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ON THE PROCEEDINGS OF THE
INTERNATIONAL CONGRESS OF HYDROLOGY AND
CLIMATOLOGY AT BIARRITZ,

OCTOBER 1886.

By G. J. SYMONS, F.R.S.,
SECRETARY ROYAL METEOROLOGICAL SOCIETY.

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IN the summons for the Meeting of the Royal Meteorological Society June 1886 it was stated that—

“ Arrangements are being made by the officers of several French Societies for holding an International Congress for discussing Papers upon Climatology, Mineral and Thermal Springs and allied subjects.

“ A letter has been received from the Foreign Office transmitting copies of documents, and stating that the French Government is anxious that Members of Scientific Societies in this country should assist.

“ The co-operation of the Royal Meteorological Society has also been specially asked by the President of the Congress, Dr. Durand-Fardel. The sittings at Biarritz will occupy the first week in October, and be followed by a three weeks tour to the principal watering places of Southern France.”

Owing to the date fixed, no English medical men were able to attend, and from various causes only three Fellows of the Society were present, though several others had intended to go. Mr. Inwards and I were, however, the only two who adhered closely to the programme. It would be unjust to commence without recognising in the warmest terms the extreme courtesy and kindness shown to the English visitors, who were regarded as delegates of the Society. Indeed, the President, Dr. Durand-Fardel, desired me to convey to our Council his thanks for the aid and encouragement afforded by the publication of the notice convening the Congress, by the Society's exhibit of publications, and by the Paper communicated by our Assistant Secretary, Mr. Marriott. The exertions, not only of the President, but of the officers, were remarkable, and contributed largely to the great success of the Congress; where all worked so well, it is only just to recognise it, and especially to notice also the exertions of Dr. Garrigou, M. O'Shea, M. Laugier and Dr. Fines.

I desire, on behalf of the English visitors, to record our thanks to the *Préfets* of the various departments, and to the Mayors and Municipalities of the various towns, for the almost endless succession of receptions and fêtes which no one who accompanied the excursion can ever forget. I think it right also to acknowledge the courtesy of all the French railway companies, not merely in reducing the fares, but in other arrangements for our comfort, which on a journey amounting to nearly 3,000 miles, are not to be ignored—a marked contrast to the uncouth treatment of the British Association by the English Railway Clearing House.

If at any time the International Congress should consent to visit England, we shall be quite unable to treat it as well as our French friends treated us.

The actual work of the Congress was commenced at a General Meeting in the Theatre at Biarritz, at 2 p.m. on October 1st. The building was decorated throughout with plants and garlands, and with the flags of most of the European nations and of course that of the United States. The platform was occupied by M. Nicolas, Conseiller d'Etat (representing the Minister of Commerce); M. Deffès, Préfet des Basses-Pyrénées; M. le Dr. Durand-Fardel (President of the Congress); M. O'Shea (President of the Biarritz Association); M. le Dr. Garrigou (General Secretary of the Congress); and a few others. The number of members present is unknown, but was probably 300 or 400.

It may be well here to dispose at once of the question of the numerical strength of the Congress. The total number of adherents was 1,056; but it must be remembered that some of these may be regarded as merely subscribers to the volume which will be published, giving *in extenso* the communications presented to, and read at, the Congress. Others, again, were residents in the South-east of France, unable to attend at Biarritz, but anxious to obtain the special information which was afforded to members of the Congress joining the excursions.

I regret that it is as yet impossible to give an approximately complete list of the numerous foreigners present—most of them delegates from the governments of the respective countries: the following is as nearly perfect as can be made in the absence of any official list:—

Austria.—M. Winternitz, Conseiller Impérial.

Belgium.—M. Gill; M. Lancaster (of the Royal Observatory, Brussels); M. Verhassel (President of the Pharmaceutical Soc. of Antwerp); Dr. Warcosuomm (President of the Roy. Academy, Brussels).

Brazil.—Dr. d' Azambuya.

Canada.—Dr. T. Sterry Hunt, F.R.S.; Dr. Huden.

Germany.—Dr. Kissch of Heidelberg.

Great Britain.—W. Bonallo, F.R.Met.Soc.; W. Dunn; R. Inwards, F.R.A.S., F.R.Met.Soc.; G. J. Symons, F.R.S., Sec.R.Met.Soc.

Holland.—Dr. Mess, of The Hague.

Hungary.—Dr. Kisch, of Buda-Pesth.

Italy.—Dr. Chiminelli.

Mexico.—Dr. F. Diaz; Dr. Covarrubias.

Monaco.—Dr. Collignon.

Portugal.—Prof. da Silva Amado; Dr. Tarrez.

Russia.—Dr. P. Soutschinsky, of St. Petersburg; Dr. Lubinoff.

Spain.—Dr. Silva; Dr. Fernandez; Dr. Diaz; M. Taboada.

Sweden.—Dr. Lamm.

Switzerland.—Dr. Vuillet, of Geneva.

United States.—Dr. Miller, of New York.

Dr. Durand-Fardel opened the proceedings with a very interesting and able address, from which, however, space prevents my quoting more than one paragraph:—

“It must be thoroughly understood that the solution of questions of climate can only be effected by co-operation. Isolated researches and fragmentary observations will not suffice, nor is it sufficient to bring together two observers or even two associations; country must join country, continent continent, for the whole globe is but their observatory and their laboratory. The honour and the ambition of the Biarritz Congress will have been to invite the *savans* of all countries to an assembly where they can each contribute to the foundation of a definite and universal science of climatology.”

After several addresses had been delivered the Bureau was constituted as follows, and the meeting closed:—

<i>President.</i>	Dr. Durand-Fardel.
<i>Secretary.</i>	Dr. Garrigou.
<i>Vice-Presidents.</i>	{ M. Antoine d'Abbadie. Dr. Martineau. M. O'Shea.
<i>Vice-Presidents</i> <i>(Foreign).</i>	{ M. Chiminelli, of Florence. M. Kisch, of Prague. M. Soutschinsky, of St. Petersburg. M. Symons, of London. M. Taboada, of Madrid.

At 8 p.m. there was a reception at the Palais-Biarritz (formerly the Villa Eugénie), in order to facilitate personal intercourse between the members.

On October 2nd the sectional work began, three sections sitting at once. The sittings began at 8.30 a.m. and lasted till about noon; resuming at 2 p.m. and closing about 4 p.m. The list of papers as printed did not by any means include all that were read; but even as it stood the programme was sufficiently formidable, the number of memoirs for each section being respectively—

I. *Scientific Hydrology.*—Water analysis, micro-organisms, collection of mineral waters, geological influences, bathing apparatus, 34.

II. *Medical Hydrology.*—Physiological and medical questions, 40.

III. *Climatology, scientific and medical,* 35.

I can of course deal only with the third section, but for that it seems desirable to give the list *in extenso*:—

Bernis.	Climatograph.
Bonald.	Duality of Climates at Arcachon.
Buckler.	On the Climate of Biarritz.
Busin, Prof.	Mean Monthly and Mean Annual Temperature of Italy.
Dambier.	On the Climate of Pau. Results of Observations recorded at Pau during 30 years, by Miss York.
Hameaw, Dr.	Climate of Arcachon.
De Wecker, Dr.	Climatology of Biarritz and its Antiseptic Atmosphere.
Piche.	New Form of Meteorological Diagram. Budget of the Meteorological Commission of Pau. Vaporimeter.
Ducourhau, Dr.	Critical Study of Observations on the Climate of Pau.
Léon and Bouyer.	Climatology of the South-west.

- Lübelsky. On the Present Climate of Poland.
- Peyroulet, Dr. Meteorological Observations at Luchon.
- Marriott. On the Climatological Stations of the Royal Meteorological Society.
- Estradère. On the Sanitary State of Luchon during 15 years.
- Doit-Lambron, Dr. Climatology of Luchon.
- Collignon, Dr. Meteorological Observations in general.
- Laserge. Meteorological Observations made at Aragnouet.
- Schrader. Two Meteorological Questions.
- Sparuzzi. Scientific and Medical Climatology—Programme for Instruction in Meteorology.
- Sébie. Meteorology of Biarritz—The Climate and the Seashore of Biarritz.
- Buys Ballot, Dr. On the Establishment of a Meteorological Station at Biarritz, and its Utility to Navigation in the Golfe de Gascogne.
- Dally, Dr. On the Influence of Altitude.
- Espina y Capo, Dr. On the Medical Effects produced by Altitude.
- Frémy, Dr. On Phthisis and High Stations.
- Lämm, Dr. On the High Station of Yemtland in Sweden.
- Chopinot, Dr. Meteorological Observations during 10 years at St. Gaudens.
- Crozats. Meteorological Observations at Béziers.
- Gandy, Dr. On the Meteorology of Bagnères de Bigorre.
- Lalesque, Dr. The Winter Station at Arcachon—Physiological Effects of Residence in the Pine Forest of Arcachon.
- Garrigou Lagrange. On certain Phenomena of Evaporation and Condensation.—On Ascending and Descending Currents.—Observations made at the Observatory of Limoges.
- Martinet, Dr. Climatology of Banyuls-sur-Mer.
- Martin, Dr. Meteorological Observations at St. Jean de Luz.
- Hedde, Dr. Scientific and Medical Climatology of Hyères.
- Pereira, Dr. Influence of Lunar and Solar Attraction on the Level of Lake Némi.
- Pitta, Dr. Climatological Researches in Madeira.
- Bonnafond, Dr. Waterspouts.

Owing to the large number of these communications it was impossible to allow much time for discussion, and my notice must be limited to the only subjects discussed at any length.

The necessity for supervising and improving the quality of the climatological observations in the Pyrenean districts was strongly urged by Dr. Fines of Perpignan, by M. Piche, Dr. Collignon and others, and finally superintendents were appointed for the departments concerned, M. Leon Teisserene de Bort on behalf of the Soc. Mét. de France undertaking to afford all possible co-operation.

In connection with the paper by Dr. Buys Ballot on Biarritz as a station for weather telegraphy, the importance of regular telegraphic reports from the Azores was urged by several speakers, and eventually a resolution embodying that view was carried unanimously, and the Portuguese representative (Dr. da Silva Amado) was requested to press it upon the attention of his government.

The practice of the Royal Meteorological Society of having all its stations photographed and the instruments inspected and verified every two years attracted considerable attention and was warmly approved, especially by the President of the Section, M. d'Abbadie.

At one of the evening meetings an interesting lecture on Storm Warnings and the Basis of their Issue was given by M. L. Teisserenc de Bort, being illustrated by a series of weather maps shown by one of Dubosq's electric lamps.

While at Biarritz I visited two out of the four meteorological stations in that town, unfortunately not having time to see the others. That at the Semaphore is practically the equivalent of an English climatological station with dry, wet, max. and min. thermometers and rain gauge. The thermometer stand was somewhat between a Glaisher and a Montsouris pattern, the position very exposed; in fact that of the rain-gauge is such that it cannot at all times fairly represent the amount falling in the town. The other station is at the Lighthouse, and the observations are under the Ministère de la Marine.

In connection with the Congress, there was an Exhibition of considerable merit. Meteorological instruments were exhibited by MM. Richard Frères of Paris, by Tonnelot of Paris, and by one or two local firms. Meteorological literature was very well represented, and the publications on baths and mineral waters were to be numbered by hundreds. The walls of several rooms were covered with photographs, diagrams, architectural plans of bathing establishments, geological sections explanatory of the collection of the mineral waters, &c. This Exhibition was held in the lower rooms of the Biarritz Casino, which has unfortunately been subsequently burned, and I greatly fear that many of the above exhibits have perished. Some of the books exhibited were stated to be very rare; if so, the loss is the more to be regretted. It may be mentioned that a Diplôme d'Honneur was awarded to the Royal Meteorological Society for its exhibit.

The excursions were of course of primary importance to the medical men, and it is obvious that my own impressions, based often merely on the weather of one day, can be of only little value. But, subject to full recognition of this fact, it seems to me that a few notes, based partly on my own experience, partly on the documents presented to the excursionists, and partly on other works already in my possession, may be generally useful.

The Pyrenees extend nearly 270 miles from West-south-west to East-north-east, viz. from the vicinity of Biarritz to that of Perpignan. The rainfall is not very accurately known, as until recently there have been few observations except at the large towns, which being generally distant from the mountains have naturally less rain. There is also reason to believe that

the large quantity of water which falls as snow during the winter months has not always been accurately measured, and the rain-gauges have frequently been at a considerable height above the ground. All these causes lead me to believe that the fall of rain is greater than that indicated by the observations collected by M. Angot, which give only two small areas exceeding 56 ins., viz. one in the extreme west and another a little south-west of Bagnères de Bigorre (based possibly on observations made at Luz); all the rest of the chain may roughly be said to be reported to have for its maximum 52 ins. with a fall decreasing rapidly towards the north and east, so that in the plains of Gascony and Languedoc the fall is only about 28 ins. In the extreme east the coast line (forming the west coast of the Mediterranean) is extremely dry, some stations having less than 20 ins. In consequence of this, and of the high summer temperature, the preparation of salt by the natural evaporation of sea-water forms an important industry along the coast from Argelès-sur-Mer, past Perpignan, and as far north as Cette.

As regards temperature it is not easy to speak with certainty, and the best plan seems to be to take a few stations at which the observations are believed to be beyond suspicion, and give the values in a table :—

ABSTRACT OF SHADE TEMPERATURES IN THE PYRENEAN DISTRICT.

Station	St. Martin de Hinx, Bayonne.	Pau.	Perpignan.	London.	
Observer	M. Carlier.	M. Otley.	Dr. Fines.	Mr. Symons.	
Duration of Observations	20 years.	15 years.	43 years.	28 years.	
Altitude	131 ft.	689 ft.	102 ft.	111 ft.	
YEAR.	Absolute Maximum	103°5	99°5	107°6	94°6
	Mean " .....	..	62°8	67°5	58°3
	Mean	55°8	55°4	59°4	49°4
	Mean Minimum .....	..	48°0	51°3	42°7
	Absolute "	8·8	9°0	18°5	6°7
JANUARY.	Absolute Maximum	74·7	72°0	76°5	56°4
	Mean " .....	..	48°4	53°2	43°3
	Mean	43·9	42°3	45°7	38°4
	Mean Minimum .....	..	36°1	38°8	33°8
	Absolute "	8·8	9°0	18°5	6°7

Biarritz.—Those who know Aberystwith can at once realise what are the general features of Biarritz. Perhaps the sands of Biarritz are rather finer, and the waves somewhat larger, but in almost all other respects the natural features are identical, but the difference of 9° of latitude gives in winter to Biarritz temperatures belonging to warmer months at Aberystwith. Without pretending to accuracy, it may be suggested that the corresponding months are roughly—

Aberystwith, September	October	February	March	April	April.
	Oct.	Nov.	Dec.	Jan.	Feb. March.
Biarritz,	57°·1	49°·0	42°·9	43°·9	46°·9 48°·9

It may be mentioned that several of the hotels at Biarritz are on a slope facing North-west, and probably 100 feet above sea-level. The drive of

about three miles from Bayonne is very agreeable, being lined almost throughout with lofty plane trees. The great want in Biarritz seems to be gardens and squares inside the town, the almost fabulous prices asked for good sites for building seems to have prevented the authorities from preserving open spaces for future requirements. The numerous villas have their own private grounds; but if the town is to continue a gem, some of the land now offered for sale must be reserved for public use.

Cambo.—The first excursion was to this little station, which is about 12 miles south-east of Bayonne at the foot of the northern slope of the Pyrenees, with a large level plain to the north and hills of considerable height immediately to the south of it, near enough, that is to say, to make pleasant pedestrian excursions. The baths are near the river and not 200 ft. above sea-level; the principal hotel is much (perhaps 100 ft.) higher, and commands a landscape which, at the time of my visit, strongly reminded me of the lowlands of Scotland. (By the bye, there is a Cambo in the county of Fife. Is there any connection?) There are two classes of water, one containing sulphur at 72° F. and one containing iron at 59°.

I am not aware of any meteorological observations having been made either at Upper or Lower Cambo, but the air is said to be very pure, and so mild that the season extends from April 15th to November 15th.

Bayonne.—Bayonne is sometimes quoted as a health resort, but I consider that its claims to that title must be but small; some parts are certainly very unhealthy, and although there are very shady woods around the ramparts, it seems to me that Bayonne should be regarded rather as a small copy of Bordeaux, *i.e.* as a commercial centre, than as a health resort.

Dax.—This is a very important station, celebrated even in the time of the Romans as d'Aquæ Tarbellicæ and d'Aquæ Augustæ, as will be seen on referring to Pliny L. XXXI. Cap. ii., which Holland thus translates:—"There is in maner no region nor coast of the earth, but you shall see in one quarter or other waters gently rising and springing out of the ground here and there, yeelding fountains in one place cold, in another hot; yea and otherwhils there may be discovered one with another neere adjoining: as for example, about Tarbelli,¹ a town in Guienne and the Pyrenæan hills, there do boile up hot and cold springs, so close one unto the other, that hardly any distance can be perceived between them." Dax is a low lying town on the bank of the Adour and only 40 ft. above sea-level, though it is 20 miles inland and 40 miles along the course of the Adour. The special characteristics of the place are, firstly, the enormous volume of its hot waters; secondly, its mud baths; and thirdly, its sedative climate. As regards the hot springs one yields 1,200 cubic metres (26,426 gallons) per diem, at the temperature of 147°·2; the basin in the middle of the town into which this spring discharges is about 50 ft. square, and even on the warm day of our visit was steaming away as if two or three locomotives were standing inside. The station is one at which mud baths are largely used, but of course I

¹ Some think Baion in France.

express no opinion upon these. The climate is considered most sedative—it is claimed to be exempt from great heat, and great cold, that snow is a rarity, that there is little rain and hardly any wind. Observations made in different parts of the town during 13 years, between 1865 and 1882, give mean temperature 57°·7; mean rainfall 43·82 ins.; mean number of fogs 22. The climate is very damp, the mean humidity being given as 84. A century since observations were made at Dax by Dr. Borda, and his records for 1781-1784 give the following values :—

	Winter.	Spring.	Summer.	Autumn.	Year.
Mean Temperature (4 years)	45°·0	55°·8	69°·6	56°·1	57°·4.

The following table is a conversion of one given by Dr. Lavielle in his *Guide to Dax* :—

	Mean Temperature.				
	Winter.	Spring.	Summer.	Autumn.	Year.
Amélie les Bains ...	46·3	58·8	73·8	60·7	59·9
Cannes ...	48·2	60·4	75·6	64·4	62·1
Dax ...	47·0	60·1	69·7	54·3	57·7
Hyères ...	43·0	53·8	74·1	59·0	57·5
Mentone ...	48·6	61·2	76·3	63·1	62·2
Nice... ..	47·0	56·7	73·2	61·1	59·5
Pau	42·4	52·7	65·5	55·6	54·1

Dr. Dujardin-Beaumetz gives rather different figures (quoted from Dr. De Valcourt), of course I express no opinion on their relative merits :—

	Winter.	Spring.	Summer.	Autumn.	Year
Arcachon	44·1	63·5	67·6	58·3	58·3
Dax... ..	46·8	59·5	73·6	63·1	60·6
Pau... ..	44·4	58·6	72·5	57·0	58·1

A fact which may throw some light upon the high winter temperature of Dax is mentioned by Dr. Barthe de Sandfort in his *Dax thermal*. With reference to the warming of the soil by the subterranean hot water, he says, “This indisputable fact has recently been verified during works connected with the Fontaine Chaude, when it was found, in Place Poyanne for example, that the soil at 6 ft. below the surface was generally at from 62° to 72° and in some places 77° F.”

Arcachon.—This is a charming town, presenting several paradoxes, *e.g.* it is a sea bathing place yet is not on the coast; it is a double town, part being the summer station, part the winter; though a sea-bathing place it claims special salubrity owing to the abundance of its pine trees. It seems to consist of a pine-covered sand dune, reaching down to an inland lagoon protected from the swell of the Atlantic by a sandy strip of land. Dotted down all through this forest are numerous villas, many of them charmingly designed and fitted. The town is entirely new, therefore there are no “slums,” and sanitary matters seem well attended to. The Moorish Casino is extremely good, I know of no English building in that style equal to it.

The rainfall at Arcachon is small, and coupled with the high summer temperature doubtless helps to explain one fact which seems to puzzle some of the residents, viz. the high specific gravity of the sea water, which is said to be quite 12 per cent. above that of the Atlantic. I infer that this is in part, if not wholly, due to evaporation.

A table of temperatures was given in the manual presented to the members of the Congress; I have converted the values into Fahrenheit degrees and reproduce the table.

THERMOMETRICAL OBSERVATIONS MADE IN THE SHADE IN THE FOREST UNDER THE SUPERVISION OF THE SCIENTIFIC SOCIETY OF ARCACHON.

Years.	8 a.m.					Noon.				
	Winter.	Spring.	Summer.	Autumn.	Year.	Winter.	Spring.	Summer.	Autumn.	Year.
1865	°	°	°	°	°	°	°	°	°	°
1866	41·4	55·6	69·1	57·6	55·8	46·2	63·7	75·7	66·4	63·0
1867	43·5	53·1	67·1	60·3	56·3	52·3	60·3	72·9	68·4	63·5
1868	46·6	56·7	68·9	54·5	56·7	53·4	63·7	76·8	62·2	62·4
1869	42·8	54·9	69·6	57·2	56·5	46·9	60·6	75·9	64·0	63·0
1870	46·2	53·6	72·0	54·0	56·8	53·2	58·8	75·7	62·2	62·2
1870	40·1	54·1	72·3	57·4	55·9	46·9	63·7	76·8	63·0	63·0
Mean ..	43·3	54·7	69·8	56·7	56·3	50·0	61·3	75·4	64·6	62·8

Pau.—Thanks chiefly to the influence of Sir Arthur Taylor, Pau occupied formerly an almost unapproached position in English estimation as a winter residence, and from information received it appears still to attract an influential body of visitors. I confess that I do not quite know why. According to the observations published by M. Piche,—and he as a skilled meteorologist, long resident in Pau, must be the highest authority,—the mean temperature of January is 42°·3, while at Penzance, according to the Meteorological Council, it is 44°·1, therefore our countrymen expatriate themselves in order to go to a place which has a reputation, but which is nearly 2° colder than our own best winter station in January; 0°·7 colder in February, and only warmer in March by 1°·6. I had no idea that the facts were as above stated, but when at Pau remarked that the vegetation looked like that of the warmer parts of Cornwall. My impression is that the English made a great mistake when they abandoned Tours and began to patronise Pau. Among other things, Pau has nearly twice the rainfall of Tours, and is twice as distant from Dover. The great feature of Pau is a terrace walk overlooking the Gave, and with a splendid unbroken view of the chain of the Pyrenees.

[Since writing the above I have stumbled upon the following note sent on January 15th, 1881, by one of my observers then staying at Pau:—"Snowing hard here for two days." And later still I have received a note from another of my correspondents, dated "Boulevard du Midi, Pau, December 4th, 1886," in which she says, "We are having very cold frosty weather. The thermometer last night registered 24° Fahrenheit, or 8° of frost."]

Eaux-Bonnes.—This is a lovely mountain station about 2,500 ft. above the sea and 30 miles from Pau. It is a summer station with endless rides and walks, the latter chiefly through woods in which also great lengths of almost horizontal terraced walks have been cut. I have not heard of any meteorological observations having been made there, but my impression is that its climate must be somewhat like that of the higher part of the English Lake District, or Loch Katrine, but rather warmer. The principal hotel (Grand Hôtel des Princes) was closed for the season, but opened for the *déjeuner* to the Congress, and would form a very charming residence for a fortnight or so.

Eaux-Chaudes.—This is only eight miles from Eaux-Bonnes, with a regular omnibus service, and the road to it is grand almost beyond description, having been blasted out of the side of a nearly perpendicular cliff: the view along the gorge for a mile or two before reaching the baths is ample reward for many an hour's weary travel. The little village is about 2,200 ft. above the sea, and below it in the gorge are the bathing establishments. The temperature of the different springs ranges from 97° downwards. The bathing season is from June 1st to September 30th, and during that season the air is very mild, and the climate much sought after because "of the uniformity of the day temperature between 63° and 68°, maintained by a local breeze which from sunrise to sunset blows gently along the gorge."

Cauterets.—This was the next station visited by the Members of the Congress, but as I remained at Pau over the Sunday, my remarks can only be based on the publications presented to me by Dr. Duhourcau, of Cauterets, and on the photographs which I obtained. The resident population is about 1,800, and there is in addition accommodation for 6,000 visitors. The season consists of six months from May 1st, and, though more than 3,000 ft. above sea level, during this half of the year it is rarely cold; the absolute minimum is said to be 39° and the maximum 86°, the mean temperature at 6 a.m. 54°·5 and at 2 p.m. 66°·2. The town is now well provided with pure drinking water and good drains, and is remarkably healthy; among the 22,000 visitors each season, many of them seriously ill, the deaths rarely reach 15. The quantity of thermal water is immense, 330,000 gallons per diem, at temperatures ranging from 133° to 93°. I did not hear a single adverse remark upon Cauterets from any one of the 150 Congressists who visited it.

Lourdes.—This was not visited by the Congress, as it is not regarded as a health resort, and there are no mineral waters of medical repute. However this may be, whether or not the water from the celebrated grotto contains notable chemical ingredients—they are not readily perceptible to the taste or smell—this much is certain, that the crutches and other supports left behind by those who have visited there must already exceed a hundred. I merely record the fact, and add that whatever the ordinary climate may be, October 11th, 1886, was bright, crisp and very sunny.

Bagneres de Bigorre.—A very interesting town of about 10,000 inhabitants, 1,820 ft. above sea, and almost surrounded by lofty mountains. The

town is irregularly built, and possesses few notable edifices except the Casino and the bathing establishment—the former is of extremely good design: the bathing premises are very plain, but were stated to be very well organised. The baths are open all through the year, but are most frequented during the summer. The climate is considered warm and relaxing rather than otherwise, and so I found it as it happened. The hills round the town are well wooded, and shady paths are numerous.

Luchon. or, as it is sometimes called, Bagnères de Luchon, is a charming town, not very large (the resident population being fewer than 4,000), but with ample accommodation for visitors, and many things to tempt them to stay. The streets are lined with plane trees, of which the trunks are in many cases 9 ft. in circumference, and lofty in proportion. The Casino and the garden in which it stands, with its lakes, flowers, electric lighting, &c., would be an acquisition to London, while all is set in a framework of mountains; the town itself is 2,000 ft. above the sea, but all around are peaks ranging from 4,000 to 11,000 ft. The thermal establishment is very large, and is, I believe, very well organised in all respects. Luchon may also be considered as one of the very best centres from which to visit the various picturesque valleys of the Pyrenees. I have not seen any thermometrical records from Luchon, but according to M. Angot's rainfall map it is one of the driest places in the Pyrenees, having less than 40 ins. per annum. M. Angot is always so careful that he doubtless has returns which justify this value, but as no record from Luchon is to be found in the last volume of *Pluies en France*, 1882, one may perhaps be permitted to wish for some modern returns.

Ussat.—A very small place, near Tarascon (Ariège), about 50 miles in a straight line from Luchon, but nearly 150 miles by train. There are few houses except the large hotels, the bathing establishment, and the post-office. It is a summer station (June 1st to October 1st), 1,400 ft. above sea-level, at the southern base of the magnificent cliffs which form the north-east bank of the Ariège, and from which the thermal water (104°) flows. These nearly perpendicular cliffs are said to be 1,300 ft. high, but they look even more. The valley is perhaps a mile across; and on the south side the hills, though less abrupt and less lofty, are specially interesting on account of the numerous and extensive caves which they contain.

No thermometric observations have been published, but the station is probably rather hot, though I did not notice any specially tropical vegetation. On the right bank of the river (the north side) there is a large grassy park or common, and the hotels have good gardens.

Ax,—or **Ax-les-Bains** or **Ax-sur-l'Ariège.**—is a somewhat large town south-east of Ussat, and 16 miles from Tarascon, which at present is the nearest railway station. The line will, however, probably reach Ax in 1887 or 1888, as most of the heavy works are complete. Ax is quite in the heart of the Pyrenees at the intersection of several valleys, is between 2,000 and 3,000 ft. above sea-level, and surrounded by lovely scenery. The quantity, heat, and strength of the sulphur springs are remarkable, water at the temperature of

160° is continuously running in steaming streams by the road side, it is so strongly charged with sulphuretted hydrogen that bright silver plunged in it for two minutes took a colour which lasted for a week in spite of rubbing. One of the smaller establishments takes a daily supply of 88,000 gallons; there is, however, far more water than all the establishments together could ever utilise. Here is the public hot bath established by Louis IX. for the use of lepers, but now chiefly devoted to washing purposes.

Montpellier.—From Ax we were obliged to return to Toulouse in order to pass to the eastern end of the Pyrenees. This took us past the excessively interesting cité of Carcassone to Narbonne Junction, and as that is only some 50 miles from Montpellier the Congress went there. It is a large and in some respects handsome city, population 55,000. Formerly a fashionable health resort, it has now I believe, on account of the strength of the winds, nearly lost its reputation. In protected places there are, however, trees which prove the absence of hard frosts, *e.g.* in the garden of the hotel there was a magnolia quite 40 feet high, while abundance of hardy trees decorate the parks and squares. This was the first place at which we saw any mosquitos.

A large party of the Congressists were kindly taken by the Municipality to the Agricultural School, and Dr. Crova gave an interesting lecture on the meteorological work of the Commission of the Department of Hérault and of the Observatory of Montpellier, which he has long directed; and after the lecture he accompanied the members in their examination of all the instruments. As I hope on a future occasion to submit a few notes by Mr. Inwards and myself upon the meteorological observatories of the South of France—Montpellier, Perpignan, Nice and others—I omit details for the present.

Cette.—On the journey from Montpellier to Perpignan, the Congressists stopped at this port. There is a good panoramic view from the Signal station, but I could not advise any one to select Cette as a residence. As regards frosts, a paper by M. Doumet-Adanson shows that on the average of twenty years there are 37 days with frost; the average minimum is 18°·1, and in the winter of 1863-64 it fell to 10°·4. No wonder that tropical vegetation was not to be found.

Boulou, or Le Boulou, is an iron spring on the river Tech, 15 miles south of Perpignan and 10 miles north-east of Amélie-les-Bains; it is not very high, and lies at the foot of a spur of the Pyrenees. There are no meteorological records, but the abundance of aloes in the sides of the road, and some fairly good orange trees in the garden, tell a tale of sunshine and of few frosts. The feature which astonished me most was the very large quantity of carbonic acid gas continually bubbling up through the water, in fact one small reservoir was always full of the gas, which escaped and flowed down along the path. A Grotta del Cane could easily be formed here of any required size. The waters are said to be almost identical with those of Vichy.

Amélie-les-Bains.—A romantic village on the Tech, at present 25 miles from the nearest railway station, but soon to have one. Only 900 ft. above sea level, and surrounded by lofty ranges. Extensive Roman baths were found here, and many relics are still to be seen, but unhappily the baths have been

so modernised that little but the name remains. The hotels and bathing establishment are on a very large scale and in high repute. The temperature of the sulphur water varies from 145° downwards. There is a large Military Hospital here with its own special baths.

The climate, owing it is said to "the warm Vent d'Espagne," is so mild that patients can stop throughout the winter, a quality which, according to one authority, renders it unique in Europe.

La Preste.—This is about 22 miles from Amélie-les-Bains, and therefore 47 miles from the nearest railway station and within 2 or 3 miles of the Spanish frontier, and is 3,707 ft. above the sea. North winds cannot reach it and hence it is said never to be cold, and the baths are open all the year. Mademoiselle Mathilde Faure, the daughter of the proprietor of the establishment, has been furnished by Dr. Fines with standard thermometers and two rain-gauges; I found them all in good order and the lady herself an accurate observer, so that all uncertainty as to the climate of this interesting station will soon cease. This station was formerly, indeed until quite recently, only accessible on mules, but now there is a splendid road—and the French make superb roads—all the way to Perpignan.

I left the party at Amélie-les-Bains, as I was anxious to get to the Riviera but my friend Mr. Inwards continued with the Congress a few days longer, and has kindly given me the two following notes.

At **Banyuls-sur-Mer**, a little fishing town near the Spanish frontier, the French Government have established an excellent Zoological Laboratory, which is now in full action, and it is probable that sea temperature observations may be forthcoming from this part of the coast of the Mediterranean.

At **Thues** there are numerous hot-springs, the temperature of one of them reaching 79° Centigrade ($174^{\circ}\cdot 2$ F.). In some of these springs, notwithstanding the temperature and the chemical impurities, there were small water snails living and thriving in the hot water close to the place where it gushes out of the rock.

