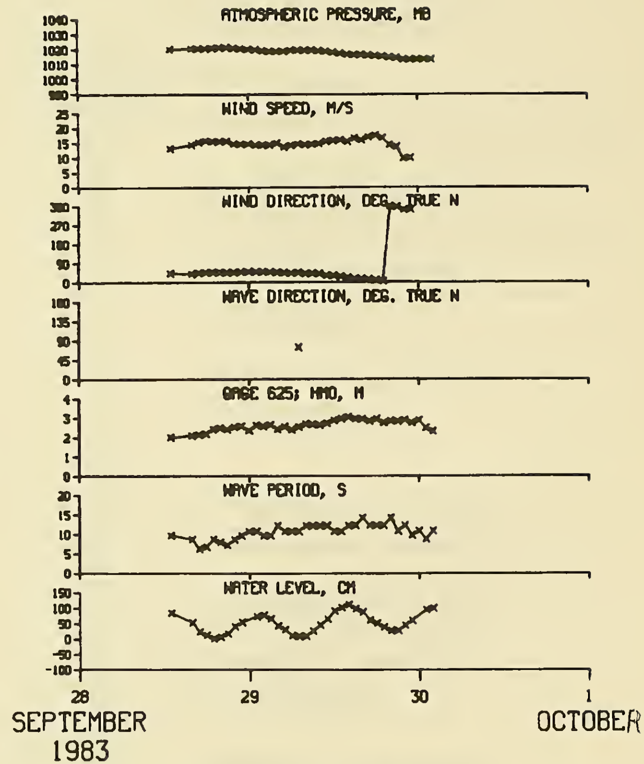

Figure D18. Storm data for
28-30 September 1983

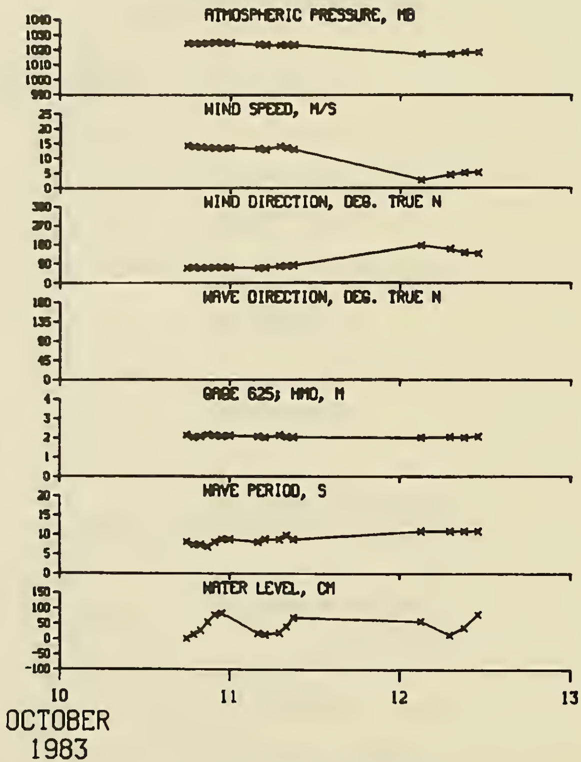

Figure D19. Storm data for 10-12 October 1983

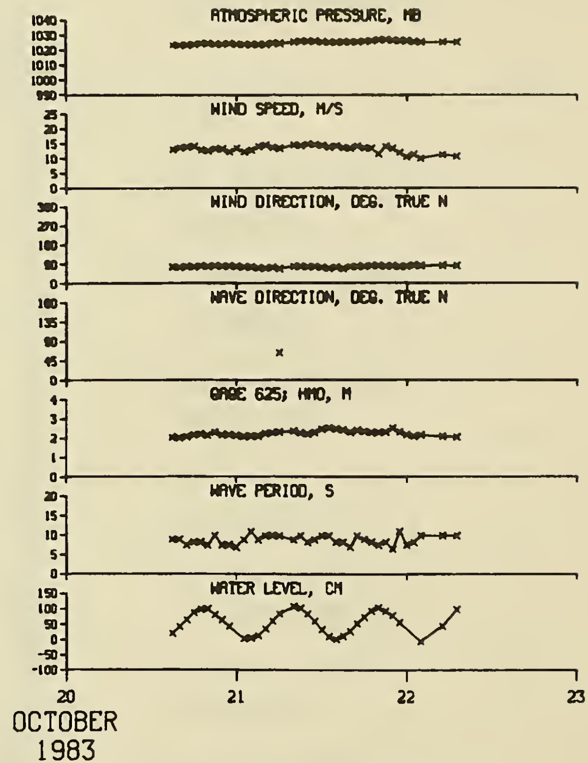

Figure D20. Storm data for 20-22 October 1983

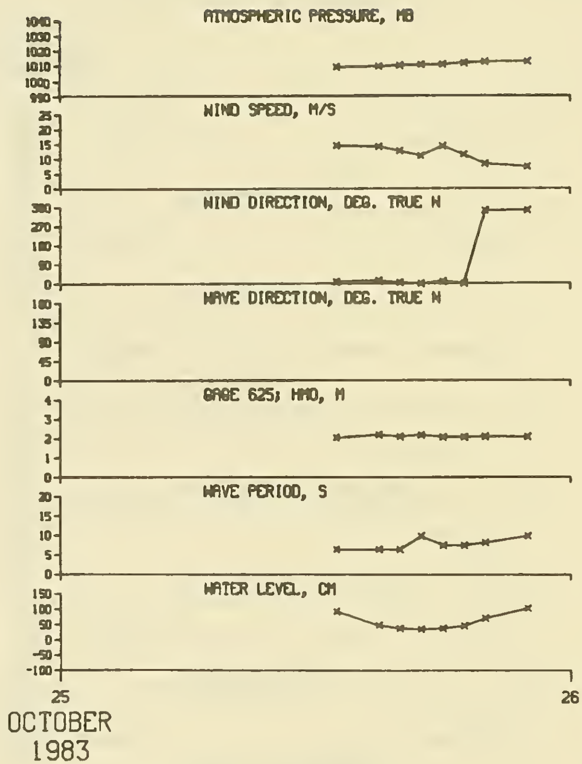

Figure D21. Storm data for 25 October 1983

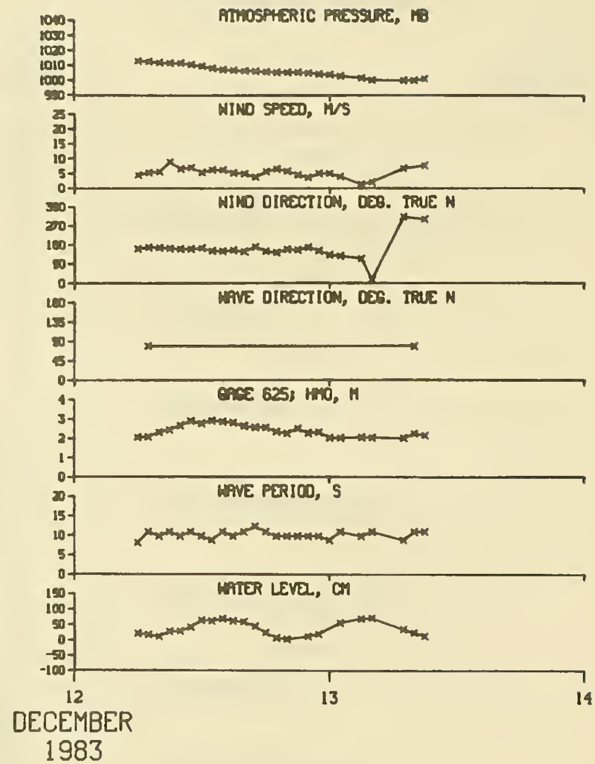

Figure D22. Storm data for 12 and 13 December 1983

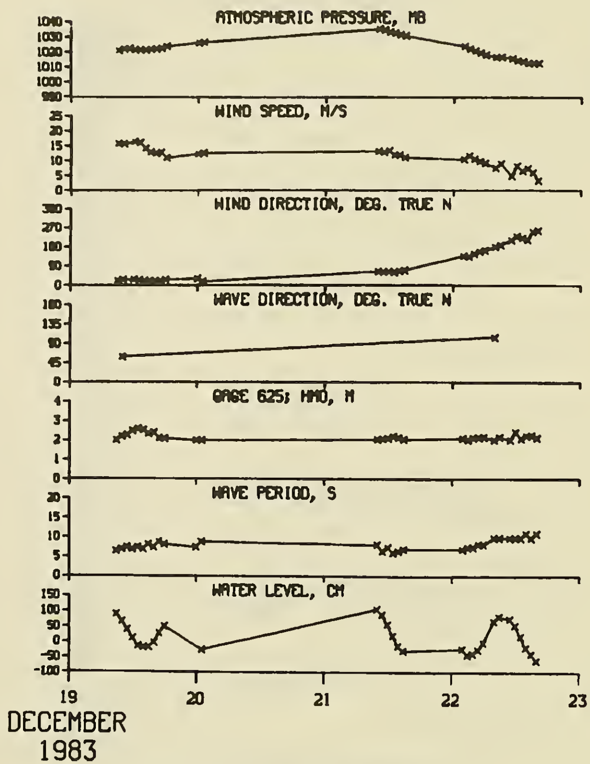

Figure D23. Storm data for 19-22 December 1983

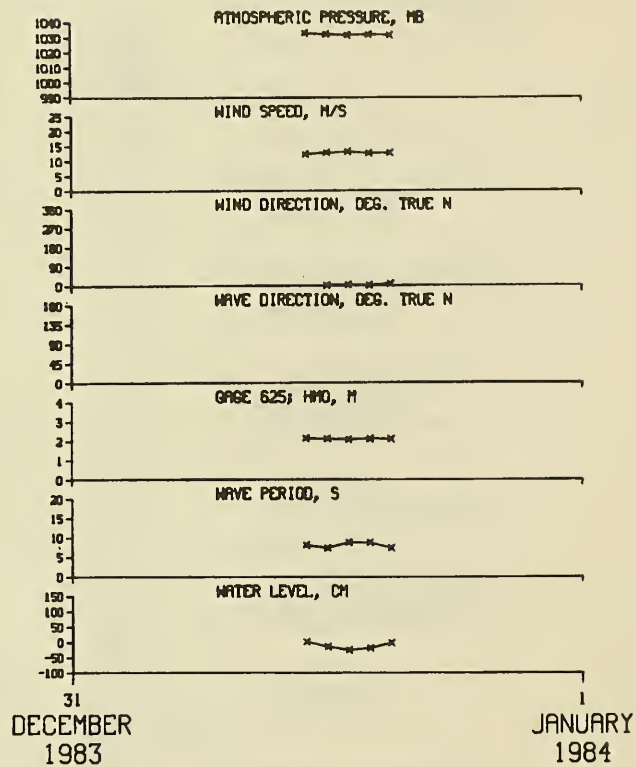

Figure D24. Storm data for 31 December 1983