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ISONEPHS—MAPS OF CLOUD-PREVALENCE OVER THE GLOBE.*

THE various publications of the French Meteorological Office contain so many interesting memoirs that they furnish rather an *embarras de richesse*, and, we are afraid, suffer accordingly.

We feel, indeed, that we owe an apology to M. Teisserenc de Bort, for not earlier noticing his work. One reason for the delay is, however, so complimentary to the author, that we may perhaps be excused for mentioning it—the paper is so useful that it has frequently been absent when we were about to notice it.

The author begins with some notes upon other Meteorological Maps; and it seems to us that it may be useful to complete his history, as far as we are able, leaving it to others, if they will kindly do so, to correct us; so that eventually a perfect list may be formed

Wind.—First mapped by Halley, more than two centuries ago, and published in the *Philosophical Transactions*, Vol. XVI, 1686.

Temperature.—Isotherms, or lines indicating localities having similar mean temperatures, first drawn by Humboldt, in 1817.

Pressure.—Isobars, or lines indicating where the sea level pressure is equal, were certainly drawn as early as 1839; because our copy of Berghaus's *Physikalischer Atlas*, published in 1849, contains a Map entitled "Uebersicht der mittleren Barometerstände am Meere und der oscillationen des Luftdruckes," which bears the foot note, Gotha, J. Perthes, 1839, Second Edition, 1849. This map shows more details of barometric range than of mean barometric pressure; but it gives both, showing even the low barometer off Cape Horn, by assigning to it a mean pressure of 330 Paris lines (= 29·31 in.), or considerably lower than any other place on the globe. M. Teisserenc de Bort rightly draws attention to the map of Western Europe, published by M. Renou, in the *Annuaire* of the French Meteorological Society, in 1864, as probably the earliest complete series of isobars of the pattern now adopted; and to Mr. Buchan's, in 1869, as the first for the whole globe.

* Etude sur la distribution moyenne de la Nébulosité a la surface du Globe, par M. Léon Teisserenc de Bort. Annales du Bureau Central Météorologique de France, 1884 - Météorologie Générale, 4to, 1886.

Rain.—The earliest rainfall map of which we are aware is not entitled to rank in this list—because there was no attempt at indicating by lines, or shading, the areas of large and of small rainfall. It was a map of England, issued in March, 1840, by J. Atkinson, of Carlisle, and showed the average rainfall by figures printed over the sites at which the observations had been made. We believe that, as with isobars, so with isohyetals, or lines of equal rainfall, priority rests with Dr. Perthes; as the map in Berghaus's Atlas above quoted, bears date, "Gotha, J. Perthes, 1841, Second Edition, 1849."

Cloud.—Just as we owe to M. Renou the first complete set of isobars, so do we owe to him the first set of isonephs,* or lines of equal prevalence of cloud. These he gave in an excellent paper in the *Annuaire*, of the French Meteorological Society, in 1879; but it treated only of part of Western Europe and Northern Africa, and was, as the author himself stated, only a preliminary.

It is to a thorough investigation of this subject that the present memoir is devoted, and the work reflects the highest credit on the author. He has spared no trouble in collecting information, or in so treating the data as to obtain the best results. He does not pretend that his charts will not require revision at some future time, he recognizes their imperfections, but he has given us not only such maps as we have never had before, but in our opinion, maps of very high excellence.

Nine large quarto pages are devoted to a list of, and notes upon, the documents which have been used in the construction of the charts.

When we state that he has evidently discussed the monthly values from at least 680 stations in various parts of the globe, for a gross total of more than five thousand years, besides working up more than 100,000 observations upon the amount of cloud over the Atlantic; we need say nothing more as to the zeal and labour devoted to the work.

As regards accuracy, M. Teisserenc de Bort remarks—"The most nearly accurate manner of forming charts to represent any Meteorological element is to group observations made simultaneously all over the globe. Unfortunately, stations of which long continued and synchronous observations exist are a few in number, and there are many breaks in the series; while, as regards observations made at sea, they are grouped according to localities and to months, rather than chronologically."

He then proceeds to explain how he has endeavoured to minimize the effect of these evils—and this has led us to make a little investigation, which is we think useful, as indicating the amount of precision attainable in the estimation of the amount of cloud, and also instructive as to the variability in the amount from year to year.

We have taken from Mr. Glaisher's tables, as published by the

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* ἴσος, equal; νέφος, cloud.

Registrar-General, the mean amount of cloud in each quarter of each year for the ten years, 1876-85, at Camden Square, London, N.W., and at Blackheath, London, S.E., the distance between them being 7 miles. The values are as follows :—

	Camden Square.					Blackheath.				
	March.	June.	Sept.	Dec.	Year.	March.	June.	Sept.	Dec.	Year.
1876...	6·7	5·7	5·3	7·5	6·3	7·0	5·3	5·1	7·4	6·2
7...	6·7	5·9	5·5	5·6	5·9	6·7	5·8	6·0	5·9	6·1
8...	7·4	6·2	5·8	7·0	6·6	7·5	6·1	6·2	7·3	6·8
9...	7·4	6·7	7·0	6·8	7·0	7·7	6·8	6·5	7·4	7·1
1880...	6·7	6·5	6·2	6·9	6·6	6·4	6·0	6·4	6·8	6·4
1...	7·2	5·8	5·9	6·6	6·4	7·5	6·3	6·5	6·7	6·7
2...	6·9	6·0	6·2	7·2	6·6	6·3	5·5	5·7	7·0	6·1
3...	6·5	5·7	6·0	6·7	6·2	6·2	5·7	5·9	6·9	5·8
4...	6·9	6·0	5·2	6·7	6·2	6·9	6·1	4·4	6·9	6·1
1885...	6·8	5·5	5·7	6·8	6·2	6·3	4·8	5·2	7·1	5·9
Mean.	6·9	6·0	5·9	6·8	6·4	6·9	5·8	5·8	6·9	6·3

This shows :—

(1). That the difference in the quarter between the two stations is usually only $\pm$ 0·3, only exceeded 0·5 on four occasions, and only once reached 0·8.

(2). That the difference in the year is usually $\pm$ 0·2, and reached only 0·4 and 0·5 once in the ten years.

(3). That the usual difference between the mean amount in two successive years is only $\pm$ 0·3.

(4). That at Camden Square, the least cloudy year was to the most cloudy as 100 : 119 ; and at Blackheath, the corresponding values were 100 : 122.

These values seem to us very satisfactory, and show the close agreement of trained observers, and thereby indicate that observations of this class are probably more accurate than most persons supposed. They also show that the amount of cloud is not an element which varies greatly from year to year. Rainfall, we know, varies between two consecutive years by about one-fifth of its average amount, the above table shows that cloud varies by only about one-sixteenth. The wettest year has, we know, more than twice the rainfall of the driest ; the above figures show that the most cloudy year has only one-fifth more cloud than the clearest one.

From this it seems to follow that M. Teisserenc de Bort, need not anticipate any material change in his isonephs, except in those parts of the world from which he has failed to obtain any information at all, and they are few in number, as any one will soon find out who tries to compile a list of unrepresented districts.

We have devoted so much space to the examination of the amount of confidence to be placed in the work, that we have to pass over the important pages in which M. Teisserenc de Bort considers the

relation of cloud areas to those of high and low barometric pressure, and to say a few words respecting the maps. They are on Mercator's projection, about 2 ft. by 1 ft., and possess that neatness and distinctness which characterizes all that is issued by the French Meteorological Office. There are 13, one for each month and one for the year. The most marked features are three areas where the average amount of cloud exceeds 7; the largest nearly covers the N. Atlantic, between lat. 47° N., and 62° N., and then sweeps away over the Gulf Stream to the North of Norway and Nova Zembla; the next is an oval extending W.S.W. to E.N.E. in the North Pacific, S.W. of Alaska; and the third takes Patagonia and all places S. of 50° S.

The least cloud is reported for a large tract covering the Sahara and much of the interior of Northern Africa, Arabia, Persia and part of Afghanistan.

Smaller areas with similarly little cloud are Central South Africa, and Central Australia.

There are in the following little table which we have drawn up from M. Teisserenc de Bort's large ones, some crumbs of comfort for Britishers, for which we ought to be more grateful than many of us a re.

Mean Annual Amount of Cloud (Overcast sky=10.)

Hamburgh ...	7·0	Bayonne	6·1	Milan	5 3	Corfu	4·2
Brussels	6·9	Dublin.....		Sydney		Rome	4·1
St. Petersburgh	6·7	Melbourne ...	6 0	Wellingtn. NZ		Cape Town...	4·0
Moscow	6·6	Paris		Buda Pesth ..	5·1	Valparaiso ...	3·9
Cracow	6·5	Christiania ...	5·9	Florence	5·0	Lucknow.....	3·5
London		Vienna.....		Madras		Nice.....	3·4
Berne	6·4	Aberdeen ...	5·7	Mexico		Smyrna	
Copenhagen..		Utrecht		New Orleans.	4·9	Pekin	3·3
Berlin	6·3	Yokohama ...		Lisbon.....	4·7	Algiers	3·1
Edinburgh ...		Oporto.....	5·6	Buenos Ayres	4·6	Lahore.....	2·7
Geneva		Toulouse.....		Bombay	4·4	Cairo	1·9
Stockholm ...	6·2			Calcutta	4·3	Athens.....	1·7
				Naples.....			

Who would have expected Brussels to be more cloudy than London? Berlin, Edinburgh and Geneva to be equally cloudy, and more so than Stockholm, Utrecht, Christiania or Dublin? In fact the equality between Dublin and Bayonne, is one of the most surprising features in the whole table—and we throw no doubt upon the accuracy of either record.

The paper is one which marks a distinct step in Meteorology, and on which the author is to be warmly congratulated.

THE BOLIDE OF NOVEMBER 20TH, 1887.

To the Editor of the Meteorological Magazine.

SINCE your issue for December last, in which you printed a considerable amount of information on the subject of the Bolide of the 20th of November, I have obtained a mass of additional materials, and the inquiry may now be said to be closed.

I purpose discussing the whole fully, for the Herts Natural History Society, and in the meantime may summarise the results already arrived at.

As regards the effects and distribution of the sound-waves originating in the passage through the air, or explosion, of the meteorite, or from both causes, records of the sound have been obtained from about 150 localities, the area covered being 105 miles in its extreme length from Westley, near Bury St. Edmund's, in the east, to Upper Lamborne, near Swindon, in the west, and of width varying from 15 to 20 miles, and extending into 11 counties. This area may be outlined by the following places :—On the north, Bury St. Edmund's, Newmarket, Cambridge, St. Neots, Risely (Beds), Bedford, Bow Brickhill (Bucks), Buckingham, Sulgrave (Northants), with an isolated observation near Leamington, Brackley (Northants), Bicester, Sandford, Oxford, Pusey, and Upper Lamborne ; and on the south, Wantage, Upton (Berks), Reading, Bisham (near Maidenhead), Prince's Risborough, Wendover, Aldbury (Herts), Watford, Hatfield, Albury (Herts) and Saffron Walden.

Looking at the distribution of sound over this area alone, the course of the meteorite may perhaps be laid down on a line of which Bury St. Edmund's and Upper Lamborne are extreme points. If regard is had to the localities from which evidence of a particular loudness in the sound has been received it is more difficult to come to a decision as to the course of the meteorite, but on the whole this consideration points to a line rather more to the northward, of which perhaps Newmarket and Wantage might be terminal points.

From a number of observers their impressions as to the direction from which the sound noticed reach them have been obtained, but there is much variety in these reports, and it is difficult to bring them into even tolerable harmony. Generally throughout Cambs, Essex, Herts and Beds, *i.e.*, the eastern half of the area affected, the sound came from the west and south-west. In the west there is a greater variety of direction. The fair inference upon this seems to be that no explosion took place within any of the former counties, but that further to the westward, at one or more centres, explosions took place. This conclusion is also supported by the descriptions given of the character of the sound. In the western section in some places a series of explosions (in one case as many as five) are recorded, all of them apparently distant ; but the general estimate of the nature of the sound was that it was of some duration and like thunder. More to the west it is often described as a single explosive sound like that of a cannon. It is probable, therefore, that in the earlier part of its observed course—possibly at a great elevation—a rushing sound, with perhaps minor detonations, gave rise to the noise noticed, and that at certain points in its later course—or at one point only—a breaking up of the main mass of the meteorite occasioned one or more distinct and very loud reports.

There is some ground for associating an explosion with the district a little south of Ampthill, in Bedfordshire, both on account of the loudness of the sound experienced there, and also from a well-marked convergence of lines of sound from places to the westward upon that point. But, however this may be, it is pretty clear that explosions took place somewhere in the neighbourhood of Thame, and again further to the west, near Wantage.

The meteorite was *seen* apparently from two points—certainly from one. As to the doubtful record (if it is doubtful), there is very little to say. I have received two letters from an observer at Solihull, near Birmingham, referring to what appeared like "an ordinary sky-rocket, just at the *moment after* it has spent itself in the air." This is stated to have been noticed "full south." The information is rather meagre—but the time (8.20) is that of the meteorite—and it seems improbable that anything else to which such a description as that given would apply, would be seen by any coincidence exactly at that time, and in broad daylight. If we take this observation to refer to a final explosion of the meteorite in the neighbourhood of Wantage, the direction would be a little to the E. of S., and the distance 60 miles. Thame would be nearly S.E., at about the same distance. If either of these points is adopted, the elevation, to enable an observer at such a distance to notice the explosion (probably at an angle of not less than 15° above the horizon,) might perhaps be put at 20 miles and upwards.

The Hertford observations are far more definite and important, and as I have visited the locality, may, I think, be accepted with considerable confidence.

The meteorite was seen from an upper window, which faces about N.N.W. It was first observed at a point about N.E., and at an elevation of about 20°. It passed across the view to the W., disappearing behind a projecting building at about W.N.W., at an elevation of about 13°. At a point about N.W. a piece appeared to fall. No sound was heard at Hertford, although the shock was felt within a few miles to the N. and W.

If we take N.E. as the exact point of first appearance, Bury St. Edmund's, 46 miles distant, may be assumed as the approximate locality over which the meteorite was first seen. The height there above the earth might perhaps be as much as 20 miles, if the angle of elevation somewhat exceeded 20°. If N.E. is too far to the E., and an allowance is made for some error in this direction, Newmarket might be a better estimate of the locality.

The point at which a fragment of the meteorite was observed, from Hertford, to become detached, if taken accurately as N.W., might perhaps be associated with the apparent centre of sound distribution in Bedfordshire already referred to, which lies due N.W. of Hertford; but some variation must be allowed in fixing such a point, and possibly it should be more to the westward. The point

of disappearance might possibly be as far W. as Aylesbury, which would be 32 miles distant, and at the estimated angle of elevation, would give a vertical height at that place of only 7½ miles. This small elevation is perhaps hardly consistent with the meteorite travelling so far westward as Wantage, and one is rather inclined to argue from the Hertford observations, that the course of the meteorite was somewhat further to the north than that deduced from other data.

The course and elevation will probably never be fixed with any great accuracy, but at all events we have not only disposed completely of the widespread idea that an earthquake occurred on November 20th, but have also obtained a sufficiently accurate general notion of the cause of the sounds and other phenomena so widely noticed on that day.

H. GEORGE FORDHAM.

Odsey Grange, Royston.

THUNDERBOLTS.

TWICE in this Magazine have I reported searches after thunderbolts. The first thunderbolt turned out to have been manufactured for fun by a young chemist; the second was the soot and part of the brick of a chimney fused by lightning into a cake with the cinders in the grate below. I intend exhibiting some other specimens of so-called thunderbolts at the meeting of the Royal Meteorological Society on March 21st, and shall be very thankful if any one who has, or can procure, a *reputed* thunderbolt, will be kind enough to send me full particulars, and to lend me the specimen.

G. J. SYMONS.

62, *Camden Square, N. W.*

RAINFALL IN NORWAY.

"The Norwegian town of Bergen has always had the character of being an excessively 'wet' place, but the amount of rain that fell there during the year 1887 seems to beat the record. It amounted to no less than 111 in., against 88 in. during 1886 and about 78 in. for the previous years, whereas the normal amount of rain there is only 67 in. The greatest amount of rain for any 24 hours was 2·91 in. There are two places in Norway that can boast a still greater amount of rain than Bergen, viz., Florö and Demmestan, where the annual amount of rain exceeds that of Bergen by 5·90 and 8·85 in. respectively. At Florö, the greatest amount of rain for any 24 hours was 4·36 in., or about half the annual amount of rain at Alten in Finmark. The average of the annual amount of rain in Christiania is only 26·38 in."—*Engineering*, Vol. xlv., p. 122 (3rd February, 1888).

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, the 15th ult., at the Institution of Civil Engineers, 25, Great George Street, Westminster; Dr. W. Marcet, F.R.S., President, in the chair.

Mr. T. S. Ainge, Mr. J. C. Bell, F.R.G.S., Mr. C. A. Markham, Surgeon-Major S. Smith, Mr. J. T. Tibbles, and Dr. J. Walther were elected Fellows of the Society.

The following Papers were read :—

1. "Electrical and Meteorological Observations on the Peak of Teneriffe," by the Hon. Ralph Abercromby, F.R.Met.Soc. The author made a trip to the Island of Teneriffe, in October 1887, for the purpose of making some electrical and meteorological observations, and now gives some of the results which he obtained, which may be summarised as follows :—The electrical condition of the Peak of Teneriffe was found to be the same as in every other part of the world. The potential was moderately positive, from 100 to 150 volts, at 5 ft. 5 ins. from the ground even at considerable altitudes; but the tension rose to 549 volts on the summit of the Peak, 12,200 ft., and to 247 volts on the top of the rock of Gayga, 7,100 ft. A large number of halos were seen associated with local showers and cloud masses. The necessary ice-dust appeared to be formed by rising currents. The shadow of the Peak was seen projected against the sky at sunset. The idea of a south-west current flowing directly over the north-east trade was found to be erroneous. There was always a regular vertical succession of air currents in intermediate directions at different levels from the surface upwards, so that the air was always circulating on a complicated screw system.

2 "Rainfall of South Africa, 1842-1886," by Mr. W. B. Tripp, M.Inst.C.E., F.R.Met.Soc. The author gives the rainfall statistics from all those stations situated in South Africa which possess records of 10 complete years and upwards. He remarks upon the chronological succession of wet and dry years, and the consecutive years above and below the mean; and also describes the seasonal distribution of monthly maxima, and the extent over which monthly rains prevail. He concludes by comparing the curves of rainfall with those of sunspot energy.

3. "Some Methods of Cloud Measurements," by Mr. Nils Ekholm. As exact cloud measurements afford almost the only easily available means of determining motions in the upper regions of the atmosphere the author describes some methods which seem to him likely to give the best results. He also details the plans adopted at the Swedish Polar Station, Cap Thorsden, in Spitzbergen, and at the Upsala Observatory, for determining the direction and angular velocity of the clouds, and for making direct measurements of the height and absolute motions of the clouds.

EARTHQUAKE IN SCOTLAND.

To the Editor of the Meteorological Magazine.

SIR,—It will interest you to have the following account of the earthquake shock here on the 2nd inst. The time was not noted, but many persons were awakened in the early morning by what seemed to be the roll of a carriage along the road, and one gentleman (who was at Cannes during the earthquake of last year) distinctly felt the shock, which lasted three or four seconds, and recognised the familiar rumbling noise, and states that the time was a few minutes after 5 a.m. It was also distinctly felt along the shores of Loch Linnhe to Port William, and thence along the great glen of the Caledonian Canal to Inverness. In the latter place several persons left their houses, and the daily papers have done full justice to their accounts.

On the other side of the Loch (Linnhe) we have accounts of the shock and rumbling from Loch Buie and Tobermory (Mull), and also along the shores of Loch Creran and Loch Leven to Ballachulish in the S.E.

It is noticeable that the tremors were felt only on the sea-shore levels, and not on the hills in the immediate neighbourhood. The captain of a steamer at Ballachulish observed (or heard) a large wave washing the shore, "while the sea was perfectly calm before and after," about the hour of the earthquake.—Yours truly,

G. WOULFE BRENAN.

Craigvarren, Oban, February 11th, 1888.

P.S. The meteorological conditions that were prevalent the evening previously were—disturbed weather, with a moderate gale and a falling bar. and temperature high; but the rain and gale moderated about midnight, and it was quite calm, I believe, at the time of the earthquake.

[Our correspondent will perhaps excuse our adding as a sort of P.S. an epitome of the reports in the *Scotsman* of February 3rd, which one of our correspondents kindly sent us. First, as to the time; it was dark, the early morning of February 2nd, and the time quoted varies from "between 4 and 5," the very unscientific report of the meteorological observer at Loch Buie in Mull, to 5.15 at Perth, and it is evident that besides the observers being sleepy and in some cases frightened, many of the clocks were wrong. Fortunately, the shock stopped the large clock in the tower of the High Church of Inverness at four minutes past 5 a.m., which is apparently as near the truth as we shall get.

As Mr. Brenan states, the shock was most violent between the Isle of Mull and Inverness, but it was felt S.E. as far as Edinburgh and N.W. up to Loch Carron, or about 120 miles from S.W. to N.E. and about 130 from N.W. to S.E. At Fort William it is stated that a concrete house was cracked, and that a basin of milk was thrown off a shelf. Several clocks were stopped at Inverness, and at Nairn one was thrown off a shelf.—ED.]

WHITE FOG BOWS.

To the Editor of the Meteorological Magazine.

SIR,—Is the editorial note to the letter on p. 11 a correct explanation of the absence of colour in fog bows, viz., that the water particles are not large enough? In viewing a single dew drop close to the eye, the smaller, and consequently the more perfectly spherical, the drop, the more perfect is the rainbow and the more distinct its spectra, though less brilliant than in a larger drop; so that one would suppose that if the particles are very small in a fog bow, the colours would be more distinct than in a rainbow, other things being equal. The explanation proposed by one writer that the want of colour was owing to the abundance of drops, so that each interferes with the rays from the others, seems a possible one, but I do not know whether it is very likely.—Yours truly,

T. W. BACKHOUSE.

Sunderland, March 6th, 1888.

THE SNOWSTORM OF FEBRUARY 14th.

To the Editor of the Meteorological Magazine.

SIR,—Perhaps you are collecting accounts of the great snowstorm of Shrove Tuesday. No doubt different parts of the country experienced the force of it in different degrees. Here it began to snow early in the morning; by 9 a.m., when melted and measured it gave 0·23 in., it ceased snowing at 11 a.m., at which time it was 6 in. deep. Snow began to fall again between one and two o'clock, by five o'clock it was 8½ in. deep, and by ten it was 12 in., and still snowing. To avoid waste by the heaping of the rain gauge or the blowing away of the snow, I melted it twice during the day. When I measured at 9 a.m. Wednesday, I had 1·49 in. So I think I am perfectly safe in supposing that snow fell to the depth of 18 inches in 24 hours, though with the foot-rule I did not measure a greater depth on the level than 13 in., but it was perfectly level; there was no blowing and drifting. We have had snow on every day since the 11th, altogether measuring 1·95 in.—I am, Sir, yours obediently,

JOHN MATHISON.

Addington, 16th February, 1888.

[Large as is the value here assigned to the depth of the snow, it is certainly not excessive; very careful measurements at Oxford gave 20·4 inches, and others at Little Wittenham, near Abingdon, 19 inches.—ED.]

UNIVERSAL DICTIONARY OF CLIMATE.

MANY things have lately combined to indicate the rapid progress of scientific work in South America; hence perhaps we ought not to be surprised at the Herculean labour which the Imperial Observatory of Rio de Janeiro now undertakes.

The circular and forms issued by M. Cruls, the director of the observatory may be epitomised as follows—and we may also mention at once, that a supply of blank forms has been sent to the Royal Meteorological Society, and that doubtless a copy will be supplied to any one who possesses a series of accurate observations of reasonable length, and is willing to co-operate by supplying the data required from his own station.

Briefly, then, M. Cruls points out that there does not exist any work giving methodical, complete, and uniform tables of climatic data for the whole globe. That even where abstracts exist, they vary endlessly in form, in the data given, and in the scales employed; besides which hundreds of volumes must be searched in order to collect them.

The Imperial Observatory of Brazil has prepared a form which appears to us excellent, erring neither by asking too much nor too little, and invites observers throughout the world to do their share by filling up the forms and sending them to Rio de Janeiro. On thier part the Brazilian authorities undertake to classify, print and publish the materials, and to send two copies to every one who contributes acceptable data. This offer is so handsome that we think that it may be well to reproduce the sentence *verbatim*.

"L'observatoire impérial de Rio de Janeiro se fera un devoir d'offrir deux exemplaires du *Dictionnaire Climatologique Universel* aux observatoires et institutions météorologiques qui auront bien voulu répondre à son appel, et qui seront ainsi autant de collaborateurs d'une œuvre devenue, par cela même, en quelque sorte internationale."

EXHIBITION OF APPARATUS CONNECTED WITH ATMOSPHERIC ELECTRICITY.

The Ninth Annual Exhibition of the Royal Meteorological Society will be held, by kind permission of the Council of the Institution of Civil Engineers, at 25, Great George-street, Westminster, on Wednesday, the 21st instant, and will consist of apparatus connected with atmospheric electricity, including lightning conductors, photographs of lightning, and damaged objects, and of such new instruments as have been invented and first constructed since the last exhibition.

The President, Dr. W. Marcet, M.D., F.R.S., will deliver an address at 7 p.m, on "Atmospheric Electricity," illustrated by experiments, and Mr. G. J. Symons, F.R.S., will make a short communication on "The Non-existence of Thunderbolts," elucidated by accounts of searches after them and the exhibition of specimens.

The exhibition will remain open till Friday, the 23rd instant, and will, we feel sure, well repay a visit and maintain the high character of the exhibitions of the Society.

Those who are not Fellows of the Society should apply for invitations to Mr. W. Marriott, the Assistant Secretary, at 30, Great George-street, S.W.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1887.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0-10
England, London	88·5	6	42·5	15	74·4	52·5	45·7	55	129·2	40·3	3·15	8	5·0
Malta	98·6	18	67·9	25	90·1	73·0	67·1	62	148·2	63·0	·56	2	1·2
Cape of Good Hope	77·0	25	33·7	7	63·6	46·4	...	...	...	...	3·98	12	5·2
Mauritius	74·6	2	54·6	18	71·9	60·8	56·4	71	123·6	42·1	2·11	20	5·0
Calcutta	90·9	17	75·9	2	87·5	78·1	77·1	80	156·7	73·4	10·28	23	8·1
Bombay	85·4	7	73·5	31	83·1	75·7	74·7	85	144·3	71·7	17·59	29	8·7
Ceylon, Colombo	87·0	3·29	71·8	7	85·2	75·5	69·4	74	146·0	67·5	4·85	18	7·0
Melbourne	72·1	25	33·6	2	57·6	43·4	44·2	80	119·9	26·7	·96	11	5·9
Adelaide	76·5	24	36·6	12	61·3	46·1	44·4	70	129·7	29·9	1·37	18	5·0
Wellington	...	...	...	...	...	...	...	...	...	...	...	...	...
Auckland	61·0	23	35·0	13	55·7	43·6	42·6	77	121·0	28·0	1·39	14	3·7
Falkland Isles	...	...	19·0	3	...	29·7	31·1	88	102·0	17·5	2·58	25	7·3
Jamaica, Kingston	90·9	1	69·3	13	89·1	72·1	72·7	78	...	...	3·63	...	...
Barbados	86·0	7	70·0	8*a*	83·0	73·0	73·8	83	142·0	...	10·97	21	6·0
Toronto	90·1	4	45·1	25	76·0	56·4	54·6	65	...	39·0	1·99	9	5·4
New Brunswick, Fredericton	82·2	2	42·0	29*b*	71·6	51·8	55·4	76	...	...	4·63	14	4·7
Manitoba, Winnipeg	88·0	7	33·3	25	74·3	47·0	52·7	75	...	...	1·49	15	5·1
British Columbia, Victoria	82·0	11	38·0	30	68·6	45·8	...	...	...	...	·01	1	...

a And 9, 19. *b* And 31.

REMARKS, AUGUST, 1887.

MALTA.—Mean temp. 80°·9. Mean hourly velocity of wind 6·2 miles per hour. Sea temp. fell from 85°·0 to 81°·9. TSS on 7th and 27th. J. SCOLES.

Mauritius.—Mean temp. of air 2°·3, and of dew point 2°·2 below, and rainfall ·36 in. above average. Mean pressure 30·174 in., ·018 in. below average. Mean hourly velocity of wind 11·6 miles, 0·3 mile below average; extremes 27·9 miles on 29th, and 1·8 miles on 20th; prevailing direction S.E. to E.S.E. The mean temp. (66°·3) was the lowest for August since observations commenced in 1875. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air the same as the average of 29 years; temp. of dew point 2°·2 above average; humidity 6 and pressure ·154 in. above average; rainfall ·93 in., and mean amount of cloud 0·3 below average. Prevailing wind N.; strong on 4 days. Dense fog on 11th. L on 26th, and 27th; heavy dew on 10 days; hoar frost on 3 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure 30·212 in., one-tenth of an inch above the average. Mean temp. about the average. Rainfall nearly an inch below average. Weather generally fine and pleasant. C. TODD.

AUCKLAND.—The early part of the month was showery and unsettled; the middle and close were very fine, with light southerly winds and cold nights. Pressure considerably above average; mean temp. nearly three degrees below average; rainfall not much more than a quarter of the average and the smallest recorded for August. T. F. CHEESEMAN.

BARBADOS.—Pressure steady. Mean temp. (77°·2) the same as the average. Mean hourly velocity of wind 1·3 miles below the average. Rainfall much above the average. Severe TS on 9th. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, FEBRUARY, 1887.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·30	XI.	Castle Malgwyn	·91
,,	Margate, Birchington...	2·58	,,	Rhayader, Nantgwillt..	1·35
,,	Littlehampton	1·15	,,	Carno, Tybrith	1·00
,,	Hailsham	1·68	,,	Corwen, Rhug	1·12
,,	Ryde, Thornbrough	·85	,,	Port Madoc	2·57
,,	Alton, Ashdell.....	·79	,,	I. of Man, Douglas	·63
III.	Oxford, Magdalen Col...	3·38	XII.	Stoneykirk, Ardwell Ho.	·58
,,	Banbury, Bloxham	1·24	,,	New Galloway, Glenlee	·52
,,	Northampton	2·04	,,	Melrose, Abbey Gate...	2·23
,,	Cambridge, Beech Ho...	·99	XIII.	N. Esk Res. [Penicuick]	2·65
,,	Wisbech, Bank House..	2·12	XIV.	Ballantrae, Glendrishaig	1·21
IV.	Southend	1·18	,,	Glasgow, Queen's Park.	·71
,,	Harlow, Sheering	·76	XV.	Islay, Gruinart School..	1·84
,,	Rendlesham Hall	2·17	XVI.	St. Andrews, Pilmour Cot	1·16
,,	Diss	2·51	,,	Balquhidder, Stronvar..	·84
,,	Swaffham	2·33	,,	Dunkeld, Inver Braan..	·19
V.	Salisbury, Alderbury...	1·09	,,	Dalnaspidal H.R.S. ...	1·04
,,	Warminster	1·79	XVII.	Keith H.R.S.	2·65
,,	Bishop's Canuings	·88	,,	Forres H.R.S.	1·16
,,	Ashburton Holne Vic....	·87	XVIII.	Strome Ferry H.R.S....	3·65
,,	Hatherleigh, Winsford.	1·79	,,	Fearn, Lower Pitkerrie.	1·00
,,	Lynmouth, Glenthorne.	1·03	,,	Loch Shiel, Glenaladale	6·77
,,	Probus, Lamellyn	1·38	,,	S. Uist. Ardkenneth ...	...
,,	Launceston, S. Petherwin	·92	,,	Invergarry	2·92
,,	Wincanton, Stowell Rec.	1·25	XIX.	Lairg H.R.S.	1·36
,,	Taunton, Lydeard Ho...	·69	,,	Forsinard H.R.S.	2·28
,,	Wells, Westbury.....	1·18	,,	Watten H.R.S.	1·72
VI.	Bristol, Clifton	1·74	XX.	Dunmanway, Coolkelure	·61
,,	Ross	1·10	,,	Fermoy, Gas Works ...	·93
,,	Wem, Clive Vicarage ...	·68	,,	Tipperary, Henry Street	1·13
,,	Cheadle, The Heath Ho.	·87	,,	Limerick, Kilcornan ...	1·03
,,	Worcester, Diglis Lock	·56	,,	Miltown Malbay.....	1·31
,,	Coventry, Coundon	·90	XXI.	Gorey, Courtown House	·83
VII.	Melton, Coston	2·11	,,	Navan, Balrath	·41
,,	Ketton Hall [Stamford]	1·90	,,	Mullingar, Belvedere ...	·65
,,	Horncastle, Bucknall ...	1·50	,,	Athlone, Twyford	·55
,,	Mansfield, St. John's St.	1·64	,,	Longford, Currygrane...	·80
VIII.	Knutsford, Heathside ...	1·14	XXII.	Galway, Queen's Coll...	·62
,,	Walton-on-the-Hill.....	·64	,,	Clifden, Kylemore	2·09
,,	Lancaster, South Road.	1·47	,,	Crossmolina, Enniscoe..	1·67
,,	Broughton-in-Furness ..	1·75	,,	Collooney, Markree Obs.	1·72
IX.	Shipley, Esholt Vic. ..	1·26	XXIII.	Rockcorry.....	·05
,,	Ripon, Mickley	1·76	,,	Warrenpoint	·46
,,	Scarborough, West Bank	1·85	,,	Seaforde	·33
,,	East Layton [Darlington]	.81	,,	Belfast, New Barnsley..	·83
,,	Middleton, Mickleton..	·71	,,	Cushendun	1·92
X.	Haltwhistle, Unthank..	1·12	,,	Bushmills	1·52
,,	Shap, Copy Hill	1·25	,,	Stewartstown	·40
XI.	Llanfrechfa Grange	1·10	,,	Buncrana	1·38
,,	Llandovery	·80	,,		

FEBRUARY, 1888.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg	Date.	No. of Nights below 32°. In shade	On grass
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·77	— ·87	·31	13	14	52·0	6	19·1	2	20	23
II.		Maidstone (Hunton Court)...	1·64	+ ·02	·77	13	13	...	...	...	...	...	...
,,		Strathfield Turgiss	1·52	— ·23	·42	13	11	52·7	6	11·8	2	20	26
III.		Hitchin	1·30	— ·30	·29	14	14	51·0	6	15·0	25	22	...
,,		Winslow (Addington)	2·73	+ ·92	1·49	14	15	51·0	4	9·0	2	22	25
IV.		Bury St. Edmunds (Culford)	2·10	+ ·33	·33	16	12	50·0	7	7·0	2	22	...
,,		Norwich (Cossey)	1·60	— ·15	·45	14	12	...	...	9·0	2	...	...
V.		Weymouth(LangtonHerring)	·56	...	·20	11*a*	6	51·0	9	20·0	25	20	...
,,		Barnstaple.....	1·61	— 1·58	·49	13	11	53·0	8*b*	25·0	25	...	...
,,		Bodmin	1·48	— 3·39	·42	13	18	49·0	6	20·0	2, 20	20	20
VI.		Stroud (Upfield)	1·65	— ·60	·36	13	14	56·0	9	20·0	1, 16	...	...
,,		ChurchStretton(Woolstaston)	·41	— 2·09	·07	2	12	50·5	4	19·0	26	22	23
,,		Tenbury (Orleton)	1·06	— 1·41	·31	14	17	51·5	4, 7	14·5	17	22	23
VII.		Leicester	·81	...	·26	3	8	...	...	...	...	...	...
,,		Boston	1·46	— ·32	·58	14	7	55·0	8	19·0	2	21	...
,,		Hesley Hall [Tickhill].....	1·18	...	·36	19	11	52·0	6	22·0	14*d*	...	...
VIII.		Manchester (Ardwick).....	1·18	— 1·01	·21	11	14	48·0	6	24·0	14	22	...
IX.		Wetherby (Ribston Hall) ...	1·07	— 1·08	·35	20	8	...	...	...	...	...	...
,,		Skipton (Arncliffe)	2·10	— 2·54	·72	19	15	50·0	8	12·0	13	19	...
,,		Hull (People's Park)	1·49	— ·76	·45	14	18	...	...	...	...	...	...
X.		North Shields	·97	— ·87	·23	19	14	54·5	6	21·0	14	17	17
,,		Borrowdale (Seathwaite).....	2·97	— 8·48	·78	2	14	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	·92	— 2·74	·60	13	8	...	...	...	...	...	...
,,		Haverfordwest	·85	— 3·60	·27	2	12	50·2	6	24·3	16	17	21
,,		Plinlimmon (Cwmsymlog) ...	2·09	...	·56	2	12	...	...	...	...	...	...
,,		Llandudno.....	·44	— 1·85	·12	16	11	48·2	7	26·2	17	10	...
XII.	SCOTLAND.	Cargen [Dumfries]	·73	— 3·08	·29	10	6	51·6	5	12·4	12	20	...
,,		Jedburgh (Sunnyside).....	1·17	— ·59	...	...	11	51·0	8	18·0	17	22	...
XIV.		Old Cumnock	1·94	— ·92	·43	12	16	48·0	4, 6	10·0	15	20	...
XV.		Lochgilphead (Kilmory)	2·15	— 2·24	·62	12	10	...	...	...	...	...	...
,,		Oban (Craigvarren)	2·08	...	·52	4	12	51·3	5	19·7	16	16	...
,,		Mull (Quinish).....	2·70	...	·48	4	13	...	...	...	...	...	...
XVI.		Loch Leven Sluices	·70	— 2·26	·20	17	6	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	·65	— 1·90	·15	16	10	53·6	5	16·3	16	15	...
XVII.		Braemar	·49	— 2·18	·25	18	13	50·2	5	4·0	16	22	26
,,		Aberdeen	2·05	...	·57	14	22	54·0	5	10·0	16*e*	15	...
XVIII		Lochbroom	3·02	...	·49	7	20	...	...	...	...	...	...
,,		Culloden	1·20	+ ·15	...	...	...	52·0	6	15·0	16	20	24
XIX.		Dunrobin	1·86	...	·35	6	13	53·0	5	20·0	16	17	...
,,		Kirkwall (Swanbister)..... ..	...	...	...	...	..	...	...	...	...	...	...
XX.	IRELAND.	Cork (Blackrock)	·27	— 4·32	·06	18	9	54·0	3	22·0	26	15	...
,,		Dromore Castle	·62	...	·30	16	5	...	...	...	...	...	...
,,		Waterford (Brook Lodge) ...	·80	...	·18	13	12	52·0	3, 4	19·0	16	16	...
,,		O'Briensbridge (Ross)	·44	...	·10	13	16	52·0	6*c*	24·0	14	19	...
XXI.		Carlow (Browne's Hill)	·89	— 2·03	·20	2	12	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·10	— 1·06	·27	25	14	51·4	3	24·8	14	12	22
XXII.		Ballinasloe	·54	— 1·97	·15	2	15	48·0	3	18·0	16	22	...
XXIII		Waringstown	·49	— 1·76	·17	2	11	53·0	4	16·0	13	20	21
,,		Londonderry (Creggan Res.).	1·59	...	·25	10	18	...	...	...	...	...	...
,,		Omagh (Edenfel)	·62	— 1·66	·20	17	12	49·0	4	17·0	14	22	...

a And 13. *b* And 9, 10. *c* And 7, 8. *d* And 26. *e* And 17.
+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON FEBRUARY, 1888.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A cold cheerless month, with a good deal of S in places. The reports of the wheat plant were not very satisfactory, but the covering of S was beneficial.

HITCHIN.—The coldest February but one since the Crimean winter, 1855.

ADDINGTON.—A somewhat remarkable month. The night of the 1st was intensely cold. From the 3rd to the 10th very fine weather prevailed. On the 11th S began to fall and the ground was covered from that date to the close. A severe S storm occurred on the 14th, from which date the temperature was low, so that the S wasted very slowly. S on 12 days.

CULFORD.—Severe weather prevailed the greater part of the month, with S on 10 days.

LANGTON HERRING.—A very dry month. A few grains of sleet or flakes of S fell on 8 days, but the quantity was not sufficient to register. The coldest February in 17 years. The only five months in that time in which the temperature was lower were January 1881, January 1879, December 1879, December 1878, and January 1880. The mean temp. was exactly 34°, very nearly six and a half degrees below the average. The mean min. temp. (31°·2) was 6°, and the mean max. (39°·0) was 7° below the average. The min. temp. in shade (20° on the 25th) was the lowest in February for 16 years.

BODMIN.—No other February is remembered so bitterly cold. Bodmin, however, was singularly favoured in escaping the S, all falls having been of short duration, though it fell on 8 days. Mean temp. 34°·4.

WOOLSTASTON.—After a few genial days in the early part of the month, the weather became intensely cold, with continued E. and N. winds. S fell on 9 days, but the quantity was insignificant. All the brooks and streams were abnormally low at the close, with every probability of scarcity of water. Mean temp. 33°·6.

ORLETON.—The 1st and 2nd were cold days, with S covering the hills, and more S fell on the 2nd, changing to R at night. From the 3rd to the 10th the weather was fine and pleasant, with temperature much above the average. Frost then set in again and continued, with frequent falls of S, till the end of the month with a very low temperature. Light S fell on the 13th and 14th to the depth of six or seven inches, with a rough wind, which caused great drifts, filling up many of the narrow roads on the high lands. After the 10th very cloudy weather prevailed, with a dry, rough N. wind, which dried up the light falls of S almost as fast as they fell. The precipitation was not half the average quantity, and of the total fall about an inch fell as S. The mean temp. was 4°·4 lower than the average of 27 years and was only lower in 1873, 1875, and 1886.

MANCHESTER.—A fairly wintry month, with rather low night temperature. There were several falls of S, but generally slight, the heaviest being on the 11th, 12th, and 19th.

ARNCLIFFE.—A very wild month, with the most continuous cover of deep S remembered, the mail cart being blocked for 14 days, post being carried on horseback.

HULL.—Remarkable for the large quantity of cloud and for the frequent, though not heavy, falls of H, S, and sleet. N., N.E., and N.W. winds prevailed.

NORTH SHIELDS.—More or less S fell on 15 days. Fog on 4th; H on 29th.

WALES.

HAVERFORDWEST.—The driest February in the last 40 years and one of the coldest. The Precelly Hills were covered with S more or less for nearly three weeks, although very little S or R fell in the lowlands. The frost was at times severe, but broken by sudden thaws. Altogether the weather was changeable and the N.E. blast severe. Mean temp. 34°·3.

LLANDUDNO.—The early part of the month was generally dull and calm. S was seen on the distant mountains on 12th and several S showers fell at night, but soon disappeared. The ground was covered again with nearly an inch and a half of S on the morning of the 17th, but it nearly all melted during the day. There was a N. gale on the night of the 15th and a heavy E. gale all day and night on the 19th. H on the 11th. The latter part of the month was generally fine and cold.

SCOTLAND.

CARGEN.—From the 11th to the close the weather was extremely cold, and the mean temp. of the month (35°·7) was 4°·1 below the average. N. or E. winds prevailed from the 13th to the close. R, sleet and 3 inches of S fell on 10th; S showers on 13th; 2 inches of S on 16th.

JEDBURGH.—After the 10th the weather was cold and ungenial, with very little wind, and from the 13th the ground was continually covered with S. Vegetation, which was then advanced, was completely stopped. The thrush was heard singing on the mornings of the 7th and 8th, and a good deal of nesting was done.

CUMNOCK.—The mean temp. was below 32° every night after the 9th.

OBAN.—An extremely dry February. The early part was warm, the latter part very cold at night, with a high daily range under a long continuance of high pressure. S on 10th, 12th, and 16th.

ABERDEEN.—The month opened with fair weather and moderate N.E. and N.W. breezes. Temperature was very low from the 10th to the 18th. Pressure was high during the last six days. The month on the whole was cloudy. Fog on 8th and 21st. A gale on 20th.

LOCHBROOM.—With one exception (the 13th) it rained or snowed, or both, every day from 1st to 21st; on 14 of these days S fell. From the 22nd to the close, beautiful, bright frosty weather prevailed, with a clear moon every night, and fine warm sunshiny days; delicious weather, only too frosty for ploughing as a rule.

CULLODEN.—A very severe month, frost, with more or less S, prevailing from the 9th to the close, in consequence of which, work of every kind was at a standstill.

IRELAND.

BLACKROCK.—A cold, winterly month, at times misty, with a few slight S showers. Wind N., N.E., or N.W. on 16 days. The fifteenth month in succession with R below the average of 23 years. Mean temp. (38°·4), 4°·2 below the average.

DROMORE.—Very dry and cold, with strong E. winds. Vegetation made some progress in the early part of the month, but was at a standstill later.

WATERFORD.—A very hard, dry month, with S in small quantities on several days, and wind principally easterly. With the exception of 1886, the driest February in 30 years. Mean temp. 37°·5.

O'BRIENSBRIDGE.—Almost all the moisture of the month consisted of melted S, frequent but very light falls occurring. N. and N.E. winds prevailed, and temperature was generally low by day as well as by night.

DUBLIN.—Notwithstanding a spell of mild weather, which lasted from the 3rd to the 10th, February proved to be a very cold and snowy month. Even in Dublin S and H fell on 11 days, and the mean temp. (38°·5) was no less than 4°·7 below the average. The amount of cloud was very great, 7·3. It is remarkable that during the mild fine weather of the earlier part of the month the wind was generally N.W. High wind on 11 days; gale on 2nd; fog on 15th and 16th. Mean humidity 83.

BALLINASLOE.—The smallest R for February since 1875, when ·90 in. fell. H storm on 11th. S on five days.

EDENFEL.—A remarkably dry, cold month, with R smaller than even June, 1887, and actually the smallest since June, 1865. Frost more or less severe prevailed on 22 nights, but did not, except thrice, continue during the day, or prevent farm labour, nor was there any S beyond occasional light showers, never altogether covering the ground. The question of water supply was becoming exceedingly serious at the close.