

SYMONS'S
MONTHLY
METEOROLOGICAL
MAGAZINE.

VOLUME THE TWENTY SECOND.

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1887.  
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LONDON :
EDWARD STANFORD, CHARING CROSS, S.W.,
SIMPKIN, MARSHALL & Co., STATIONERS' HALL COURT,
AND ALL BOOKSELLERS.

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SYMONS'S
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METEOROLOGICAL MAGAZINE.

CCLIII.]

FEBRUARY, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

METEOROLOGICAL PAMPHLET EXCHANGE.

IN the course of my work on Meteorological Bibliography, I have formed an opinion which I desire to lay before working meteorologists.

It seems to me that many authors and establishments have stores of their own publications lying idle which would be very useful if distributed among those interested. As it is, they become older and older, their authors (if they think at all) think that all who desire to read them have long ago done so, and finally the entire remainder is destroyed as waste paper.

On the other hand, there are many persons who repeat investigations already conducted, and experiments already made, simply because they are unaware of what has been done. And there are many who while glad to obtain copies of meteorologists' publications, do not like to write and ask the authors for copies, and cannot afford to pay the prices sometimes put upon the few copies which come into the hands of dealers in second-hand books.

I am often asked by authors for a list of persons interested in the subject on which they have been writing, in order that they may send out a few copies as presents, but that is a very weak and imperfect way of achieving the object which I have in view, viz., the widest possible distribution and utilization of *all* printed copies of meteorological matter. This object is in no respect a commercial one. I am not thinking of books published for sale, but of privately-printed papers, extracts from Journals and Transactions, and such like.

I shall be glad to hear criticism of this idea, and if it be approved, to try to organize it. It is evident that it must be self-supporting, but perhaps the following rules would be sufficient:—

- I. Authors to send their papers carefully packed, but carriage unpaid.
- II. On receipt of any bundle, the cost of carriage (and sixpence for printing) to be divided by the number of pamphlets, and added to a charge of one penny each for expenses of despatching, and to whatever may be the book or parcel postage of each. This total (probably generally under 4d.) to be in fact the price of each.

- III. The title of each pamphlet, the total number of copies available, and the cost as settled by Rule II., to be printed in each number of the *Meteorological Magazine*, and copies to be forwarded to all applicants in priority of application, but *only* on receipt of the amount. No book-keeping or correspondence can be undertaken.
- IV. The undersigned reserves the right to abandon the scheme at any time should it prove too onerous.

G. J. SYMONS.

62, Camden Square, N. W.

EVAPORATION.*

It is so long since any good English paper has appeared upon the above subject, that one almost feels to be living life over again when reading it. We give a few references in support of this statement, and because they may be useful to those interested in the subject.

1870. "British Rainfall," 1869, contained descriptions of, and results obtained with, nearly thirty different patterns of evaporator. During this year very elaborate experiments with fifteen different patterns of instrument were made at Strathfield Turgiss, Hants. A brief description of the instruments and of their position was given in "British Rainfall," 1870.
1876. Paper on "Evaporation," read by Mr. Greaves, at the Inst. C.E., and important discussion thereupon.
1878. Prize awarded to Mr. S. H. Miller by the Utrecht Soc. of Arts and Sciences for his essay on "Evaporation," and the same published.
1883. Paper in "Wild's Repertorium," by E. Stelling, "On the determination of the absolute evaporation from a water surface."
1883. Paper in "Comptes Rendus," by M. Salles, on observations made at Arles (Bouches du Rhone.)

Hence it will be seen that it is eleven years since any important paper on the subject has been printed in England, and seventeen years since the commencement of the Strathfield Turgiss experiments.

It is impossible to give here a summary which should do justice to Mr. FitzGerald's able paper. His sections are as follows:—Investigation of the laws of evaporation—Influence of heat on evaporation—Effect of wind—Barometer—Formula for comparing evaporation—Influence of sun—Influence of depth. All these sections are developed with reference to special experiments and apparatus, which are fully described. The author then passes to what he calls

* "Evaporation," by Desmond FitzGerald, M. Am. Soc. C. E. 66 pp., 8vo. (Excerpt Trans. American Soc. C. E.)

Natural evaporation, viz., the amount evaporated from various tanks floating on the reservoirs of the Water Works of the City of Boston, the largest of these being 10 ft. in diameter and 10 ft. deep, with recording apparatus attached. This apparatus being useless in frost, the author made many experiments on the evaporation of ice and snow, and finally concludes that until more accurate values are obtained, those marked with an asterisk may be adopted.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
.90*	1.20*	1.80*	3.10	4.61	5.86	6.28	5.49	4.09	2.95	1.63	1.20*

This makes the total evaporation for the year 39.11 inches.

In conclusion the author devotes a few pages to a summary of the principal investigations of the subject on both sides of the Atlantic.

We regret that Mr. FitzGerald frequently speaks of the evaporation as being so much "per cent. of the rainfall." This ratio, as far as we are aware, proves nothing, for the variations in the amount of rain are so great as to vitiate such calculations, and besides that, though these values as to the evaporation from a water surface tell us approximately how much a reservoir loses, they tell us nothing of the loss between the fall of the rain and its collection in the reservoirs—that can be known only after long future work on the evaporation from trees and plants and soils—in fact, is too complicated ever to be accurately known.

ROYAL METEOROLOGICAL SOCIETY.

The Monthly Meeting of this Society was held on January 19th at the Institution of Civil Engineers, 25, Great George Street, Westminster; Mr. W. Ellis, F.R.A.S., President, in the Chair.

Mr. J. Willis Bund was elected a Fellow of the Society.

The following papers were read:—

(1.) "On the Identity of Cloud Forms all over the World; and on the general principles by which their indications must be read," by the Hon. R. Abercromby, F.R.Met.Soc. The author illustrated the identity of cloud forms by exhibiting 37 photographs of different kinds of clouds which he had taken in various longitudes, and in latitudes ranging from 72° N. to 55° S., including some actually on the Equator. Cumulus was shewn to be the commonest cloud in the Tropics; cumulo-stratus and cirro-stratus in the Temperature Zone; and stratus and fog in the Arctic Regions. The author considers that 90 per cent. of the skies all over the world might be described by Howard's well-known types of cloud:—cumulus, stratus, cirrus, cirro-stratus, cirro-cumulus, cumulo-stratus and nimbus. If by cirro-cumulus fleecy-looking clouds are denoted, although the forms are alike, the prognostic value of the same shape of cloud is not identical everywhere; for while woolly clouds indicate fine weather in England, they denote rain in Italy. The author shewed that the form alone of clouds is equivocal; and that

the indications of coming weather must be drawn not only from the form, but also from the surroundings of a cloud, just as the meaning of many words can be judged only by the context. This paper was rendered most interesting by the photographs being thrown on the Screen by his Lime-light Lantern, by Mr. B. C. Wainwright, F.R. Met. Soc.

(2.) "On the Cloud to which the name 'Roll-Cumulus' has been applied," by the Hon. R. Abercromby, F.R. Met. Soc. The author thinks that this cloud should be reported as "Stratus" or "Cumulo-stratus" according as the component masses partake more or less of the character of one or other of these clouds.

After the reading of these papers, the Annual General Meeting was held, when the Report of the Council was read by Dr. Tripe, which shewed the Society to be in a satisfactory condition. The number of Fellows was 524.

The President, Mr. W. Ellis, in his address, drew attention to the remarks made by Mr. Hawksley at the meeting of the Society on June 16th last, in which, after acknowledging the indebtedness of engineers to meteorologists for the information collected by them concerning floods and rainfall, without which as he said it would not be possible for engineers to carry on their work efficiently, he proceeded to urge on meteorologists the need of more investigation into the causes of the various phenomena connected with their science. The President suggested that this is just what meteorologists were always endeavouring to do, pointing out how great an amount of labour had already been thus expended, if not always wisely, at any rate with every desire to trace out connections and causes, any want of success being due rather to the difficulties of meteorological inquiry than to any other cause. Referring then to the connection of the physical sciences, and especially those of astronomy, terrestrial magnetism, and meteorology, he drew attention to various contrasts and relations existing between them, mentioning how in astronomy strict mathematical processes may be employed, whilst in meteorology tentative methods have to a great extent to be relied on—a state of development through which in earlier ages astronomy itself had also to pass, giving hope that in the confessedly difficult subject of meteorology we may in time pass from present systems to others more logical. There has already been progress; the preparation of a daily synoptic weather chart, made practicable by the aid of the electric telegraph, would have been impossible not very many years ago. Again, in astronomy the power of assimilating observations, as it were, is mostly in advance of the observational power, rendering ever greater instrumental means desirable. Not so in meteorology, for the purposes of which instruments can be constructed with accuracy beyond the power of adequately employing them, of which the difficulty of ascertaining the true temperature of the air is an illustration. This indeed troubles also the astronomer, the element of air temperature being one that

enters into the calculation of astronomical refraction, besides which he has in various other ways to reckon with temperature effects. After referring to some popular notions on weather changes as related to the sun and moon, as well as to more systematic endeavours made to discover relations, generally insignificant, between position and periods of the moon and different meteorological elements, the President remarked that the modern meteorologist had happily found a wider sphere of work, for troubling himself less about cycles and periods, he has seen the necessity of studying, by the aid of synoptic charts, the complex and broad phenomena of the atmosphere in all their varied relations. Passing on to consider some relations between meteorology and terrestrial magnetism, he mentioned some analogies existing between the meteorological element of temperature and the motion of the magnetic needle, as regards their diurnal and yearly variations; proceeding then to discuss to some extent the relation between solar spots, terrestrial magnetism and meteorology, pointing out that whilst in certain broad features their relation with magnetism was very striking, that with meteorology, as far as we are able to interpret the results obtained, is comparatively uncertain. Before concluding, the President, viewing the present outlook as regards meteorology, spoke of the new and higher meteorology that in spite of the difficulties of the subject is now springing up, and referring to the various international congresses as having promoted uniformity of action and division of labour, said that meteorology now, perhaps more than ever, stood in need of combined action among its workers, and alluding to the idea of federation of which of late so much has been heard, suggested that a permanent federation of the meteorologists of different countries might regulate meteorological action and inquiry throughout the world, and so promote the better elucidation of meteorological laws, whilst also accumulating materials for the future discussion not only of the meteorology of the earth as a whole, but also of any periodical or secular changes, however produced, that might be proceeding thereon.

THE CENTRE OF A BRITISH CYCLONE.

To the Editor of the Meteorological Magazine.

SIR,—May I ask any of your readers whether they can give me any information about the appearance of the sky in the centre of a cyclone?

It has been asserted that a blue patch is sometimes found there in this country, as in tropical cyclones. If any of your correspondents have any observations on this point, perhaps they will be good enough to send me the particulars as minutely as possible.

Yours faithfully,

RALPH ABERCROMBY.

21, Chapel Street, London, S. W., Jan. 22nd, 1887.

DAY AND NIGHT BREEZES.

To the Editor of the Meteorological Magazine.

SIR,—Dr. Burder seems to imply, though he does not state distinctly, that the tendency of the *diurnal* wind to veer, observed at Sunderland, exists over this country generally. If this is the case it would disprove the theory I suggested on pp. 121, 122 of vol. xxi. ; *Meteorological Magazine*, according to which, on the West Coast of England, the daily wind ought to back instead of veering. My letters in the *Magazine* have elicited no definite information on the subject, as regards Britain ; but I have received two pamphlets by Mr. C. Chambers, F.R.S., “The Climate of the Bombay Presidency” and “The Normal Winds of Bombay,” which show the diurnal changes in that part of India, and which distinctly contradict my theory.

At Bombay the principal diurnal winds are, of course, the sea-breeze by day and the land-breeze by night ; but there is also a veering of the wind, whereas according to my theory it ought to back, except in the summer, when the sun is north of the latitude of Bombay. These phenomena are well marked, except from June to August—the rainy season. Mr. Chambers prefers to look at the question as not one of veering or backing, but as an oscillation of the wind in a north and south direction ; and he shows that in every month of the year the north component of the wind has *two* daily maxima and minima. In the average of the whole year the principal minimum is about 10.30 a.m., and the maximum about 6.15 p.m. ; the secondary minimum and maximum being about 1.30 a.m., and 5.15 p.m. respectively. In a portion of the year the secondary minimum is the principal one.

At Deesa, where, though about 240 miles from the open sea, the sea-breezes are felt, the diurnal change in the monsoon (or summer) months is, however, a backing instead of a veering. During the rest of the year the circulation is in the same direction as at Bombay. Inland at Belgaum and Poonah there are no sea-breezes, the chief daily variation of the wind being of the reverse character—viz., blowing towards the interior of the country in the night, and the opposite way in the day, the reason for which is not assigned ; but the wind veers at those places also, so that the north and south winds must reach their maxima at opposite times to those at which they are reached at Bombay, and at similar times as at Sunderland.

Here, I cannot say whether the double oscillation of the north component takes place, inasmuch as I have not made observations in the night, which would be required to show it ; but the oscillation I have observed here takes place at just about the reverse times to what the principal one does at Bombay, the wind blowing from the north at the same time as it there blows from the south, and *vice versa*.

I cannot see the force of Dr. Burder's first suggestion on p. 161

(vol. xxi.) ; but his second one (p. 162) that the veering may be caused directly by the rotation of the earth, seems a more likely explanation ; the earth's rotation causing anything in the northern hemisphere to deviate towards the right ; but this would not explain the *whole* of the mode of the diurnal variation at Bombay, because, whereas it turns to the right during the greater part of the day, there is a portion of the night in which, owing to the double oscillation, the turning is towards the left. Mr. Chambers does not explain the north and south oscillations in the pamphlets, but Mr. F. Chambers believes that they, together with a portion of the variation of the east components of the wind and the diurnal variation of the barometric pressure, are three phenomena with one cause, applying to widely distant places.

T. W. BACKHOUSE.

Sunderland, February 4th, 1887.

THE WEATHER AND THE "CYCLISTS."

To the Editor of the Meteorological Magazine.

SIR,—I think that your readers will not set a very high value on Mr. Ryves' criticisms, for a critic who directs his most caustic remarks against acts similar to those which he commits himself, cannot be regarded as a very formidable opponent. For instance, why does he object to my references to the weather of March and May, 1886, when he has made the same references himself? I should not have thought of alluding to the spring months at all if his letter (in your November number) had not suggested it to me. Mr. Ryves, in using the words of Mr. Harding, goes back to "January 4th" in order to prove that up to "August 2nd" the summer of 1886 was not warm. He thought it expedient to give a quotation containing some allusions which he considered "irrelevant" to the subject under discussion.

In his first letter, to which I have referred, he says, "The max. shade temp. at Greenwich during the summer of 1886" was "only 87°, whereas in recent years it has frequently exceeded 90°, and on one occasion reached 97°." If it is true that "the shaded thermometers at Greenwich are sometimes several degrees in excess of the true reading," then, probably, 97° was never really reached there at all, and 90° was not "frequently exceeded in recent years." Mr. Ryves approves of these high maxima to fortify his own statements, but objects to them when they are used by me. Is this fair?

The summer of 1886, if limited to June, July and August, differed from that of 1869 in one important respect—it was considerably warmer, the mean temp. having been 0°·7 above that of 17 years before.

Although October cannot "properly be included amongst the summer months," we certainly had an extension of summer into the October of last year. On the 4th and 5th of that month, the Greenwich shade maxima were 79°·2 and 77°·0, and the mean daily values

66°·7 and 64°·9 respectively, which are higher temperatures than those of any other *two consecutive* October days during at least 72 years past, and including Luke Howard's observations during 80 years past.—Yours truly,

GEORGE D. BRUMHAM.

Barnsbury, Feb. 3rd, 1887.

REMARKABLE DISPLACEMENT OF EARTH.

To the Editor of the Meteorological Magazine.

SIR,—A rather unusual occurrence took place a few days ago in a grass field near my house. The facts are these. On a dry hill side a piece of turf (with soil adhering to a depth of 5 inches), was lifted bodily out of its position and placed in exactly its original shape at a distance of 8 feet. It is triangular in shape, and its sides are respectively 3 ft., 3 ft. 2 in., and 2 ft. 11 in. There is a large crack in the soil where it has been torn out about a yard long. This occurred during hard frost, when the ground was frozen. There is ample proof that no artificial means were employed, for a thick hoar frost prevailed on the morning of its occurrence, and foot marks would have been readily detected. Can any one suggest a cause?

Yours truly,

THOS. G. BENN.

Newton Reigny Observatory, Penrith, Jan. 25th.

P.S.—The hill is not steep, and the displaced soil was not thrown downwards, but cross-wise.

R E V I E W S .

Jahrbücher der k. k. Central-Anstalt für Meteorologie und Erdmagnetismus.
Vol. XXII., n.s. Vienna, 1886.

THE Austrian Meteorological Office has just published its yearly volume of observations for 1885. It corresponds generally in contents and arrangement to its predecessors, and contains:—(1) Observations made three times daily at 16 stations in the Austrian Empire, and 2 foreign stations, Alexandria and Beyrout.—(2) Monthly and yearly summaries at 363 stations of the I.–III. orders. Some of the stations are nearer each other than may be absolutely necessary, there being no less than 10 in Vienna alone.—(3) Temperature means in the Alpine district for each month and year for the period 1851–85 for the principal stations used in Dr. Hann's work, *Temperatur der oesterreichischen Alpenländer*. These observations are additions to the usual tables, and are followed by means for each of the seven lustra. Dr. Hann expresses the hope that others will follow this plan, so as to render comparison easier for similar periods in Europe. There are also tables of the monthly and yearly means

of 380 stations for the 30 years 1851-80, being a reprint of all the observations used in the above work, in a form convenient for reference.—(4) Hourly observations taken at the central office at Vienna, with the addition of the results of hourly observations at Eger, Klagenfurt, Kremsmünster and Hochobir. Much credit is due to Dr. Hann and his staff for the way in which these year books are worked up, and we note that in the hourly observations both the *hourly* and daily means are calculated. There seems, however, a reluctance on the part of all central offices to deal in a general way with the results of wind observations, whether by reduction to two components, as in the Orkney and Bermuda discussions published some years ago by our Meteorological office, or otherwise. We are not sure whether the reason lies in the difficulty of the problem or in the amount of the labour entailed. Probably both.

Part 5 contains the magnetic observations made at the Central Institute.

J. S. HARDING.

The Mountain Meteorological Stations of Europe. By A. LAWRENCE ROTCH, S.B., F.R.Met.Soc., &c. 8vo., 42 pp., 15 plates. [Reprinted from *American Meteorological Journal*]. Ann Arbor, 1886.

Mr. ROTCH, the founder, proprietor and director of the Blue Hill Observatory, Readville, Massachusetts, adopted the very wise course of coming to the old world and visiting the majority of the high level stations so as to apply the experience so gained to the equipment of his own. He published in successive numbers of the *American Meteorological Journal*, descriptions of the observatories which he visited, and notes respecting a few others, and the work before us is a reprint of those articles illustrated by fourteen plates, most of them excellent heliotype reproductions of photographs of the various observatories. Full details as to site, equipment and publications are given respecting the following establishments:—

Country.	Station	Latitude.	Longitude.	Altitude feet.
Germany ...	The Brocken ...	51° 48' N	10° 37' E	3744
„ ...	Schneekoppe ...	50 44 N	15 44 E	5246
„ ...	Wendelstein ...	47 42 N	12 1 E	5669
Austria	Hoch Obir	46 30 N	14 27 E	7047
Switzerland ..	Säntis	47 23 N	9 28 E	8215
„	Righi	47 3 N	8 30 E	5873
France	Puy de Dome ...	45 47 N	0 37 E	4800
„	Pic du Midi ...	42 56 N	2 12 W	9439
Scotland	Ben Nevis	56 48 N	5 8 W	4400

The work is in all respects well done, very interesting and useful.

Handbuch der ausübenden Witterungskunde, von DR. W. J. VAN BEBBER. 1 Theile, Geschichte der Wetterprognose. Stuttgart, Ferdinand Enke, 1885. 8vo., viii.—392 pp.

If we turn to the last pages of this book first, we shall probably give to the English reader a clear idea of its importance. The last 24 pages are entirely occupied by no fewer than 394 notes and references to other works upon weather and weather prognostics, ranging from Hippocrates, Cicero, Ovid and Pliny, through the times of W. Cock, J. Goad, Toaldo, Schübler and so down to modern times, with references to almost every one who has dealt with the subject of weather forecasting, from Mathieu (de la Drôme) and Wiggins, to the International Congresses. The only weakness seems to be in English authors; we do not see Brumham, or Clouston, Inwards, Swainson or Whistlecraft—no, nor either Old Moore or Zadkiel, yet these last are at least as worthy of note as Mathieu (de la Drôme). By-the-bye we hear that he, like Zadkiel, made a fortune by his almanac—truly Carlyle was a sage.

The work is divided into sections, the first being devoted to an analysis of writings, indicating a belief in the influence of supernatural powers in modifying Meteorological phenomena. In this, various quotations are made from both the Old and the New Testament, and reference is made to the existing prayers, litanies, &c., for change of weather. The author then traces similar ideas in Greek and Latin authors, and approaches thereto among the Chaldees, Egyptians, Brahmins and others. Ten pages are then devoted to beliefs in demoniacal influence on the weather, and startling details are given as to witch burning, and the assumed influence of witches in producing storms and shipwrecks.

The second section is much longer and is devoted to Astro-Meteorology in all its forms, but the lunar influence is excepted and forms a section by itself. The Astro-Meteorological section deals very fully with the subject, starting with the Chaldæans and coming down through Greeks and Romans, past Paracelsus and Melancthon down to Schneider. As regards the Egyptians and the early Greeks, such as Hesiod (B.C. 850), we are inclined to think that Dr. van Bebbler would agree with us that, except as regards the moon, theirs was scarcely what is understood by Astro-Meteorology, but was rather a species of calendar, indicating dates of the year by the visibility of certain constellations, and then saying that at those dates such and such weather was probable. True Astro-Meteorology should rather be called Planeto-Meteorology.

The influence of the moon on atmospheric pressure is very fully treated, nearly 100 authors and papers being quoted and referred to, and abstracts given of the results obtained at many stations during the present century. Small effects seem established, but we agree with the author that in our latitude the changes are too small to have any influence on the weather.

The subsection II. *b* (Influence of the Moon on Weather Changes) opens with a great mistake, for which, however, we can hardly hold Dr. van Bebbber responsible. He (evidently impressed by the reputation of the elder Herschel) reproduces *in extenso* the weather table which was falsely attributed to Herschel. Dr. van Bebbber gives his authority Dr. Jahn's *Handbuch der Witterungskunde*, and it is not for us to complain that he was not aware of the repudiation of it in the *Met. Mag.*, Vol. IV., p. 136. We may as well give the history abridged from the full account in Smyth's *Speculum Hartwellianum*, and supplemented by one or two facts which have come to our own knowledge.

The table (which, as far as we know, appeared in English first in 1803, in Vol. LX., p. 24 of the *European Magazine*) was not original but pirated from the *Curiosiora et Selectiora Variarum Scientiarum Miscellanea* of Martin Szent-Jvany. It was, however, impudently and falsely stated to be by Dr. Herschel. Dr. (afterwards Sir William) Herschel repudiated all connection with it on every possible occasion, and his son did the same: and yet here we are, nearly a century later, still trying to correct the libel and the lie.

Subsequent subsections deal with lunar influence on rainfall, the amount of cloud, frequency of thunderstorms, direction of wind, and temperature. By the bye, there is no reference to Mr. Glaisher's two papers in the *Quarterly Journal Royal Met. Soc.*—"The influence of the Moon on the amount and frequency of Rainfall as dependent on her age" and "The Influence of the Moon on the Direction of the Wind." Then come sections on the influence of comets, meteorites and sunspots, and section VII. on weather rules (the only weak section in the book) closes the first part.

The second part commences with a section on the "Origin and Developement of the Newer Meteorology," *i.e.* all the results flowing from our knowledge of storm areas, barometric gradients, &c., and then passes on to summarise the actions of the various governments with respect to weather telegraphy, and gives a history of the proceedings and of the work of most of the various congresses and conferences.

The book is useful and interesting in the highest degree, the only thing to be regretted is that it is not in English.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1886.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London	87·5	4	44·4	28	74·4	54·4	53·5	73	133·4	43·7	2·37	11	0·10 5·6
Malta	94·4	26	63·2	14	85·8	68·8	64·3	66	146·9	58·3	·00	0	0·7
<i>Cape of Good Hope</i> ...	73·0	30	35·0	7, 21	63·8	44·4	44·9	86	...	...	2·43	9	3·8
<i>Mauritius</i>	76·2	8	58·2	15	73·7	63·2	59·0	74	124·2	49·4	2·22	20	5·2
Calcutta	92·5	11	74·7	8	88·4	78·7	78·5	87	161·5	74·1	15·35	29	8·2
Bombay	87·6	5	74·6	23	84·0	77·3	76·2	86	144·8	72·9	35·79	29	8·6
Ceylon, Colombo	87·2	5	72·8	23	84·9	76·8	73·0	76	146·0	66·0	7·87	15	6·2
<i>Melbourne</i>	65·1	19	28·1	8	56·8	39·5	41·3	80	116·0	20·8	·84	11	5·9
<i>Adelaide</i>	69·0	3	36·6	16	59·9	45·8	42·6	69	121·5	27·5	2·72	21	5·5
<i>Wellington</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Auckland</i>	60·0	19	37·0	8	56·1	43·8	42·9	78	119·0	28·0	2·26	12	5·5
Jamaica, Kingston.....	94·7	10	69·5	31	91·1	73·1	72·5	76	...	...	2·10	13	6·8
Barbados	84·0	1, 2a	68·0	15	82·0	72·0	72·4	81	144·0	...	10·63	24	7·0
Toronto	89·5	6	47·5	1	76·6	55·9	55·8	68	...	40·0	2·45	10	5·1
New Brunswick, } Fredericton	89·3	6	44·5	25	75·8	55·0	56·5	67	...	...	1·56	14	5·7
Manitoba, Winnipeg } British Columbia, } Victoria	94·8	10	46·0	17b	84·4	55·0	57·7	66	...	...	1·34	13	5·2
	85·0	18	43·0	3	70·5	50·4	...	...	...	...	·80	5	...

a And 8. b And 21.

REMARKS, JULY, 1886.

MALTA.—Mean temp. 76°·4; mean hourly velocity of wind 7·3 miles. J. SCOLES.

Mauritius.—Rainfall 31 in., and mean temp. 0°·9 below the average; mean hourly velocity of wind 12·2 miles; extremes 28·8 miles on 21st, and 1·7 miles on 15th prevailing direction E.S.E.

C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air and mean humidity, average; rainfall 88 in., and temp. of dewpoint and mean amount of cloud, slightly below average; pressure 101 in. above average. Prevailing winds N. and N.E., strong on 4 days; heavy dew on 11 days, hoar frost on 10, ice on 3, fog on 6 days.

R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure slightly above average, the highest reading recorded here (30·731 in.) occurring on 14th; mean temp. (52°·8) 1°·2 above average; rainfall slightly above average, but over the northern areas splendid rains fell, principally during the latter half of the month.

C. TODD.

Auckland.—An unusually fine month with little wind. Showery from 1st to 5th, and 12th to 20th, remainder of month fine and settled, with clear and often frosty nights. Pressure above the average, mean temp. below it, rainfall not half the average.

T. F. CHEESEMAN.

BARBADOS.—Mean temp. (76°) 1° below the average; rainfall greatly above the average, nearly equal to the fall of the previous six months. On the 15th 1·20 in. fell in about half an hour; only once in 25 years has a larger rainfall been registered (11·47 in. in 1877.) Prevailing wind N.E.; mean hourly velocity 10·4 miles; extremes 17·1 miles and 4 miles. Twelve days were cloudy and overcast. T and L on 4 days.

R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
JANUARY, 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	2·77	XI.	Castle Malgwyn	4·41
„	Margate, Birchington...	1·32	„	Rhayader, Nantgwillt..	4·95
„	Littlehampton	2·15	„	Carno, Tybrith	3·47
„	Hailsham	2·97	„	Corwen, Rhug	3·16
„	Ryde, Thornbrough	3·27	„	Port Madoc	4·62
„	Alton, Ashdell.....	2·60	„	I. of Man, Douglas	3·75
III.	Banbury, Bloxham .....	...	XII.	Stoneykirk, Ardwell Ho.	1·89
„	Oxford, Magdalen Col...	2·16	„	New Galloway, Glenlee	6·26
„	Northampton	2·51	„	Melrose, Abbey Gate...	1·86
„	Cambridge, Beech Ho...	1·55	XIII.	N. Esk Res. [Penicuik]	1·40
„	Wisbech, Bank House..	1·94	XIV.	Ballantrae, Glendrishaig	4·84
IV.	Southend .....	...	„	Glasgow, Queen's Park.	2·05
„	Harlow, Sheering	1·25	XV.	Islay, Gruinart School..	3·66
„	Rendlesham Hall	2·36	XVI.	St. Andrews, Pilmour Cot	1·97
„	Diss	1·84	„	Balquhider, Stronvar..	9·53
„	Swaffham	1·79	„	Dunkeld, Inver Braan..	3·54
V.	Salisbury, Alderbury...	3·58	„	Dalnaspidal H.R.S.	7·10
„	Warminster	3·00	XVII.	Keith H.R.S.	1·24
„	Calne, Compton Bassett	2·30	„	Forres H.R.S.	1·15
„	Ashburton, Holne Vic..	6·69	XVIII.	Strome Ferry H.R.S....	7·31
„	Holsworthy, Clawton...	2·79	„	Tain, Springfield.....	2·13
„	Hatherleigh, Winsford.	3·47	„	Loch Shiel, Glenaladale	13·63
„	Lynmouth, Glenthorne.	4·29	„	S. Uist. Ardkenneth ...	7·54
„	Probus, Lamellyn	3·39	„	Invergarry	10·14
„	Wincanton, Stowell Rec.	2·84	XIX.	Lairg H.R.S.	1·75
„	Taunton, Lydeard Ho ...	2·50	„	Forsinard H.R.S.	4·46
„	Wells, Westbury.....	2·78	„	Watten H.R.S.	2·05
VI.	Bristol, Clifton	2·27	XX.	Dunmanway, Coolkelure	8·85
„	Ross	2·73	„	Fermoy, Gas Works	5·14
„	Wem, Clive Vicarage ...	...	„	Tralee, Castlemorris ...	5·32
„	Cheadle, The Heath Ho.	2·92	„	Tipperary, Henry Street	4·34
„	Worcester, Diglis Lock	2·46	„	Newcastle West .....	...
„	Coventry, Coundon	3·51	„	Milton Malbay.....	4·21
VII.	Melton, Coston	1·96	XXI.	Gorey, Courtown House	3·71
„	Ketton Hall [Stamford]	2·35	„	Navan, Balrath	2·57
„	Horncastle, Bucknall ...	1·90	„	Mullingar, Belvedere...	2·80
„	Mansfield, St. John's St.	2·25	„	Athlone, Twyford	3·00
VIII.	Macclesfield, The Park.	2·24	XXII.	Galway, Queen's Coll...	2·40
„	Walton-on-the-Hill.....	2·32	„	Clifden, Kylemore .....	...
„	Lancaster, South Road.	...	„	Crossmolina, Enniscoe..	5·11
„	Broughton-in-Furness ...	3·98	„	Collooney, Markree Obs.	3·43
IX.	Wakefield, Stanley Vic.	1·89	„	Carrick-on-Shannon ...	...
„	Ripon, Mickley	2·08	XXIII.	Rockcorry.....	...
„	Scarborough.....	2·49	„	Warrenpoint	2·78
„	EastLayton[Darlington]	2·63	„	Newtownards .....	...
„	Middleton, Mickleton..	1·74	„	Belfast, New Barnsley .	3·03
X.	Haltwhistle, Unthank..	1·89	„	Cushendun	2·99
„	Shap, Copy Hill	7·39	„	Bushmills	2·18
XI.	Llanfrechfa Grange	3·49	„	Stewartstown	1·83
„	Llandoverly	4·19	„	Buncrana	2·55

JANUARY, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°		
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which $\frac{1}{10}$ or more fell.	Max.		Min.			In shade.	On grass.
				Dpth	Date.		Deg.	Date	Deg.	Date.			
I.	London (Camden Square) ...	1.26	- 1.09	.34	3	13	52.2	19	14.5	2	19	23	
II.	Maidstone (Hunton Court)...	1.28	- 1.29	.46	3	9	...	...	...	...	...	...
	Strathfield Turgiss	2.39	- .16	.98	3	15	...	...	...	...	...	...
III.	Hitchin	2.00	- .22	.77	3	14	50.0	28 _c	15.0	1	19	...	
IV.	Winslow (Addington)	2.44	- .11	1.14	3	15	52.0	29	6.0	1	22	27	
	Bury St. Edmunds (Culford)	1.76	- .08	.34	5	14	51.0	31	15.0	1	23	...	
	Norwich (Cossey)	1.43	- .27	.50	8	7	53.0	29	36.0	24	11	20	
V.	Weymouth (Langton Herring)	3.17	...	.92	3	15	50.0	19 _d	23.0	1	13	...
"	Barnstaple	3.96	- .30	.64	6	17	55.0	26	25.0	1, 2	...	...
"	Bodmin	3.70	- 2.81	.74	10	16	51.0	19	27.0	2, 13	14	17	
VI.	Stroud (Upfield)	3.03	+ .04	.49	2	18	52.0	28	20.0	1	18	...	
"	Church Stretton (Woolstaston)	1.98	- 1.45	.50	19	14	53.0	29	22.0	17	18	24	
"	Tenbury (Orleton)	2.97	- .02	.52	10	17	55.0	28	15.6	7	22	23	
VII.	Leicester	2.67	...	.99	7	17	54.2	28	14.0	17	17	29
"	Boston	1.22	- .50	.28	11	7	54.0	28	16.0	1	23	...	
"	Hesley Hall [Tickhill]	2.30	...	.60	7	15	53.0	29	14.0	13	20	...
VIII.	Manchester (Ardwick)	1.72	- 1.52	.35	5	16	49.0	20	23.0	17	17	...	
IX.	Wetherby (Ribston Hall) ...	1.56	- .66	.48	8	10	...	...	...	...	...	...
"	Skipton (Arncliffe)	5.86	- 1.07	.80	17	20	...	...	...	...	...	...
"	Hull (Beverley Road)	1.57	- .22	.26	5	16	49.0	28 _c	21.0	2, 7	16	21	
X.	North Shields	1.63	- .21	.25	5	15	54.0	30	21.5	17	19	20	
XI.	Borrowdale (Seathwaite)	12.11	- 6.64	1.76	31	23	53.5	27	18.5	8	17	...	
"	Cardiff (Ely)	3.28	- 1.43	.76	7	23	...	...	...	...	...	...
"	Haverfordwest	5.97	- .30	.90	8	23	52.0	19	22.0	12	16	24	
"	Plinlimmon (Cwmsymlog) ...	3.88	...	.92	19	15	...	...	...	...	...	...
XII.	Llandudno	2.75	- .21	.69	31	16	...	...	27.4	16	9	...
"	Cargen [Dumfries]	3.63	- 2.48	.64	3	15	49.8	27	19.4	6, 10	15	...	
"	Jedburgh (Sunnyside)	1.63	- .40	.49	6	11	53.0	29 _k	19.0	6, 8	19	...	
XIV.	Old Cumnock	3.54	- 1.10	.82	3	18	51.0	25	16.0	10	16	...	
XV.	Lochgilthead (Kilmory)	5.49	- 2.38	1.28	10	20	...	...	...	...	...	...
"	Oban (Craigvarren)	6.96	...	1.65	18	22	53.0	3	21.0	9	10	...	
"	Mull (Quinish)	6.76	...	.69	17	24	...	...	...	...	...	...
XVI.	Loch Leven Sluices	1.70	- 2.12	.30	11 _a	11	...	...	...	...	...	...
"	Arbroath	2.63	+ .18	.46	10	11	50.0	28 _e	25.0	15	15	...	
XVII.	Braemar	1.91	- .87	.75	11	16	46.0	19	14.0	15	17	23	
"	Aberdeen	2.92	...	.53	17	18	54.0	29	24.0	14 _h	13	...
XVIII.	Lochbroom	6.30	...	.93	18 _b	26	...	...	...	...	...	...
"	Culloden .....	.94	- .83	...	...	...	53.0	26 _f	23.0	6	11	20
XIX.	Dunrobin	2.72	...	.65	6	13	55.0	26 _e	27.0	10 _j	18	...
"	Kirkwall (Swanbister) .....	...	...	...	...	...	...	...	...	...	...	...
XX.	Cork (Blackrock)	4.57	- 1.45	.93	10	21	53.0	25 _g	27.0	9, 11	12	...	
"	Dromore Castle	7.63	...	.73	25	24	54.0	25	29.0	7	...	...
"	Waterford (Brook Lodge) ...	4.57	...	1.42	10	16	52.0	26	22.0	10	11	...	
"	O'Briens Bridge (Ross)	3.63	...	.69	31	21	53.0	30	27.0	8	11	...
XXI.	Carlow (Browne's Hill)	3.23	- .39	.77	9	17	...	...	...	...	...	...
"	Dublin (Fitz William Square)	1.32	- .44	.44	10	16	57.4	26	23.1	10	8	19	
XXII.	Ballinasloe	2.96	- 1.40	.44	31	23	51.0	26	24.0	10	17	...	
XXIII.	Waringstown	3.57	+ .16	1.42	10	16	56.0	27	12.0	9	20	20	
"	Londonderry (Creggan Res.) ..	2.22	...	.37	18	22	...	...	...	...	...	...
"	Omagh (Edenfel)	2.74	- 1.03	.94	10	19	53.0	26	11.0	9	17	22	

a And 19. b And 21. c And 29, 31. d And 31. e And 29. f And 27. g And 27, 29. h And 15. i And 17. j And 11. k And 30.

+ Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON JANUARY, 1887.

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.—The new year opened with very severe weather, repeated (but fortunately without S), on 17th and 18th. At the end of the month the weather was mild and springlike. The melting of the snow caused rather severe floods, and the land at the close was very wet. Much S on 2nd and 3rd.

ADDINGTON.—Intense frost after the lifting of the fog on the morning of the 1st. The min. only 6° at 9 a.m., the dry bulb 7°, and at 10 a.m. only 10°.

CULFORD.—The weather up to the 18th, was very cold and frosty, gradually improving towards the close. Mean temp. 33°. S on 3rd and 17th. Fog on 6th, 9th and 24th.

LANGTON HERRING.—The weather was very unsettled, especially from 1st to 19th. R slightly in excess of the average of 12 years. Mean temp. at 9 a.m. (37°·0) 2°·5 below the average of 15 years. During the night of 17th, the temp. rose to 45°. There were great fluctuations of pressure, which from 4th to 9th was unusually low. Dense fogs on 27th, 28th and 29th.

BODMIN.—The latter part of the month was singularly bright and fine. Mean temp. 38° 5.

STROUD.—The temp. fell to 32° daily from 1st to 17th. S fell on 8 days, though never to any great depth, but more fell on the hills, where it drifted. A little fog on 13th and 14th.

WOOLSTASTON.—Severe frost prevailed till 18th, after which the weather became more open. S fell on 4th and 7th, and heavily on 8th. Mean temp. 35°·8.

ORLETON.—Great fog and rime, with severe frost occurred on 1st and 2nd, followed by a slight thaw. Then frequent falls of S ensued, succeeded by slight thaws, and severe frosts rendering the roads very icy and dangerous. The ground was covered with S and ice till the 19th. The mean temp. of the first 18 days was only 29°·3. The remainder of the month was above the average temp. but dry, with many days fine and pleasant, and a few frosty mornings. The S was nearly all gone by 21st, but in many places the roads were very icy till 23rd. Mean temp, 3°·3 below the average of 26 years. Range of pressure great. S on 7 days; about 4 inches deep on 5th and 8th. Fog frequent.

LEICESTER.—The early part of the month was intensely cold and dreary; the latter part very much milder.

MANCHESTER.—A seasonable month; rather cold throughout with occasional B, sleet, and a little S.

HULL.—Dull and cold. During the two months December, 1886, and January, 1887, the max. temp. in shade only once reached 50°, viz.: on December 5th.

WALES.

HAVERFORDWEST.—Another stormy, wet, and cold month. During the first 16 days the frost was at times very sharp, although the temperature during the daytime neutralized the effects of the low night temperature to a considerable extent. The latter 15 days were damp, very wet at times, and the air was raw and cold. There was no skating. The Precelly Range was three times covered with S. On the 4th it was very stormy; about midnight a squall of unusual violence occurred, so sudden and powerful, that some thought it the shock of an earthquake. S on 5th and 8th.

LLANDUDNO.—Mean temp. (41°·3) within a fraction of the average; the range, diurnal and monthly, also near the average. The weather on the whole was fine, especially from 19th to 30th. From the 1st to the 17th the temp. was

considerably below the average, thence to the close considerably above it. An uninterrupted cyclone prevailed from 20th to 30th., followed by a sudden fall of pressure on 31st, accompanied by high wind and heavy R. There was a sprinkling of S on the ground on the morning of the 6th and occasional S showers occurred during the day, but it melted almost as it fell; the S storms of North Wales seldom reach this peninsula. H on 3rd; fog on 14th.

SCOTLAND.

CARGEN.—Cold weather prevailed during the first half of the month, while the last ten days were remarkably mild. Mean temp ($36^{\circ}\cdot8$) $1^{\circ}\cdot3$ below the average. There was great want of sunshine, only 40 hours being recorded. High winds prevailed during the last ten days. S on 5th and 17th.

OBAN.—A stormy month, cold, and signalled by a heavy and continuous rainfall. On the 18th the R was unusually heavy for a short period of time and caused a large amount of damage to roads and bridges, one of the latter being swept away in Glen Etive. T on 24th; S on 5th, 9th, and 17th; aurora on 16th, followed by very severe weather.

ABERDEEN.—The first half of the month was cold, with frequent falls of S; later, however, milder weather set in, and prevailed to the close. Rainfall about half an inch above the average. Aurora on 14th and 23rd.

LOCHBROOM.—This month was very much like the last, a mixture of all kinds of weather; from fine, warm, summerlike weather to the rigour of Siberia, and from calms to strong gales. Seldom has a month been seen of such variety, yet on the whole it was fine and open. S on 3rd, 6th, and 17th; sleet on 3rd and 10th; H on 6th; gales on 17th, 18th, and 28th to 30th; T and L on 31st.

CULLODEN.—Very changeable with heavy storms of wind and much frost.

IRELAND.

BLACKROCK.—Excepting three bright days the weather was dull, humid and depressing. Pressure very variable. Prevailing wind W. Mean temp. $41^{\circ}\cdot5$. S on two days.

DUBLIN.—Cold, changeable and inclement until the 19th, the weather afterwards was singularly mild and fine. The wind blew freshly from W. or S., scarcely any rain fell for a period of ten days, and the mean temp. of the week ending 29th was as much as 9° above the average, which raised the mean temp. of the month to the average. During the last two days the fine weather broke up, and there was a S.W. gale on 31st. Solar halo on 10th; fog on 7th, 10th, 14th and 18th. High winds on 13 days; S gale on 11th; H on 3rd and 7th. S or sleet on 4th, 6th, 7th, 9th and 16th. Mean humidity 86; mean amount of cloud 6·3; prevailing winds S.W. and W.

EDENFEL.—The weather of the first fortnight was of the same severe character as that of December, but from the 18th to the end there followed a mild, comparatively dry and occasionally summer-like period, during which much of the time lost to agricultural operations through wet, was made up.

HEAT OF JANUARY 8TH AND 9TH, 1887, IN SOUTH AUSTRALIA.

According to the *South Australian Register* of January 10th very exceptional heat prevailed in Adelaide and over much of South Australia on January 8th and 9th. At the Adelaide Observatory the values were:—

	9 a.m.	9 p.m.	max.	min.
January 8th.....	98°	93°·3	110°·1	—
„ 9th.....	97°·6	94°·2	111°·2	84°·0

At various other stations max. temperatures in shade are reported of from 106° to $114^{\circ}\cdot8$.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCLIV.]

MARCH, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

THE EARTHQUAKE IN THE RIVIERA.

WE always feel doubtful whether it is right for us to describe or write about earthquakes.

Japan can start and support a Seismological Society, but England has nothing of the kind—indeed, to our knowledge, there is no seismometer at work in the British Isles, and no publication in which the scattered notices of earthquake shocks are collected and arranged. Our learned contemporary, *Nature*, does more perhaps than all other journals put together, but its treatment of the subject is miserably poor as compared with what might and should be done.* Why does not some one take up the subject and start a Volcanological Society? Nobody can doubt its being interesting; we are strongly of opinion that it would be useful, and such phenomena as the earthquake in Spain, that at Ischia, and the present one in the Riviera, would bring in plenty of subscribers. Such a society should have correspondents near each of the principal and more accessible volcanoes, and should publish a record of the proceedings of each; and this, collated with records of seismometers, and of all the notes of earthquake shocks which could be collected, would soon bring order out of chaos, and enable the value of many theories and of many reputed facts to be ascertained.

However, the Society has yet to be formed, and meanwhile we may, perhaps, be excused for following our old custom and giving a few particulars.

TIME.

The first point we have attacked is, When did the principal shock occur? Owing to the very different modes of time reckoning adopted in the Riviera, we have had considerable difficulty in finding out which records were correct. There were three principal shocks roughly at 5.45, 5.54, and 8.30 a.m., Paris time, on February 23rd.

* Of course that wonderful book, *Whitaker's Almanac*, gives a list, and beats *Nature* in regard to arrangement, but it is packed so tight as to be too small for old eyes to read, and many events are dismissed in one line.

The most trustworthy records of the time of the first shock, and some conclusions therefrom, are given in the following table :—

	h. m. s.	Corresponding Greenwich mean time.	Distance from assumed centre in Gulf of Genoa	h. m. s.	Difference from reported time.
Observatory, Moncalieri, Turin	6.22	= 5.30. 4...	110	5.31.34...	+1.30
Milan electric clocks stopped at	6.25	= 5.33. 4...	120	5.31.43 ..	-1.21
Basle Observ. clocks stopped at	6.42.50	= 5.34.30...	250	5.33.34...	-0.56
Lyons, magnetic trace disturb. at	5.55	= 5.35.44...	250	5.33.34 ..	-2.10
Paris " " " "	5.45	= 5.35.40...	480	5.36.51...	+1.11
Greenwich " " " "		5.38 ...	700	5.40. 0...	+2. 0
Kew Observatory " " " "	5.40	= 5.40 ...	700	5.40. 0...	0
Mean					-0.2

This table shows several great irregularities ; for instance, the time reported for Milan is three minutes later than for Turin, and for Lyons two minutes later than for Basle, yet each pair of places is at approximately the same distance from the centre of disturbance. The fact is that, as with the Essex Earthquake,* the records of time are not accurate enough to indicate correctly the rate of motion of an earthquake shock which is from 3,000 to 10,000 miles an hour. As regards the magnetic instruments, the time scale is generally about 0.6 inch an hour, therefore at an earthquake velocity of 6,000 miles an hour, we have only one-tenth of an inch of paper for 1,000 miles of travel of the shock. Hence, the wonder is *not* that there are discrepancies, but that they are so small.

As regards the last two columns, our readers may attach to them just what value they please ; we have a strong impression that the figures in the last column but one are true within a minute, but, if so, the shock must have travelled very slowly, for 4,200 miles an hour, or 70 miles a minute is, we believe, a very low rate for the travel of an earthquake shock.

LOCALITY.

As already intimated, the centre of disturbance is believed to have been under the Gulf of Genoa, and serious damage is almost confined to the portion of Italy ceded to Napoleon III. in 1860, to Piedmont and to Liguria. The serious cases are in a still smaller area, viz., in the Riviera, between Savona and Monte Carlo, about 66 miles from W.S.W. to E.N.E., and extending, perhaps, 20 miles inland. Fortunately, much of this area is mountainous and without population, but still the loss of life and destruction of property has been serious. The latest returns that we have seen give the following results :—

* "The East Anglian Earthquake of 1884." Macmillan and Co., 1885.

	Dead.	Wounded.		Dead.	Wounded.
Alassio	3	8	Noli.....	16	12
Albenga	—	30	Oneglia	23	150?
Albissola.....	3	12	Pompeiana.....	5	7
Bajardo	230	30	Porto Maurizio.....	1	10
Bussano	80	27	Savona	11	—
Castellano	41	65	Taggia.....	8	14
Ceriana	5	12	Triora	4	9
Diano Castello	35	10			
Diano Marina	180	65			
Montaldo	1	3	Total.....	646	464

We do not, for a moment, suggest that these figures are correct ; they bear in the disproportion of dead to wounded strong evidence to the contrary ; but, doubtless, they are as near the truth as the “ 2,000 killed ” of some daily journals.

STRUCTURAL DAMAGE.

We now pass to the consideration of structural damage, and here originally there was much difficulty caused by gross exaggeration and by contradictory statements. Time enough has, however, now elapsed to allow of the facts being approximately ascertained, though we are still doubtful upon many points, *e.g.*, about 200 persons were killed in one church, but whether it was at Bajardo or at San Romolo, or a similar catastrophe occurred at both, we have not been able to decide.

Albissola.—Many houses cracked from top to bottom.

Antibes.—No damage.

Aurigo.—Church fell in.

Avignon.—Shock felt, but no damage.

Bajardo.—A mountain village (2,500 feet) about 10 miles N.W. of San Remo. Parish church fell in during early service, and 220 dead bodies were subsequently removed ; 120 houses had to be pulled down.

Bar, near Grasse.—A village seven miles N. of Cannes. Three cottages crushed by the fall of an old tower.

Berne.—Slight shock.

Bordighera.—Houses badly shaken, but not much serious damage.

Bouyon.—A village 10 miles N.W. of Nice. The nine o'clock shock here was more violent than the early one, therefore, although about 80 houses were destroyed or damaged, no lives were lost.

Bussano.—A village about three miles from San Remo suffered severely ; the number of persons killed is variously reported as from 80 to 250 out of a total population of from 500 to 800. One report states that nothing was left standing except the steeple of the church.

Cannes.—Shock felt and slight damage to furniture, but nothing at all serious.

Castellaro.—A village about six miles N. of San Remo was much damaged and 41 inhabitants were killed ; the church is said to have fallen in.

Castillon.—A village about four miles N.W. of Mentone very badly injured.

Cerviana.—This is about six miles N.W. of San Remo and about two miles E. of Bajardo, and was considerably injured.

Cervo.—Serious damage.

Cipulina.—Several houses fell.

Corsica.—Two sharp shocks ; no damage reported.

Costabelle, near Hyères.—Shock scarcely felt.

Diano Castello.—A village about 14 miles N.E. of San Remo and near the coast, suffered very severely. Reports vary as to the number of houses left standing, but none states that more than two-thirds were left, and most of them say that all, or all but one, fell.

Diano Marina.—This is an adjoining village on the shore of the Mediterranean, and it suffered, if possible, more than Diano Castello ; even the strongly-built railway station was in ruins.

Digne.—The former capital of Provence. Sharp shock, but only a few small cracks produced.

Genoa.—Damage very slight.

Geneva.—Shock felt.

Grenoble.—A few floors and ceilings cracked and some furniture upset.

Lausanne.—Slight shock.

Leghorn.—Slight shock.

*Lyon*s.—Shock very slight.

Marseilles.—Sharp shocks, some houses cracked.

Mentone.—This may be said to be the only one of the Riviera health resorts at which the shock was as bad as, or worse than, that in the neighbourhood of Colchester in 1884. No deaths were reported, but there were many wounded, and the old town and many of the modern villas suffered severely. It is said that 250 houses were destroyed, and that ten hotels were ordered to be closed as being unsafe.

Milan.—Electric clocks stopped at 6.25 a.m.

Monaco.—Shock insignificant, and very little damage.

Nice.—This city has suffered far more from panic and weak nerves than from the earthquake. There were very few deaths,* and few wounded. One church tower fell, and another was cracked, two large hotels were so cracked that the guests left, and many cornices, chimney pots, &c. fell ; but the real injury to Nice was mental rather than physical, and now that the bulk of their customers have left, the tradesmen of Nice probably see the folly of not opening their shops because a few chimney pots had been thrown down during the night.

Nîmes.—House bells rung and clocks stopped.

Oneglia.—A station on the coast, eight miles N.E. of San Remo, was considerably injured ; several houses fell, and more were damaged.

Richmond, Surrey.—A gentleman who was lying in bed awake, felt the shock at about 5.45 a.m., and mentioned the fact to his wife long before any tidings had arrived from Italy.

* We know of only one.

Rome.—Shock only just perceptible.

San Remo.—No loss of life, and no serious damage, except to some old houses, and to one small hotel.

Savona.—Two houses were said to have fallen, and many others to be on the point of doing so, but a gentleman who on Feb. 28th visited every quarter of the town, says that he could find only a few small cracks.

Toulon.—Slight shock.

Turin.—Church bells rang, and a few cornices fell.

Valence.—Clocks stopped.

Veve.—A village six miles N. of Antibes, a roof fell and killed a child.

Ventimiglia.—Scarcely any damage.

Vienna.—Shock just perceptible.

PREVIOUS EARTHQUAKES AT NICE.

The last issue of Dr. Onimus's *Midi Medical* contains several interesting articles, especially one entitled "Faits exagérés et erronés," in which he speaks of the panic at Nice much as we have done. Another article of importance is the translation into French of an Italian MS. in the Library of Nice, giving a list of earthquakes felt in that city during several centuries. There are very few, so we give all the dates but curtail the descriptions :—

1212.—Great earthquake, and several houses crushed by stones which rolled down from the hills. [We think that this must refer to houses in the environs, not in the city. ED. M. M.]

1564.—July (or Aug.) 20. Violent shock in the neighbourhood of Nice, and extending to Villafranca, but nothing is said of any person being killed or building damaged.

1612.—Jan. 31. Sharp shock at 3 p.m. but no damage.

1618.—Jan. 14, 16 and 18, at 5 p.m. (probably a muddle of dates). A sharp shock which did much damage to buildings, but not one person was injured.

1637.—Nov. 29. Sharp shock, nobody hurt.

1644.—Feb. 15. A shock felt at Marseilles, throughout Provence, and as far as Nice. Fourteen market towns were destroyed, and many persons buried.

1752.—Feb. 16. On the first day of Lent there was a shock at 4.45 a.m., which caused many of those who were in bed to rush into the streets, where they met many others who had been dancing when the shock came, and had also rushed into the streets. Nothing is said as to any damage having occurred.

The parallelism between this event and that of 1887 is extremely remarkable—each on Ash Wednesday, each in the early morning, and probably each of nearly equal violence, or shall we say weakness, for with a population (not counting visitors) of 55,000, there was, we believe, but one death from the recent shock.

WHIRLWIND NEAR DOVER.

AN unusual occurrence is reported from Guston, a small village near Dover. On March 9th, about two p.m., the inhabitants were alarmed by a loud rushing noise, as of a heavy downpour of rain. This was immediately followed by a storm of wind, which, rushing along with terrific force, lifted fowls, ducks, and sticks from the ground, carried them round and round, and to a great height in the air. Large pieces of timber and stones were also lifted and dropped at some distance from the point where they lay. Trees were stripped of branches, but no serious damage to property is recorded. A second gust of wind was felt, though it was not so strong as the previous one. The condition of the atmosphere at the time was very peculiar, the sky being overcast and the air sultry. The wind storm passed from inland towards the sea. A similar occurrence took place about the same time last year, when the storm was also felt at Deal and Walmer.—*St. James's Gazette*.

REVIEWS.

Jahrbuch der Meteorologischen Beobachtungen der Wetterwarte der Magdeburgischen Zeitung, 1884. Magdeburg, 1886. 58 pp., 4to, 12 plates.

THIS volume fully maintains the excellence attained in the previous years, and the contents and admirable arrangement are essentially the same as before, with some important additions. The observations taken at 8^h, 2ⁿ and 8ⁿ are published in the international form, and *in addition*, the *daily* temperature means for 1881-4, have been calculated from the above hours according to the formula adopted by the *Deutsche Seewarte* :—

$$\begin{array}{r|l} \text{FOR MAY TO AUGUST.} & \text{FOR SEPTEMBER TO APRIL.} \\ \left(\frac{8 + 8}{2} \right) + \frac{(\text{Max.} + \text{Min.})}{2} & \frac{8 + 8}{2} + \frac{(8 + 2 + 8)}{3} \end{array}$$

The continuous curves of air-pressure and the registration of sunshine are reproduced, but we confess that we shall not be surprised if this method of representation is eventually abandoned in favour of the more simple numerical process, as has been the case in other countries owing to the great expenditure of time and money demanded by the former process. The hourly records of Wind-Direction and Velocity; and observations of temperature and humidity at an altitude of 105 ft., Earth Temperature, Solar radiation, Evaporation, &c., for specified hours, are given as before, and, *in addition*, the observations made with an Actinometer of the Arago-Davy principle. These are of considerable interest. Some very useful discussions

are promised for the next volume, *e.g.*, on the important question of determining the daily means of temperature from various combinations of hours as compared with those obtained from hourly observations, with a view of deducing the most reliable values with the least trouble to the observer; and a comparison of the temperature observations at 105 ft. and 6 ft. above the ground, in order to show the influence of an elevation of 100 ft. upon the daily means. We congratulate Dr. Assmann upon the results already attained in this great and important undertaking, and look forward with confidence to still further achievements in the future. For fuller details respecting the methods employed, and the apparatus, we may refer to a notice in this Magazine for December, 1884. (Vol. xix. p. 169).

J. S. H.

Ergebnisse der Meteorologischen Beobachtungen im Jahre, 1885. Herausgegeben von dem Königlich Preussischen, Met. Inst. durch WILHELM VON BEZOLD, Direktor. A. Asher & Co., Berlin, 1887. 4to., lxx-246 pp., and two maps.

It is often said that a good start has much to do with final success. If that be true, Dr. von Bezold has a bright future before him, for no one can examine this volume without feeling that it is, in design and execution, exactly what the first volume of a new series should be. There is a just recognition of the importance of continuity by its resemblance to its precursors, but at the same time there are so many new features that on the whole we are much charmed with it.

After a brief introduction, Dr. von Bezold gives lists of stations, their latitudes, longitudes, altitudes, times of observation, &c. He then gives details as to the organization of the office, its separation from the Statistical bureau, and its establishment in its new premises. This is followed by an article, in which, though it only occupies eight pages, Dr. Hellmann gives a capital summary of the work of the Royal Prussian Meteorological Institute from its foundation in 1847 to its re-organization in 1885. An alphabetical list of all stations in Prussia at which observations have been made since 1847, with particulars as to the period, the instruments, the observers, &c., is followed by various summaries and diagrams (on the plan adopted many years ago by Moritz of Tiflis), showing at a glance the life-history of each station.

Appendix No. 2 contains a description of the instruments issued at different epochs, into which Dr. Hellmann (with true German thoroughness) has packed an immense amount of useful information. The facts which would most astonish Englishmen are the excessive prices paid in past years for self-registering thermometers, and their consequent rarity in Germany until a quite recent date.

Appendix No. 4 is a very useful one, giving a list of all the official

publications of the old office and a summary of the principal contents of each.

Appendix No. 6 gives a list of monographs on the meteorology and climatology of various German towns, arranged alphabetically according to the names of the towns.

The first set of tables gives the observations taken at 6 a.m., 2 p.m., and 10 p.m. daily during 1885 at eight stations, one being the Schneekoppe, at an altitude of 5,246 ft. The second set gives monthly summaries on the International pattern for about 150 stations, and this is followed by many others respecting wind, rain, &c. We may call special attention to a table of the temperature at Breslau for every month of 95 consecutive years, 1791 to 1885. The volume closes with tables of monthly rainfall communicated by the members of the Association for the Promotion of Agricultural Meteorology during the years 1881 to 1885, and a map of these stations; which could easily be made a little clearer in the next issue; it requires only to be made a little more like the map which it immediately follows.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this society was held on Wednesday evening, Feb. 16th, at the Institution of Civil Engineers, 25, Great George Street. Mr. W. Ellis, F.R.A.S., President, in the chair.

Mr. E. T. Edwards, Mr. D. Fitzgerald, C.E., Mr. T. B. Groves, F.C.S., and Mr. W. W. Midgley were elected Fellows of the society.

The adjourned discussion on the Hon. R. Abercromby's paper 'On the Identity of Cloud Forms all over the World; and on the general principles by which their indications must be read' was resumed; and the following papers were read:—

(1.) "Remarks concerning the Nomenclature of Clouds for ordinary use," by Prof. H. H. Hildebrandsson, Hon. Mem. R. Met. Soc.

(2.) "Suggestions for an International Nomenclature of Clouds," by the Hon. R. Abercromby, F.R. Met. Soc. Both Prof. Hildebrandsson and Mr. Abercromby have paid great attention to the question of the forms of clouds, and, having recently conferred together, they have agreed to recommend for international use the following ten principal varieties, viz.:— High-level clouds: cirrus, cirro-stratus, cirro-cumulus; middle-level: strato-cirrus, cumulo-cirrus; and low-level: cumulus, stratus, strato-cumulus, nimbus and cumulo-nimbus.

(3.) "The influence of Weather on the proportion of carbonic acid in the air of plains and mountains," by Dr. W. Marcet, F.R.S., and Mons. A. Landriset. The authors give an account of some experiments which they have made on the proportion of carbonic acid in the air at Geneva and on the summit of the "Dole," the highest point of the Jura chain, the difference in altitude being 4,193 feet. The result of these experiments is (1) that in fine

clear weather, on a mountain chain of moderate alpine altitude and in the adjoining valley or plain, the atmosphere holds the same mean proportion of carbonic acid at both places; and (2) that when the summit of a mountain chain is in a fog, a circumstance which frequently happens in an alpine district, the air in the fog contains a smaller proportion of carbonic acid than it would hold in fine clear weather.

The Secretary, Dr. Tripe, read a letter received from Sir F. Abel, organising secretary to the proposed Imperial Institute, inviting the council to draw the attention of the Fellows to the undertaking, with the view of their contributing towards it. The President stated that copies of the letter and of the accompanying paper, explanatory of the scheme, would be forwarded to each Fellow.

THE FLOODS.

SOME parts of New South Wales have been visited by rather too much moisture. Owing to the flood in the Clarence River several houses have been swept away at Ulmarra and Copmanhurst. The losses of stock in these district have been enormous, and nearly all the settlers and tradespeople will lose more or less. Numbers of small landslips have taken place, some involving the wreck of buildings of various kinds. The wharves and sheds at South Grafton have been carried away, while several houses have also disappeared from the same place. Fully forty or fifty boats were engaged in rescuing those who were hemmed in by the flood waters, and but for the vigorous efforts made a large number of people, would undoubtedly have lost their lives. Many were on the point of succumbing when taken out of their half-filled houses. A half-caste was drowned in trying to cross one of the streets in Grafton. Next day the flood waters slowly receded; many of the stock, which were at first supposed to be drowned, were found all right, after having been carried miles away by the flood. Some houses, which had been swept away from South Grafton, were found three miles further down the river. The losses of the storekeepers in South Grafton alone are estimated at £10,000. Immense damage was done to the maize crops. The losses of the farmers are roughly estimated at £100,000. The Government have granted £500 towards repairing the streets of Grafton and £350 towards the Relief Fund.

There have been more floods in Queensland, bringing with them, it is to be regretted, loss of life and great injury to property. The latest reports from the Logan and the Albert rivers show that in one place about 260 persons were reduced to a state of starvation, and were destitute of clothing or shelter. On the Upper Logan the watercourses rose 120 feet. The Waterford bridge was all right, but the Logan railway bridge, which cost £12,000, was swept away. Mr. John Brown, sawmiller, was drowned at Swan Creek, near

Warwick. The water rose there 30 feet in half an hour. The shores of Moreton Bay were lined with dead cattle, pigs, and fish of all descriptions. At a meeting called by the Mayor of Brisbane, on January 28th, for the relief of the sufferers, there were present the Colonial Treasurer, Minister of Works, Sir T. McIlwraith, Bishop Webber, several Members of Parliament, and influential citizens. It was decided to form a general fund, and a committee was appointed. Sir S. W. Griffith sent £100 from Melbourne.—*Colonies and India.*

REMARKABLE SHOWERS AND MARVELLOUS METEOROLOGY.

To the Editor of the Meteorological Magazine.

SIR,—Since writing the letter which appeared in your issue of November last, I have come across some records of wonderful showers in the translation of M. Flammarion's "L'Atmosphère," edited by James Glaisher, F.R.S., one at least of which is, I think, worthy of transcription.

"In 1688 they [*i.e.* cockchafers] formed so dense a cloud in Galway, that the sky was darkened to the distance of a league, and the peasants had a difficulty in finding their way about. They destroyed all vegetation, so that the country around had the look of winter. Their voracious jaws made a noise like that caused by the sawing of a thick piece of timber, and in the evening the flapping of their wings resembled the distant rolling of a drum. The unhappy Irish were compelled to cook and eat them for want of other food."

In his preface the Editor says: "I believe the volume will be found to be readable, popular, and accurate, and it covers ground not occupied by any one work in our language."—Yours faithfully,

H. SOWERBY WALLIS.

25, Northwood Road, Highgate, March 10th, 1887.

RAINFALL OF ANTIGUA.

The rainfall of Antigua is registered at the Library in the city of St. John. The following shows the rainfall for six years:—

1881—66·85	1882—42·65	1883—69·14
1884—53·49	1885—51·15	1886—48·14

LARGE HAILSTONES.

A hailstorm of quite a phenomenal character passed over Riet Vlei, Cape Colony, the other day. Numbers of hailstones fell in rapid succession as large as cricket balls, one of them measuring 4 inches by $3\frac{3}{4}$ inches, and several of them weighing $\frac{1}{2}$ lb. to $\frac{3}{4}$ lb. each.—*Colonies.*

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1886.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.		Average.				Absolute.		Total Rain.		Aver.		
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
England, London	88·4	30	44·6	3	73·9	54·6	54·3	75	124·4	39·0	·76	12	0·10
Malta	92·3	12	65·4	4	84·1	69·5	65·4	69	149·0	...	·00	0	1·6
<i>Cape of Good Hope</i>	83·0	1	35·2	10	64·0	47·8	49·3	87	...	...	3·88	10	6·8
<i>Mauritius</i>	76·6	21	57·7	14	74·6	62·6	56·4	67	129·1	48·2	·74	2	4·8
Calcutta	89·8	22a	75·5	26	87·5	78·4	78·3	87	160·6	74·3	8·93	23	8·1
Bombay	86·3	5	73·9	15	84·4	77·0	75·1	83	146·4	71·9	10·69	25	8·2
Ceylon, Colombo	85·7	24	73·1	2c	83·6	76·1	71·8	76	143·0	67·0	1·74	11	6·7
<i>Melbourne</i>	68·1	9	32·9	24	57·7	42·5	41·5	74	116·4	24·3	2·45	15	6·2
<i>Adelaide</i>	73·1	29	38·6	23	61·4	47·4	44·5	69	128·1	30·1	3·09	24	6·4
<i>Wellington</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Auckland</i>	62·0	12	36·0	28	57·7	46·6	45·2	84	125·0	28·0	5·68	29	7·0
Jamaica, Kingston	96·2	18	70·5	1d	91·8	73·4	74·0	81	...	...	12·24	21	6·3
Barbados	84·0	15b	69·0	16	82·0	73·0	73·4	80	147·0	...	17·87	23	7·0
Toronto	87·9	11	46·3	5	74·8	56·5	57·1	74	...	40·0	2·63	9	5·2
New Brunswick, } Fredericton	89·2	27	45·0	19	73·6	53·2	56·1	77	...	...	2·79	14	5·8
Manitoba, Winnipeg } British Columbia, } Victoria	103·0	24	31·7	31	78·4	49·9	52·7	67	...	...	1·17	10	5·2
	79·0	6	39·0	23	70·0	49·0	...	...	...	...	·73	4	...

a And 23. b And 22, 27, 30. c And 8, 14. d And 2, 28.

REMARKS, AUGUST, 1886.

MALTA.—Mean temp. 76°·2; mean hourly velocity of wind 8·3 miles. Severe shocks of earthquake were felt on 14th and 15th and on 27th there were very severe shocks at 11 p.m., lasting two minutes and a quarter. J. SCOLES.

Mauritius.—Rainfall ·96 in. and mean temp. 0°·7 below the average; mean hourly velocity of wind 11·1 miles, extremes 26·5 miles and 1·9 miles; prevailing direction E.S.E. Fore and after glows were more intense than usual. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air and of dew point both 0°·6, and pressure ·195 in. below average; mean humidity, average; rainfall ·58 in., and amount of cloud slightly above average. Prevailing wind N, strong on 11 days; heavy dew on 2 days, hoar frost on 2, sleet and H on 1 day, L on 2 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure (29·886 in.) the lowest on record and ·239 in. below the average of 29 years. Rainfall nearly an inch above the average; mean amount of cloud excessive; mean temp. about the average. C. TODD.

Auckland.—Stormy, wet, and disagreeable. Mean temp., average; pressure considerably below; rainfall considerably above the average. T. F. CHEESEMAN.

JAMAICA.—Cyclone on 20th doing much damage. R. JOHNSTONE.

BARBADOS.—Mean temp. (76°·8), about the average; rainfall excessive, never having been exceeded during 35 years. Prevailing wind N.E.; mean hourly velocity 7·7 miles, extremes 12·5 miles and 3·2 miles. TSS on 3 days; 15 days were overcast. Between 6 a.m. and 7 a.m. of 17th a hurricane raged at St. Vincent (90 miles W.), causing great destruction to buildings, with loss of life. R. BOWIE WALCOTT.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPT., 1886.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London	84.2	1	42.2	17	68.7	52.5	51.2	0.100 75	117.7	33.8	inches 1.73	11	5.1
Malta	89.7	9	64.5	14	81.9	69.2	66.5	75	140.7	...	4.09	11	3.1
Cape of Good Hope	88.4	23	39.8	18	67.2	49.9	52.1	86	...	...	2.50	9	5.3
<i>Mauritius</i>	78.3	21	60.0	24	76.3	64.1	58.3	69	130.4	48.2	.85	15	5.3
Calcutta	89.5	4	74.2	29	87.1	78.0	78.3	88	162.0	72.0	13.93	24	7.8
Bombay	87.8	24	74.3	4	85.1	76.8	75.5	83	149.1	71.2	6.54	19	6.1
Ceylon, Colombo	86.8	21	71.3	6	84.7	76.2	72.5	75	146.0	64.3	8.07	14	6.8
<i>Melbourne</i>	78.9	30	36.6	12	65.4	45.7	43.3	65	128.1	28.0	1.30	10	5.0
<i>Adelaide</i>	82.5	30	40.1	27	69.9	52.0	45.2	56	141.2	29.3	.69	11	4.4
<i>Wellington</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Auckland</i>	62.0	28 ^a	41.5	14	58.6	47.6	45.5	74	128.0	32.0	3.05	19	7.4
Jamaica, Kingston	95.8	16	68.5	13	93.3	72.6	72.6	79	...	...	2.55	12	5.7
Barbados	87.0	22	70.0	8	83.0	73.0	74.0	82	146.0	...	14.80	24	7.0
Toronto	83.9	8	40.1	15	67.8	49.7	52.9	79	...	33.0	3.83	17	4.9
New Brunswick, Fredericton	87.7	8	29.5	23	62.6	41.4	46.5	73	...	...	2.88	14	5.2
Manitoba, Winnipeg ...	82.1	1	23.5	30	60.3	37.6	41.9	75	...	...	4.73	13	5.0
British Columbia, Victoria	80.0	11	35.0	27	65.8	45.6	...	...	...	...	1.59	7	..

^a And 30.

REMARKS, SEPTEMBER, 1886.

MALTA.—Mean hourly velocity of wind 7.4 miles; R unusually heavy; temp. of dew point above average. TSS on 4 days, L on 3 other days. J. SCOLES.

Mauritius.—R .85 in. and temp. 0°4 below average. Mean hourly velocity of wind 11.7 miles; extremes 26.0 miles on 11th, and 2.1 miles on 2nd; prevailing direction E.S.E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 2°3 and pressure .043 in. above average; temp. of dew point 0°3; humidity 6; cloud 1.1 and R 1.03 in. below average. Prevailing wind N., strong on 9 days; heavy dew on 7, T and L on 2, L on 6.

R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 4°0 above the average and the highest recorded. R considerably below average. C. TODD.

Auckland.—Beginning and middle of month stormy and wet, end fine, but cool and cloudy. Mean temp. and R slightly below average. T. F. CHEESEMAN.

BARBADOS.—Mean temp. (77°2) average; R 43 per cent. above average. Wind N.E. on 22 days, S.E. on 3, S.W. on 5; mean hourly velocity 6.4 miles. T and L on 6 days, severe on some. R. BOWIE WALCOTT.

FREDERICTON.—Aurora on 1 night. TSS on 2 days.

WINNIPEG.—Aurora on 6 nights. TSS on 3 days, first S on 29th.

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	·89	XI.	Castle Malgwyn	1·23
„	Margate, Birchington	·37	„	Rhayader, Nantgwillt	1·84
„	Littlehampton	·95	„	Carno, Tybrith	1·68
„	Hailsham	·72	„	Corwen, Rhug	1·26
„	Ryde, Thornbrough	·97	„	Port Madoc	2·38
„	Alton, Ashdell	·99	„	I. of Man, Douglas	1·26
III.	Oxford, Magdalen Col... ..	·67	XII.	Stoneykirk, Ardwell Ho.	·99
„	Banbury, Bloxham	·70	„	New Galloway, Glenlee	3·11
„	Northampton	·60	„	Melrose, Abbey Gate	·99
„	Cambridge, Beech Ho... ..	·62	XIII.	N. Esk Res. [Penicuik]	2·80
„	Wisbech, Bank House.. ..	·69	XIV.	Ballantrae, Glendrisaig	1·85
IV.	Southend .....	...	„	Glasgow, Queen's Park	3·00
„	Harlow, Sheering	·56	XV.	Islay, Gruinart School.. ..	3·05
„	Rendlesham Hall	·43	XVI.	St. Andrews, Pilmour Cot	1·12
„	Diss	·55	„	Balquhiddel, Stronvar.. ..	8·93
„	Swaffham	·64	„	Dunkeld, Inver Braan.. ..	2·30
V.	Salisbury, Alderbury	·71	„	Dalnaspidal H.R.S.	7·49
„	Warminster	·64	XVII.	Keith H.R.S.	·63
„	Calne, Compton Bassett	·89	„	Forres H.R.S.	·93
„	Ashburton, Holne Vic.. ..	1·81	XVIII.	Strome Ferry H.R.S.	6·37
„	Holsworthy, Clawton... ..	·76	„	Tain, Springfield	1·40
„	Hatherleigh, Winsford. ....	...	„	Loch Shiel, Glenaladale	10·08
„	Lynmouth, Glenthorne	1·04	„	S. Uist. Ardkenneth	4·48
„	Probus, Lamellyn	1·01	„	Invergarry	10·35
„	Wincanton, Stowell Rec.	·59	XIX.	Lairg H.R.S. ....	...
„	Taunton, Lydeard Ho... ..	·48	„	Forsnard H.R.S.	1·88
„	Wells, Westbury	·46	„	Watten H.R.S.	1·12
VI.	Bristol, Clifton	·70	XX.	Dunmanway, Coolkelure	3·67
„	Ross	·40	„	Fermoy, Gas Works	1·26
„	Wem, Clive Vicarage	·42	„	Tralee, Castlemorris	3·90
„	Cheadle, The Heath Ho.	·45	„	Tipperary, Henry Street	·94
„	Worcester, Diglis Lock	·57	„	Newcastle West	·82
„	Coventry, Coundon	·54	„	Miltown Malbay	2·61
VII.	Melton, Coston	·55	XXI.	Gorey, Courtown House	·72
„	Ketton Hall [Stamford]	·60	„	Navan, Balrath	·92
„	Horncastle, Bucknall	·68	„	Mullingar, Belvedere	1·36
„	Mansfield, St. John's St.	·53	„	Athlone, Twyford	1·36
VIII.	Macclesfield, The Park	·75	„	Longford, Currygrane	2·43
„	Walton-on-the-Hill	·72	XXII.	Galway, Queen's Coll... ..	2·77
„	Lancaster, South Road. ....	...	„	Clifden, Kylemore	3·73
„	Broughton-in-Furness	3·35	„	Crossmolina, Enniscoe.. ..	5·36
IX.	Wakefield, Stanley Vic.	·35	„	Collooney, Markree Obs.	3·11
„	Ripon, Mickley	1·69	XXIII.	Rockcorry	1·36
„	Scarborough .....	...	„	Warrenpoint	1·12
„	East Layton [Darlington]	1·09	„	Newtownards .....	...
„	Middleton, Mickleton	1·18	„	Belfast, New Barnsley.. ..	1·45
X.	Haltwhistle, Unthank.. ..	1·48	„	Cushendun	3·69
„	Shap, Copy Hill	4·24	„	Bushmills	1·67
XI.	Llanfrechfa Grange	1·13	„	Stewartstown	1·41
„	Llandoverly	1·59	„	Buncrana	2·61

FEBRUARY, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which .01 or more fell.	Max.		Min.			
				Dpth	Date.		Deg.	Date	Deg.	Date.		
I.	London (Camden Square) ...	.48	- 1.16	.12	17	5	54.1	5	22.6	17	14	21
II.	Maidstone (Hunton Court)...	.51	- 1.11	.26	18	5	...	...	...	...	...	...
III.	Strathfield Turgiss .....	.69	- 1.06	.24	17	9	54.7	5	21.0	17	18	21
III.	Hitchin .....	.63	- .97	.18	2	7	53.0	4, 5	22.0	16	19	...
IV.	Winslow (Addington) .....	.64	- 1.17	.16	2, 17	7	54.0	27	16.0	17	20	21
IV.	Bury St. Edmunds (Culford)	.59	- 1.18	.15	1	8	55.0	4	14.0	16	19	...
V.	Norwich (Cossey) .....	.57	- 1.18	.17	1	5	...	...	...	...	...	...
V.	Weymouth (Langton Herring)	.71	...	.22	2	8	52.0	23	25.0	17	15	...
V.	Barnstaple .....	.59	- 2.60	.23	17	6	54.0	4a	30.0	9	...	...
VI.	Bodmin .....	.92	- 3.95	.37	2	9	53.0	3, 4	23.0	17	10	20
VI.	Stroud (Upfield) .....	.74	- 1.51	.30	2	8	54.0	24	23.0	16	17	...
VI.	Church Stretton (Woolstaston)	.56	- 1.94	.25	2	8	52.5	5	23.0	10	16	21
VI.	Tenbury (Orleton) .....	.44	- 2.03	.26	2	5	55.0	3	20.5	10	16	20
VII.	Leicester .....	.48	...	.16	2	8	57.0	27	23.0	17	19	25
VII.	Boston .....	.41	- 1.37	.20	2	4	58.0	6	21.0	16	11	...
VII.	Hesley Hall (Tickhill) .....	.31	...	.11	17	7	56.0	27b	22.0	8	19	...
VIII.	Manchester (Ardwick) .....	.43	- 1.76	.12	17	6	52.0	23c	25.0	10	12	...
IX.	Wetherby (Ribston Hall) ...	.89	- 1.26	.26	3	8	...	...	...	...	...	...
IX.	Skipton (Arncliffe)	2.87	- 1.77	.85	2	17	53.0	27	28.0	26	...	...
IX.	Hull (Beverley Road) .....	.41	- 1.53	.10	13	9	53.0	23c	23.0	8	17	20
X.	North Shields .....	.38	- 1.46	.20	2	6	56.2	24	20.0	10	13	14
X.	Borrowdale (Seathwaite)	9.51	- 1.94	3.20	22	13	52.5	28	18.0	10	14	...
XI.	Cardiff (Ely)	1.48	- 2.18	.56	2, 3	8	...	...	...	...	...	...
XI.	Haverfordwest	1.33	- 3.12	.34	2	10	52.0	3d	19.0	9	18	25
XI.	Plinlimmon (Cwmsymlog) ...	1.55	...	.34	17	10	...	...	...	...	...	...
XI.	Llandudno .....	.55	- 1.74	.13	5	10	56.1	3	24.5	10	6	...
XII.	Cargen [Dumfries]	1.98	- 1.83	.68	24	8	52.8	18	19.2	9	9	...
XII.	Jedburgh (Sunnyside) .....	.41	- 1.35	.20	3	4	56.0	23c	18.0	9, 10	10	...
XIV.	Old Cumnock	2.99	+ .13	.70	22	15	53.0	28	23.0	10	15	...
XV.	Lochgilhead (Kilmory)	5.57	+ 1.18	.97	22	18	...	...	...	...	...	...
XV.	Oban (Craigvarren)	6.15	...	1.09	22	16	56.6	26	28.0	9	3	...
XV.	Mull (Quinish)	5.17	...	.95	23	15	...	...	...	...	...	...
XVI.	Loch Leven Sluices	2.90	- .06	.70	5	8	...	...	...	...	...	...
XVI.	Arbroath	1.06	- 1.10	.44	2	8	54.0	23	24.0	9	7	...
XVII.	Braemar	1.86	- .81	.64	2	14	57.0	28	19.2	10	11	22
XVII.	Aberdeen .....	.89	...	.27	2	12	54.0	23	22.0	9	6	...
XVII.	Lochbroom	4.26	...	.82	23	17	...	...	...	...	...	...
XVII.	Culloden	1.59	+ .54	...	...	...	55.0	27	30.0	7, 9	4	29
XIX.	Dunrobin	1.35	...	.35	17	8	55.0	28	27.0	9	8	...
XIX.	Kirkwall (Swanbister)	2.06	...	.32	24	19	51.3	27b	30.5	3, 17	...	...
XX.	Cork (Blackrock)	1.32	- 3.27	.32	1	11	54.0	17	26.0	10	8	...
XX.	Dromore Castle	2.33	...	.35	24	13	56.0	25	26.0	10	...	...
XX.	Waterford (Brook Lodge) ...	.59	...	.14	1	9	52.0	22g	26.0	10	6	...
XX.	O'Briensbridge (Ross)	1.40	...	.35	22	12	52.0	...	25.0	11	10	...
XXI.	Carlow (Browne's Hill) .....	.85	- 2.07	.34	2	12	...	...	...	...	...	...
XXI.	Dublin (Fitz William Square)	.54	- 1.62	.14	2	11	57.1	27	26.0	10	5	19
XXII.	Ballinasloe	1.62	- .89	.36	22	17	51.0	22h	22.0	10	15	...
XXIII.	Waringstown .....	.95	- 1.30	.28	2	12	57.0	22h	23.0	10	16	17
XXIII.	Londonderry (Creggan Res.) ..	3.23	...	.85	4	19	...	...	...	...	...	...
XXIII.	Omagh (Edenfel)	2.17	- .11	.65	2	14	53.0	23c	22.0	9	12	20

a And 5, 25, 28. b And 28. c And 24. d And 4, 5. g And 23, 28. h And 23. i And 11.
 + Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON FEBRUARY, 1887.

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

ENGLAND.

STRATHFIELD TURGISS.—On the whole a cold dry month, with local fogs, rather severe frosts at night, and a slight rainfall, constituting about the best possible conditions for the land. Purple dead nettle, daisy and lesser periwinkle in flower on 4th, chickweed and blue birds-eye on 5th; first primrose in the open on 18th; skylark heard on 5th.

ADDINGTON.—A dry cold month, with the least rainfall of any February for years, except February 1886, when only .63 in. fell. From 7th to 20th, very cold N.E. wind prevailed. Pressure was particularly high on 7th, 8th and 9th, S on 1st, high wind on 3rd. Fog on 16th, 17th and 22nd, and dense on 20th.

CULFORD.—A very dry month, with low night temp. Out-door operations progressed favourably. Fog on 6th and 26th.

LANGTON HERRING.—A month of splendid weather. Mean temp. ($37^{\circ}\cdot6$) $3^{\circ}\cdot0$ below the average of 15 years. Mean pressure higher than for any month since January 1882. From 6th to 17th, the wind was E.N.E. or N.E. On the 18th, there was a fog, but on the whole the weather was remarkably clear.

BODMIN.—A very singular February. I have never known a February with so little E, so little wind and so much sunshine. Mean temp. $38^{\circ}\cdot6$.

WOOLSTASTON.—A pleasant, seasonable month, with a good deal of severe frost. Mean temp. $37^{\circ}\cdot8$.

ORLETON.—A very dry and cold month, with frequent severe frosts at night and many bright sunny days. Mean temp. $3^{\circ}\cdot2$ below the average of 26 years. Rainfall less than that of any February for the last 56 years, not excepting even 1860, when .48 in. fell. There was no S. Pressure was generally high and steady.

LEICESTER.—A very cold month, with an exceptionally small rainfall.

MANCHESTER.—The month was fine and favourable for agriculture, with temp. lower than that of January.

HULL.—A fine, dry month, with sharp night frosts; pressure generally high. The driest February since 1863.

WALES.

HAVERFORDWEST.—The month commenced wet, but from the 5th to the 16th, strong E. breezes prevailed with severe frost; a week of broken milder weather followed, and from the 24th to the end it was again cold and frosty. Rainfall very slight.

LLANDUDNO.—The month did not fulfil the old adage, "February fill the dyke either with the black or white." On the contrary, the weather was remarkably fine, with a large amount of sunshine, particularly from 6th to 13th, and from the 22nd to the close. S was conspicuous by its absence, and the rainfall was barely a quarter of the average. There were two cyclonic storms, one, on the 3rd, of great force from S.W., the other, on the 23rd, of a much less violent character. With these exceptions the weather was generally calm with high pressure. The mean temp. ($42^{\circ}\cdot1$) was within half a degree of the average. The mean daily range of temp. ($10^{\circ}\cdot7$) was $1^{\circ}\cdot6$ and the monthly range was $4^{\circ}\cdot7$ above the average.

SCOTLAND.

CARGEN.—The most remarkable feature of the month was the unusually high pressure. Mean temp. ($39^{\circ}\cdot4$) rather below the average.

JEDBURGH.—Rainfall less than in any other February for 23 years. For the first ten days the temperature was lower than in January, but after that it gradually rose, and spring flowers were in full bloom at the close. High S.W. wind prevailed on 22nd, 23rd and 24th, otherwise the weather was singularly quiet.

OBAN.—Stormy periods occurred at the beginning and end of the month. The temperature was mild, and spring vegetation was much advanced at the close. A very fine aurora was seen on 12th. From the 22nd to 24th, very heavy R fell, accompanied by gales. A very heavy gale without R blew on 26th.

BRAEMAR.—A month of unusually fine weather. T from 2 p.m. to 4 p.m. on 18th.

ABERDEEN.—The month was fine and dry throughout. Rainfall nearly an inch and-a-half below the average. Prevailing wind S.W. Aurora on 19th.

LOCHBROOM.—The first five days were very stormy and disagreeable, with winter in every sense, but from the 6th to the 17th, the weather was lovely, more like summer than spring, thence to the end there was much variety, with a strong gale on 23rd and 24th. S on 1st, 5th, and 18th. Sleet on 5th, 19th and 20th.

CULLODEN.—The month generally was fine, with little frost; the period from 4th to 19th was dry and favourable for labour.

IRELAND.

BLACKROCK.—From 1st to 6th showery, with high wind at times, followed by nine dry and bright days, then showery again. The driest February for 22 years, except 1867 and 1868, when 1.32 in. and 1.00 in. fell. Pressure unusually high. Mean temp. ($42^{\circ}1$) $0^{\circ}5$ below the average of 11 years. Wind N.W. or S.W. on 18 days, E. or S.E. on 10 days. Fog on 15th.

DROMORE.—Very fine and calm, with no high winds; vegetation good.

WATERFORD.—A remarkably dry February. The next driest in 28 years was in 1877, when more than twice as much R was registered. The average of the period is 3.50 in., or very nearly six times as much as the fall this month.

O'BRIENSBRIDGE.—Unusually fine for February. Some strong S. winds prevailed, without R. There was no S, and the frosts were slight.

DUBLIN.—Showery and squally at first, the weather soon became quiet, dry and fine. From the 4th to the 21st, the pressure was uninterruptedly high. The driest February for very many years. The weather on the whole resembled that of the preceding month, although the extremes were less marked. Mean temp. slightly below the average. Aurora on 12th; fog on 10 days; high winds on 11 days, gales on 3rd and 24th. Mean humidity 81; mean amount of cloud 5.2; prevailing winds W., S.W., and N.E.

EDENFEL.—With the exception of two short broken periods in the first and third weeks, the weather of February was ideal in its character. With just sufficient frost to check vegetation, the days were, as a rule, calm and frequently clear and balmy, and such as would not have been out of place in the Riviera.

METEOROLOGICAL PAMPHLET EXCHANGE.

It is with much pleasure that we find that it is to so high an authority as Dr. Hann that we owe the first support of the proposal made in our last number. Dr. Hann has, however, not sent old papers, but copies of a recent one, as set out below:—

No of Copies.	Title.	Price, Post Free.
9	DR. HANN.—Bemerkungen zur täglichen Oscillation des Barometers	2½d.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCLV.]

APRIL, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

INJURY BY LIGHTNING.

A VERY important paper on this subject, by Dr. Hellmann, was issued last year by the Prussian Statistical Office. The general conclusions have been translated and published in the "Monthly Weather Review" of the United States Signal Service, and we think them of sufficient importance to reprint them *in extenso*. When will our Government order a similar investigation to be made respecting injury in the British Isles?

The observations from which the following conclusions are drawn have been made in different parts of the German Empire, for the past ten years.

1. Statistics show that in Schleswig-Holstein, Baden, and Hesse, in thickly settled districts, a constant increase of damage from lightning does not appear to be proven any more than a decrease.

2. The yearly as well as the daily periodicity of lightning flashes corresponds very closely with the storm frequency. One interesting fact, previously noted, is that on the west coast of Schleswig-Holstein the greatest number of lightning flashes occur in the first hours after midnight.

3. In Schleswig-Holstein, in the ten years from 1874 to 1883, of all the buildings struck by lightning, of those with "hard" roofing, 9 per cent. caught fire, 91 per cent. did not; with "soft" roofing, 68 per cent. caught fire, 32 per cent. did not; so that buildings with "soft" roofing when struck by lightning catch fire from seven to eight times as often as those with "hard" roofing. Besides this consideration of the nature of the roof, the nature of the building is of importance. Averaging for a year of a million instances:

Ordinary buildings (with "hard" roofing, 163, with "soft" roofing 386) 290 are struck; churches, 6,277 are struck; wind-mills, 8,524 are struck; manufactories, chimneys, &c., 306 are struck.

In Schleswig-Holstein, the risk from lightning to churches and bell-towers is thirty-nine times, and in the case of wind-mills fifty-two times, greater than in the case of ordinary buildings with hard roofs.

4. In the case of Schleswig-Holstein the marsh lands from Husum to Steinberg are often struck while the country round the fords of the east coast is entirely protected. The coefficient representing the number of buildings struck of a million is generally from four hundred to five hundred and forty; but here falls to one hundred and sixty or one hundred and seventy, *i.e.* about one-third. The great danger in the case of flat and moist lands comes

from the fact that the farm premises are the most prominent features of the landscape, and the ground, besides, is quite moist.

5. The risk of danger from lightning decreases with increase of number of houses contained in any given district. In Prussia the risk in the country is five times greater than in the city districts. In Berlin the number of fires caused by lightning averages only 0·2 to 0·3 of one per cent. For an ordinary dwelling house, which stands among others, not particularly high, the erection of a lightning-rod is not needed.

6. In the Grand Duchy of Baden differences in the distribution of lightning strokes are found. In Heidleberg of a million, twenty-four buildings are struck, while in Waldshuter the rate is two hundred and sixty-five.

7. In the northern half of Baden and the neighbouring half of Hesse the number of buildings struck between 1868 and 1883 shows a decrease.

8. In Hesse the parts protected best are regions along the Rhine, where the encircling hills and mountain sides are interposed to protect them. But the danger is increased where, as in the case of Rhine Hesse, the country above is wooded.

9. The causes of variations in the number of buildings struck are to be sought in local causes and not in extra-territorial happenings. The supposed relation between frequency of lightning strokes and sun spots appears to have no foundation.

10. Averaging for fifteen years, of a million of people, the number killed by lightning is, in Prussia, 4·4 ; Baden, 3·8 ; France, 3·1, and Sweden, 3·0.

11. The geological features of the ground, particularly the water capacity, have a marked influence upon the number of lightning strokes. If we call a chalk-bed, 1 ; then we have for marl, 2 ; for clay, 7 ; for sand, 9 ; and for loam, 22. These conditions have much to do with the frequency of lightning strokes in the flat lands of northern Germany, as compared with southern Germany and Austria.

12. Differences in space and distribution of lightning strokes are due to four causes ; two of a physical and two of a social nature. The first, the unequal frequency of storms, and the difference in the geological character of the earth ; the latter, the changing and the improved construction of buildings.

13. Of all trees, the oak was most frequently and the beech least frequently struck. If we let 1 equal the beech, then pines are 15, oaks 54, and other trees 40.

14. Most frequently the trees struck were standing in the clear, or on the edge of forests, and averaging from sixteen to twenty metres high.

15. The trunk is struck about three times as often as boughs, and generally the stroke seems to travel toward the ground. Only in three of one hundred cases did it jump to other trees.

ROYAL METEOROLOGICAL SOCIETY.

The usual Monthly Meeting of this Society was held on Wednesday evening, March 16th, at the Institution of Civil Engineers, 25, Great George Street, Mr. W. Ellis, F.R.A.S., President, in the chair.

Mr. G. Eyres, Mr. J. T. Hotblack, and Capt. C. H. M. Kensington, R.E., were balloted for and elected Fellows of the Society.

The following papers were read :—

(1.) "Notes on taking Meteorological Observations on Board Ship," by Capt. D. W. Barker, F.R.Met.Soc. The author makes various suggestions as to the placing of meteorological instruments on board ship with the view of securing uniformity.

(2.) "Marine Temperature Observations," by Dr. H. R. Mill, F.R.S.E. After briefly sketching the principal historical methods of observing temperature beneath the surface of the water, Dr. Mill discussed in some detail the relative merits and defects of the two instruments now in common use for this purpose. The self-registering maximum and minimum thermometer on Sixe's principle, even with the addition of an outer bulb to protect it from pressure, has certain inherent defects. It merely shows the highest and lowest temperatures passed through, the indices are liable to be shaken from their proper position, and it requires long immersion in order to attain the temperature of its surroundings. Mr. J. Y. Buchanan has shown how by the use of mercury and water piezometers the actual temperature at a given point may be obtained, no matter how the temperature between that point and the surface may vary. Such instruments have not been much used, and now a modification of the mercurial outflow thermometer, patented by Messrs. Negretti and Zambra as the "Standard deep-sea thermometer," is largely used. When fitted in a frame which admits of the thermometer registering at a precisely known depth, admirable results are obtained by it. The manner of using these thermometers in the Scottish frame, and of conducting temperature trips in comparatively shallow water were described; and the best ways of recording the observations and elaborating the results were alluded to; the work of the Scottish Marine Station on the Clyde Sea-area being taken as an illustration. The importance of marine temperature observations as bearing on sub-marine geography, on navigation, on the distribution of animal life, and consequently on fisheries was alluded to. The paper was illustrated by diagrams and by the exhibition of the apparatus which was described.

After the reading of these papers the Meeting was adjourned in order to afford the Fellows an opportunity of inspecting the Exhibition of Marine Meteorological Instruments and Apparatus which had been organised under the auspices of the Society.

EXHIBITION OF MARINE METEOROLOGICAL INSTRUMENTS.

An interesting and instructive Exhibition of Marine Meteorological Instruments, organised by the Royal Meteorological Society, was opened on Tuesday, March 15th, in the Library of the Institution of Civil Engineers, 25, Great George Street. Specimens of almost every kind of instrument used for taking meteorological

observations at sea were included in the Exhibition ; sets of instruments as supplied to the British, French, Dutch and other Navies being shewn. There were numerous forms of Deep-sea Thermometers, including Johnson's registered metallic, the records of which are obtained by the varying expansion of brass and steel bars acting upon indices ; Miller-Casella maximum and minimum ; and Negretti and Zambra's reversing thermometer. Special interest attaches to the instruments used on board the *Challenger*, many of which were constructed by Mr. Buchanan during the voyage of that vessel. The instruments and apparatus used at the Scottish Marine Station, Granton, near Edinburgh, and at the Lochbaine Marine Institute, Isle of Mull, were also shewn. In addition to the above there were various forms of Anemometers, Rain-gauges, Logs, Current Meters, Clinometers, &c., for use on board ship.

The Exhibition also included a number of Diagrams, Photographs, &c., shewing the meteorological conditions prevailing over the various oceans of the globe. The most interesting charts were the specimens of the Daily Synchronous Weather Charts of the North Atlantic, exhibited by the Meteorological Council ; examples are given shewing the meteorological conditions (1) in summer, (2) in winter, and (3) in early spring, illustrating the persistence of the European anti-cyclone producing cold dry winds over England.

A number of new instruments brought out during the past twelve months were also shewn.

The Exhibition remained open till Friday evening.

THE SNOW OF MARCH 15TH.

To the Editor of the Meteorological Magazine.

SIR,—As the chief severity of the recent snowstorm appears to have fallen upon this part of the country, the following particulars may be of interest :—

Snow commenced before daybreak on March 15th, and continued throughout the day. At 7 a.m. the depth, as seen on the coping of a wall, was judged to be about 4 inches. At 9 a.m. a measurement on a gravel walk gave a depth of 10 inches and by 5 p.m. this had increased to 15 inches. The snow lay nearly level, and was of very light texture. The downfall did not entirely cease until near midnight, and next morning it was found that 2 inches of fresh snow had fallen since 5 p.m., on a board then exposed. The old snow, however, had become so far compressed by its own weight, that the total depth, including the fresh snow, was reduced to 14 inches.

To ascertain the depth of water, three independent methods were employed.

1. The snow collected in the rain-gauge was removed, and melted on the morning of the 15th, and again on the morning of the 16th.

To effect the removal as accurately as possible, the snow about the gauge was trodden down and scraped away until a cylinder of snow remained above the funnel equal in diameter to the receiving surface.

2. At 5 p.m. on the 15th, the cylinder of an old gauge was inverted over 15 inches of snow, the whole of which was taken up with the cylinder. To the melted product was added the product of the 2 inches of snow which fell after 5 p.m., collected separately.

3. At 5 p.m. on the 15th, snow was removed from a gravel walk in such manner as to leave a block of snow 12 inches square, and 15 inches deep. This block being removed and melted, yielded exactly five pints of water, and this was reduced by calculation to vertical depth over an area of 12 inches square. The product of the 2 inches that fell after 5 p.m., was added as in the second experiment.

The mean result obtained by these three methods was 1.25 in. as the total depth of snow measured as water, and it is satisfactory, in view of the necessary roughness of the processes, that the largest deviation of any one result from the mean did not exceed four hundredths of an inch.

As regards the equivalence of snow and water on this occasion, I adopt the three following conclusions:—

1. From the mean of experiments 2 and 3, it results that 15 inches of fresh-fallen light dry snow, yielded 1.19 in. of water—proportion 12.6 to 1.

2. Fourteen inches of the same snow with an addition, measured 10 hours after it had ceased falling, yielded 1.25 in. of water—proportion 11.2 to 1.

3. The last 2 inches of the snow, collected and measured separately, yielded 0.09 in. of water—proportion 22 to 1. So great is the difference due to superincumbent pressure.

I know of no previous record of so deep a snow in this locality. The nearest approach was a depth of 12 inches on the 19th of March, 1867, just 20 years ago. In the great snow of January, 1881, the average depth here was 9 inches; in that of December last, it was $4\frac{1}{2}$ inches. The comparative absence of wind with the recent snow, and the lightness and dryness of the snow itself, reduced very much the inconvenience and damage sustained. The trees and shrubs were loaded to a degree very seldom seen, but even these suffered less injury than on some former occasions. The appearance of the trees was strikingly beautiful. The most troublesome consequences arose from the great weight of the snow on the roofs of houses, shutes in particular being borne down by the pressure.

GEORGE F. BURDER, M.D.

Clifton, March 25th, 1887.

From March 12th to 21st snow showers were frequent over the British Isles, but were generally slight with the exception of the fall of the 15th. On that day snow fell over almost the whole of the southern part of England and Wales, the fall being greatest over Monmouthshire and the mouth of the Severn, so that Dr. Burder had an opportunity of accurately recording almost, if not quite, its

greatest depth. In a northerly direction the quantity decreased rapidly, but over a large district extending southwards and eastwards was unusually great, though it varied considerably and apparently irregularly. The depth was carefully measured at the following stations :—

Clifton, Bristol	15 inches	Ross, Herefordshire	5 inches
Llanfrechfa Grange, Mon. 14 ..	„	Camden Square, London..	5 „
Tiverton	12 „	Orleton, Tenbury	2 „
Pinner Hill, Middlesex ...	9 „		

Although nearly all the snow fell in 24 hours, it was measured partly at 9 a.m. on 15th and partly at 9 a.m. on 16th ; it has, therefore, been necessary, in the following table of the yield of water, to include the record for both days :—

Div.	Station.	Snowfall, March 14th & 15th. in.	Div.	Station.	Snowfall, March 14th & 15th. in.
V.	Warminster	1·74	V.	Weymouth, Langton Herring ..	·91
XI.	Llanfrechfa Grange	1·41	XI.	Llechryd, Castle Malgwyn..	·70
VI.	Clifton, South Parade	1·25	III.	Oxford, Magdalen College..	·61
V.	Beamminster Vicarage ...	1·23	VI.	Cirencester, Further Barton	·60
„	Temple Combe, Stowell Rec.	1·23	II.	Strathfield Turgiss.....	·57
XI.	Cardiff, Ely	1·20	V.	Salisbury, Alderbury	·53
I.	Pinner Hill	1·10	I.	Finchley	·52
V.	Wells, Westbury	1·02	XI.	Llandovery	·52
„	Tiverton	1·00	VI.	Stroud, Upfield	·51

EXTREMES OF RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—The rainfall on the Radnor Forest for the last six months (October 1st, 1886, to March 31st, 1887) presents some very exceptional features, and I think that you may like to have a note of them.

There fell, from October 1st to March 31st last, in the six months at my station, 21·58 inches of rain, which may be taken probably, as nearly as possible, as the average. But there are two markedly distinct periods to it, from October 1st to January 19th inclusive (or three-and-a-half months), when 18·58 inches fell ; while from January 20th to March 31st (or two-and-a-half months) exactly 3 inches fell ; and from January 20th to March 20th inclusive (or two full months), exactly 1·50 inches fell, there having been only five days in the two months on which more than a tenth of an inch of rain fell, and only nineteen days on which one hundredth or more of rain fell. I may add that the dry period continues.

Yours very truly,

G. F. PEARSON.

*Downton, Kington, Herefordshire,
7th April, 1887.*

DAY AND NIGHT BREEZES.

To the Editor of the Meteorological Magazine.

SIR,—In calling attention to a mistake in my letter on this subject at page 6, where, line 28, "5.15 p.m." should be "5.15 a.m.," I may also state that, since writing that letter, I have received a paper by Mr. F. Chambers, read before the Royal Society, 19th June, 1873, and appearing in the *Philosophical Transactions*, entitled "The Diurnal Variation of the Wind and Barometric Pressure at Bombay;" in which, by separating the land-and-sea-breeze from the diurnal variation, the times of maximum and minimum of the North component are obtained probably more accurately, and are given as about 1 p.m. and 0.30 a.m. for the minima, and about 7 p.m. and 6 a.m. for the maxima.

This paper also gives Mr. F. Chambers' theories on the diurnal variation of the wind and of the barometric pressure. A curve shows the supposed diurnal variation of the wind at Bombay when the sea breeze is deducted. It exhibits "a double diurnal right-handed rotation in the same direction as the hands of a watch."

Mr. Chambers points out that Sir John Herschel, in his *Meteorology*, arts. 172 and 77a, has advanced the theory of "a morning and evening tendency of the wind to draw *towards* the points of sunrise and sunset, to compensate the overflow from off the heated atmosphere which takes place aloft in a contrary direction," and also one of "a general movement of air setting *outwards* from the heated hemisphere," together with a single rotation of the wind at any spot, in connexion with the diurnal variation of the barometer, but has not explained the double variation. The theory I suggested in your Magazine, Vol. XXI., p. 121, for 1886, seems virtually the same as the first of Herschel's, just given.

But Mr. Chambers thinks it probable that the movement *from* the heated hemisphere is more marked than the opposite movement, and that if we suppose oscillatory movements to follow the disturbance of equilibrium thus caused, we have a likely explanation of the diurnal variations at Bombay. He also examines the variations at Sandwick (in the Orkneys) and at Falmouth and Toronto, and finds decided support to his theory in the former, and to some degree in those at Falmouth and Toronto. The daily wind *veers*, on the whole, at all these places. As there are decided differences between the places named, and also between them and this north-east coast, is it not possible that one kind of breeze may be strongest at one place and another at another? Are not more observations required, especially in the centres of continents or islands? All the places named are on the shores of seas or lake, which circumstance complicates the phenomena with the addition of sea and land breezes.

Possibly further investigations have been made since the date of Mr. Chambers' paper, but in any case his facts seem not to be generally known.—Yours truly,

T. W. BACKHOUSE.

Sunderland, April 9, 1887.

REVIEWS.

Jahrbuch des K. Sächs. Meteorologischen Institutes, 1885. CHEMNITZ, 1886; la. 4to. with plates.

THIS volume, containing the observations for the year 1885, is the third of the new series of the publications of the Meteorological Office of Saxony. The first section (74 pp.) contains, as in previous years, the observations taken thrice daily at eleven stations of the second order. The synoptic Weather Charts, which previously formed part of this section, are now published in a separate volume, which we think is a decided improvement. The second division (64 pp.) contains the monthly results of 27 stations for each of the years 1876-81, for three hours daily, arranged in a convenient form for use. These tables fill up the gap which existed between the observations published by the late Dr. Bruhns and those by Dr. P. Schreiber, the present very able director. Dr. Bruhns published the results up to 1875, and the new series began with 1882, so that up to the present time the results for 1876-81 were missing. Part III. (138 pp.) contains the Administration Report of the Office for the year 1885, together with nine Appendices, being partly results of observations and partly communications of general interest, among which we would especially mention (1) a statement of all essential details respecting the stations, the periods of the observations, and the positions of the instruments from 1863-85. These particulars are of much value, as although we trust the Central Offices to render their observations as reliable as possible, yet it is more satisfactory that this information should be plainly stated as in the work now before us. (2) Monthly Rain Charts for 1885, and (3) a very comprehensive "Contribution to the Climatology of Saxony," dedicated to the memory of Dr. C. Bruhns. From this discussion we extract the following *average* values, calculated from observations at various stations in Saxony and for a series of years:—

	Rainfall (inches.)	Temp. Fahr.		Rainfall (inches.)	Temp. Fahr.
January	1·45 ...	29°·7	August.....	2·78 ...	60°·9
February	1·66 ...	31 ·8	September	2·07 ...	55 ·8
March	2·01 ...	34 ·9	October	2·13 ...	45 ·5
April	1·78 ...	44 ·1	November	2·08 ...	36 ·5
May	2·41 ...	52 ·0	December	2·13 ...	30 ·6
June	3·38 ...	58 ·6			
July	3·14 ...	62 ·8	Year.....	27·02 ...	45 ·3

The influence of the mountains in increasing the rainfall at some of the stations is clearly shewn in the various tables, while as regards temperature it is shewn that a difference of elevation of the stations does not always cause a lower temperature; the contrast between town and country, and mountain and valley, sometimes quite masks the recognised law of decrease of temperature with height.

We observe that Dr. Schreiber has broken through the rules laid down by the International Congresses, with respect to the arrangement of the observations, and has also changed the hours from 6, 2, 10 to 8, 2, 8, whereby comparisons with previous publications by

Dr. Bruhns are prevented. But for these important exceptions, we could not speak too highly of this valuable year book.

J. S. HARDING.

Die Meteorologie der Sonne und die Wetterprognose des Jahres, 1886.

Von Prof. K. W. ZENGER. 8vo., xii.-52 pages, and one heliogravure. Prag, 1887.

WE consider that the methods of solar photography to which Prof. Zenger has devoted himself for upwards of ten years ought to have been examined and reported upon fully and carefully. We do not think that Mr. Whipple would regard his abstract of Prof. Zenger's "Die Meteorologie der Sonne" as fulfilling these conditions, yet we are not aware that the subject has been elsewhere dealt with. Prof. Zenger may be entirely wrong, but if so, surely the right thing is for some one to prove him to be so and thus save time and thought in the future. The matter is very simple. In, or about, 1875 Prof. Zenger took some photographs of the Sun, and instead of getting a clear image he got one with wings, halos, and other appendages. It appeared to him that there was a distinct relation between these appendages and the weather which followed. He has continued to take these photographs almost every day for 12 years, and they are the basis of the pamphlet before us and of the one abstracted by Mr. Whipple in the "Quarterly Journal of the Royal Meteorological Society," vol. xii., p. 215. Mr. Whipple adds the following short note:—

"A close examination of the Kew Solar Photographs taken almost daily for more than ten years, has not revealed the presence in any of them of the appearances described by Prof. Zenger. Halo-like forms, due to irradiation or halation have been easily produced as an experiment, by over-exposing a prepared plate, even when the luminous source was but a candle. These are due to the glass plate supporting the sensitive surface; and it has been suggested to Prof. Zenger that he should employ paper or films in his future experiments in order to avoid this source of uncertainty in his results."

We have not a copy of "Die Meteorologie der Sonne," but we have had the pleasure of meeting Prof. Zenger more than once, we have seen and possess copies of many of his photographs, and we are most desirous on the one hand that he should have fair play, and on the other hand that if his photographs represent simply bad photography they should be branded accordingly. Mr. Whipple's opinion is tolerably apparent from the above note, but there are some remarks to be made upon it. The first is that the Kew photographs do perfectly that which they are intended to do, viz., represent the surface of the sun; but the sun's disc fills nearly the whole plate, while in the Prague photographs the peculiar appearances occupy a space at least twice as large as the sun itself, consequently they would be *outside* the plates used at Kew. We are not arguing that the Prague photos represent real phenomena—we express no opinion on that—but we do hold that similar appearances on the Kew plates were not to be expected. We rather gather from the present pamphlet that Prof. Zenger has adopted Mr. Whipple's suggestion and employed paper, and still obtains these blurred images

The apparatus used by Prof. Zenger is, we believe, both small and inexpensive; surely one or two skilled photographers will volunteer to bring matters to a crisis. For instance, if the appearances are due to real atmospheric or solar conditions, it is evident that two photos taken at the same place and at the same instant of time are bound to be alike; if the appearances are due to bad photography they ought to differ. Whether or not they are real weather indicators will be evident by comparing a set for even a month with the daily weather reports. Doubtless Prof. Zenger would prefer that the comparison should be made upon the lines adopted in his latest book, *i.e.*, picking up all the exceptional phenomena which occur on the right dates in any part of the world, but with so large an area to gather from, one could find a thunderstorm, snowstorm, cyclone, or flood on any date that one desired, and could thereby justify any prediction that could be made.

In the interest both of meteorology and of Prof. Zenger, we hope that some one, who has no preconceived views to push, and whose sole aim is to find out the truth, will write to Prof. Zenger at Prague, procure the necessary apparatus and publish the results obtained.

Über den Auf- und Zugang der Gewässer des Russischen Reiches.
 BEARBEITET VON M. RYKATSCHEW. 4to., iv.—312 pages, 3 maps.
 [2nd supplementary volume to the *Repertorium für Meteorologie.*]
 Eggers and Co., St. Petersburg, 1887.

THE reputation of Dr. Wild's *Repertorium* is level with, if not above, that of any meteorological publication in the world, and the present volume is well worthy of the series. There are many things which are done abroad which we are either too lazy or too uninterested to do. One of these is to notice the dates at which our rivers are frozen in the autumn and open for navigation in the spring. Of course we may be told that in the British Isles many winters pass without any river being frozen and that the phenomenon is too rare and of too little commercial import to be worthy of note. Perhaps so; but although we are aware that bridges, drainage, and other engineering operations have changed the *régime* of many rivers we still hold that a series of records of the dates at which any one part of any one river was frozen would be of considerable utility. But however this may be for ourselves, the matter is a very vital one for Russia, and in the volume before us it receives most careful and elaborate examination.

It is quite impossible in a short notice to do justice to this work, but we may indicate the nature of its contents by giving a partial summary of the data for one of the shorter rivers—the Onega for example, which flows from south to north and empties itself into the White Sea. There are six sets of observations, comprising altogether 170 records of the date of the ice breaking up and 147 of the river becoming ice-bound. The following is an epitome of the information.

Station.	Lat.	Lon.	Altitude. feet.	Period. years.	AVERAGE.		Ice free. days.
					Open.	Close.	
Kargopol	61°30'	38°58'	410	21	April 16	Nov. 2	200
Bereshnodubrowsk.	62 9	39 21	308	11	„ 27	?	...
117 miles from Sea..	62 50 ?	40 0 ?	115 ?	16	„ 30	?	...
98 „ „ „	62 55 ?	39 25 ?	98 ?	7	May 3	?	...
Turtschassow	63 7	39 15	82 ?	30	„ 3	Nov. 15	196
Onega	63 54	38 8	0	87	„ 10	„ 23	197

But it must be understood that the whole of the data are given *in extenso*, so that nearly four quarto pages are devoted to this one medium sized river. Some of the larger ones, the Wolga for instance is reported upon from 54 stations, and occupies between 20 and 30 pages. Altogether there are about 23,000 records from 921 stations from the year 1530 to 1880. And the book unlike some that we could name is not a mass of figures for some hypothetical Newton to work up—but is complete in itself, and accompanied by three large maps, showing by “Isopektiken”* or lines of synchronous freezing, by “Isotaken,”† or lines of synchronous thawing, and “Isopagen,”‡ or lines of equal duration of frost-boundness, the results indicated by all the mass of data here collected.

The only suspicion which has crossed our minds is, whether the observers all had the same idea of the closing and opening of the rivers. There may be somewhere in this large book a clear definition and a reference to the instructions given to the observers, but we have not seen it, and if no such instructions have been given (which we are loth to believe is the case in recent years) we hope that they will be issued forthwith. As regards 1530, 1609, 1739 and such like dates, it is hardly likely that the instructions were very precise.

However, this will doubtless be discussed in the second portion of the work, viz., that dealing with secular changes which we are glad to see M. Rykatschew promises us. He almost always gives us valuable information and the present work is an excellent specimen.

The Journal of the National Fish Culture Association, edited by J. W.

WILLIS BUND, M.A., F.L.S. Vol. I., No. 1; 8vo., 83 pages.

London: Blackfriars Printing and Publishing Company.

WE bid this new periodical a hearty welcome, because its primary object is the good and useful one of “Collecting and publishing periodically reports and information from this and other countries on fish culture and fisheries.” The present number has a special claim upon the patronage and attention of meteorologists, because it contains probably the best article ever written upon “The influence of Weather on the Migration of Fish,” by Mr. J. W. Willis Bund. We shall not epitomise this paper, but leave our fishermen readers to buy a copy or to join the association and so get one for nothing.

* *ισοπηχτιχός* equally fastened. † *ισοτήχω* equal melting.

‡ *ισοπάγος* equally a concrete mass.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCT., 1886.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
England, London	78·8	4	39·6	14	60·3	47·8	49·3	86	112·2	32·3	inches	23	0·10
Malta.....	88·4	20	62·3	16	78·5	67·8	63·7	75	145·7	58·0	·64	4	4·9
<i>Cape of Good Hope</i> ..	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Mauritius</i>	81·0	7	61·0	3	77·7	66·5	60·5	71	131·2	49·5	2·58	23	5·9
Calcutta.....	89·5	13 ^a	73·5	31	87·7	76·9	76·6	86	159·3	68·1	3·91	12	4·9
Bombay.....	90·4	29	74·2	25	85·7	76·9	75·7	83	150·6	68·8	1·69	7	5·4
Ceylon, Colombo	87·7	19	71·8	26	85·5	76·1	72·4	75	147·0	68·5	16·07	20	6·9
Melbourne.....	75·5	28	38·6	8	63·5	45·9	44·6	70	126·8	31·0	2·84	16	6·5
<i>Adelaide</i>	79·3	27	39·5	13	68·1	48·6	44·8	60	135·8	30·7	2·17	19	4·8
Wellington	66·5	23	37·0	31	57·3	46·8	45·9	80	134·0	33·0	5·63	21	4·3
Auckland	68·5	26	44·0	16	62·3	51·1	49·3	76	132·0	35·0	3·42	17	6·9
Jamaica, Kingston.....	96·4	1	66·0	17	92·4	72·1	72·0	81	...	...	3·90	14	5·6
Barbados	84·0	var.	71·0	var.	82·0	73·0	72·0	80	143·0	...	11·65	19	6·0
Toronto .....	...	...	...	...	...	...	...	...	...	...	...	...	...
New Brunswick, Fredericton .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg .....	...	...	...	...	...	...	...	...	...	...	...	...	...
British Columbia, Victoria .....	...	...	...	...	...	...	...	...	...	...	...	...	...

^a And 15, 17.

REMARKS, OCTOBER, 1886.

MALTA.—Mean temp. 72°·1; mean hourly velocity of wind 10·0 miles. Sea temp. fell from 78° to 68°. The three days, 19th to 21st, were unusually hot, and orange trees were much damaged.
J. SCOLES.

Mauritius.—Rainfall ·90 in. above, mean temp. of air and of dew point slightly below average; mean hourly velocity of wind 13·1 miles, 1·1 miles above average; extremes 30·2 miles, and 3·1 miles; prevailing direction E. by S. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 2°·2, and of dew point 1°·7, mean pressure ·113 in., and rainfall slightly below their respective averages; mean humidity, average; mean amount of cloud slightly above average. Prevailing winds S and N., strong on seven days; H on two days; T on three days; L on two. R. L. J. ELLERY, F.R.S.

Adelaide.—The coldest October ever experienced in Adelaide; mean temp. 3°·6 below the average of 29 years. Rainfall ·42 in. above average; pressure slightly below average. C. TODD.

Wellington.—On the whole a showery, unpleasant month, frequently stormy, with prevailing N.W. wind. Rainfall ·81 in. above, and mean temp. 1°·6 below the average. T and vivid L on 25th. Earthquakes on 11th, at 4·12 p.m. slight, and on 13th about 8·30 p.m., very slight. R. B. GORE.

Auckland.—A cold, showery and unsettled month; pressure, mean temp. and rainfall all slightly below the average. T. F. CHEESEMAN.

Barbados.—Pressure steady; mean temp. (76°) about the average; mean hourly velocity of wind six miles; rainfall considerably above the average. TS on 2nd. Five days more or less overcast. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
MARCH, 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	2·03	XI.	Castle Malgwyn	2·32
"	Margate, Birchington...	1·37	"	Rhayader, Nantgwillt..	4·15
"	Littlehampton	·89	"	Carno, Tybrith	2·58
"	Hailsham	1·43	"	Corwen, Rhug	1·72
"	Ryde, Thornbrough	1·06	"	Port Madoc	2·88
"	Alton, Ashdell.....	2·32	"	I. of Man, Douglas	1·81
III.	Oxford, Magdalen Col...	1·58	XII.	Stoneykirk, ArdwellHo.	1·70
"	Banbury, Bloxham	1·51	"	New Galloway, Glenlee	1·71
"	Northampton	1·37	"	Melrose, Abbey Gate...	1·84
"	Cambridge, Beech Ho...	1·26	XIII.	N. Esk Res. [Penicuick]	1·95
"	Wisbech, Bank House..	1·46	XIV.	Ballantrae, Glendrishaig	1·84
IV.	Southend .....	...	"	Glasgow, Queen's Park.	1·66
"	Harlow, Sheering	1·16	XV.	Islay, Gruinart School..	2·42
"	Rendlesham Hall	1·15	XVI.	St. Andrews, PilmourCot	1·15
"	Diss	1·98	"	Balquhider, Stronvan..	2·57
"	Swaffham	2·01	"	Dunkeld, Inver Braan..	1·45
V.	Salisbury, Alderbury ...	1·39	"	Dalnaspidal H.R.S. ...	2·72
"	Warminster	2·87	XVII.	Keith H.R.S.	·79
"	Calne, Compton Bassett	2·03	"	Forres H.R.S.	·89
"	Ashburton, Holne Vic..	3·25	XVIII.	Strome Ferry H.R.S....	2·96
"	Holsworthy, Clawton...	1·19	"	Tain, Springfield.....	...
"	Hatherleigh, Winsford.	·77	"	Loch Shiel, Glenaladale	5·13
"	Lynmouth, Glenthorne.	2·03	"	S. Uist, Ardkenneth ...	1·64
"	Probus, Lamellyn	2·02	"	Invergarry	2·72
"	Wincanton, Stowell Rec.	2·32	XIX.	Lairg H.R.S. ....	...
"	Taunton, Lydeard Ho ...	1·66	"	Forsinard H.R.S.	1·04
"	Wells, Westbury.....	1·81	"	Watten H.R.S.	·34
VI.	Bristol, Clifton	2·38	XX.	Dunmanway, Coolkelure	3·63
"	Ross	1·50	"	Fermoy, Gas Works ...	1·77
"	Wem, Clive Vicarage ...	1·54	"	Tralee, Castlemorris ...	1·45
"	Cheadle, The Heath Ho.	1·78	"	Tipperary, Henry Street	1·51
"	Worcester, Diglis Lock	1·16	"	Newcastle West	·39
"	Coventry, Coundon	1·70	"	Milton Malbay.....	1·10
VII.	Melton, Coston	1·61	XXI.	Gorey, Courtown House	1·85
"	Ketton Hall [Stamford]	1·65	"	Navan, Balrath	1·12
"	Horncastle, Bucknall ...	1·42	"	Mullingar, Belvedere ...	1·12
"	Mansfield, St. John's St.	1·87	"	Athlone, Twyford	1·57
VIII.	Macclesfield, The Park.	1·80	"	Longford, Currygrane...	1·16
"	Walton-on-the-Hill.....	1·42	XXII.	Galway, Queen's Coll...	1·27
"	Lancaster, South Road.	...	"	Clifden, Kylemore	1·58
"	Broughton-in-Furness ..	2·62	"	Crossmolina, Enniscoe..	1·88
IX.	Wakefield, Stanley Vic.	1·04	"	Collooney, Markree Obs.	1·79
"	Ripon, Mickley	1·74	XXIII.	Rockcorry.....	1·12
"	Scarborough.....	1·96	"	Warrenpoint	·96
"	EastLayton[Darlington]	2·16	"	Newtownards .....	...
"	Middleton, Mickleton ..	1·42	"	Belfast, New Barnsley..	1·56
X.	Haltwhistle, Unthank..	2·41	"	Cushendun	2·10
"	Shap, Copy Hill	1·53	"	Bushmills	1·91
XI.	Llanfrechfa Grange	2·99	"	Stewartstown	1·00
"	Llandoverly	2·69	"	Buncrana	2·00

MARCH, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which -01 or more fell.	Max.		Min.		In shade.	On grass.
				Dpth	Date.		Deg	Date	Deg	Date.		
I.	London (Camden Square) ...	1.65	+ .04	.37	15	12	57.5	27	22.4	14	16	20
II.	Maidstone (Hunton Court)...	1.89	+ .31	.33	15	14	...	...	...	...	...	...
III.	Strathfield Turgiss	1.70	+ .30	.45	15	11	57.4	29	15.2	19	15	24
IV.	Hitchin	1.36	- .12	.34	31	13	53.0	29 ^a	20.0	16	17	...
V.	Winslow (Addington)	1.66	- .10	.34	31	12	56.0	27 ^b	18.0	13	17	26
VI.	Bury St. Edmunds (Culford)	1.90	+ .34	.49	31	12	56.0	28	17.0	12	23	...
VII.	Norwich (Cossey)	2.05	+ .36	.51	31	11	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	1.27	...	.25	22	10	56.0	30	23.0	17	15	...
IX.	Barnstaple	1.69	- .80	.40	22	10	60.5	30	21.0	14	...	...
X.	Bodmin	2.08	- 1.08	.73	22	10	54.0	30	30.0	14	...	...
XI.	Stroud (Upfield)	1.44	- .37	.31	22	12	58.0	27	20.0	13	18	...
XII.	Church Stretton (Woolstaston)	1.62	- .54	.43	22	16	55.0	29	19.0	17	18	23
XIII.	Tenbury (Orleton)	1.37	- .50	.27	22	13	59.7	29	16.8	14	20	...
XIV.	Leicester	1.82	...	.45	22	14	58.8	29	21.0	13	17	30
XV.	Boston	1.17	- .12	.26	23	10	67.0	29	20.0	14	17	...
XVI.	Hesley Hall [Tickhill]	1.38	...	.39	11	13	59.0	29	19.0	18	16	...
XVII.	Manchester (Ardwick)	1.77	- .68	.51	22	9	50.0	29 ^c	24.0	13	16	...
XVIII.	Wetherby (Ribston Hall)	1.47	- .76	.59	23	7	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	3.17	- 1.59	.84	22	15	53.0	4	23.0	3	9	...
XX.	Hull (Beverley Road)	1.52	- .28	.35	11	19	58.0	29	23.0	17	15	18
XXI.	North Shields	1.82	+ .37	.50	11	15	58.5	29	18.5	17	17	19
XXII.	Borrowdale (Seathwaite)	4.52	- 5.37	1.33	26	12	54.0	5	20.0	13	14	...
XXIII.	Cardiff (Ely)	2.57	- .12	.70	14	10	...	...	...	...	...	...
XXIV.	Haverfordwest	2.32	- .87	.66	22	10	58.0	...	21.0	12	22	26
XXV.	Plinlimmon (Cwmsymlog)	2.70	...	.76	26	12	...	...	...	...	...	...
XXVI.	Llandudno	1.83	- .05	.39	14	8	51.0	5	26.4	17	11	...
XXVII.	Cargen [Dumfries]	1.33	- 1.45	.46	11	7	57.4	30	20.0	15	14	...
XXVIII.	Jedburgh (Sunnyside)	1.71	+ .14	.48	13	12	58.0	30	10.0	13	19	...
XXIX.	Old Cumnock	2.53	- .40	.45	10	14	57.0	30	13.0	13	18	...
XXX.	Lochgilthead (Kilmory)	3.54	- 1.07	.68	12	15	...	...	...	...	...	...
XXXI.	Oban (Craigvarren)	2.13	...	.58	26	12	57.9	30	25.0	12	8	...
XXXII.	Mull (Quinish)	3.54	...	.69	10	20	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	1.90	- .22	.7	11	10	...	...	...	...	...	...
XXXIV.	Arbroath	1.69	+ .06	1.17	10	8	58.0	2 ^c	18.0	12	12	...
XXXV.	Braemar	1.32	- .87	.63	10	15	55.2	22	16.2	16	22	28
XXXVI.	Aberdeen	2.11	...	.42	10	16	61.0	3	19.0	15	16	...
XXXVII.	Lochbroom	1.75	...	.38	27	14	...	...	...	...	...	...
XXXVIII.	Culloden	1.13	- .62	...	...	...	55.0	2	17.0	12	11	22
XXXIX.	Dunrobin .....	...	...	...	...	...	...	...	...	...	...	...
XL.	Kirkwall (Swanbister) .....	...	...	...	...	...	...	...	...	...	...	...
XLI.	Cork (Blackrock)	1.96	- .80	.60	21	9	62.0	29	24.0	16	11	...
XLII.	Dromore Castle	2.38	...	.55	10	11	60.0	29	25.0	17	...	...
XLIII.	Waterford (Brook Lodge) ...	1.82	...	.80	22	12	57.0	28	24.0	17	13	...
XLIV.	O'Briensbridge (Ross)	1.24	...	.28	11	11	55.0	30	27.0	13	13	...
XLV.	Carlow (Browne's Hill)	1.24	- .87	.56	22	11	...	...	...	...	...	...
XLVI.	Dublin (Fitz William Square)	1.49	- .24	.59	11	15	55.8	28	25.8	13	8	26
XLVII.	Ballinasloe	1.28	- 1.10	.25	24	12	54.0	29 ^c	21.0	13	19	...
XLVIII.	Waringstown	1.31	- .75	.30	24	17	64.0	30	20.0	12	15	23
XLIX.	Londonderry (Creggan Res.) ..	1.94	...	.50	24	19	...	...	...	...	...	...
L.	Omagh (Edenfel)	1.22	- .87	.45	24	13	55.0	30	22.0	12	17	20

a And 30, 31. b And 29. c And 30. d And 18. g And 14. h And 13, 18. i And 17. j And 22.
 + Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON MARCH, 1887.

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

ENGLAND.

STRATHFIELD TURGISS.—Severe wintry weather characterized the month, with S storms and bitter nights. On some days there was bright warm sunshine for a few hours. S on three days. H on two days. Wheat crop in excellent condition. Honey bee first seen on 11th, peacock butterfly on 25th.

ADDINGTON.—A fine month for the land. A very cold period occurred from 12th to 21st, and there were many severe frosts. Prevailing winds E. and N.E. Dense fog on 1st and 4th; four inches of S on 15th.

CULFORD.—An unusually severe month, and all vegetation very backward; fog on two days, S on four days.

LANGTON HERRING.—A very fine month; R or S fell on only ten days, and the total is .54 in. below the average of 12 years. With the exception of 1883, the coldest March in 16 years, the mean temp. being 4°·8 below the average; for eight days (13th–20th), the temp. never reached 40°, and at 9 a.m. on 17th, it stood at 27°, the lowest recorded at that hour in March during 16 years. Pressure generally high, and range slight. Severe S.W. gale on night of 22nd; solar halo on 17th; fog on two days.

BODMIN.—A very dry month, with much sunshine. Mean temp. 38°, 6°·6 below the average.

STROUD.—Slight S fell on 12th, and lay on the hills for an hour or so; and on night of 14th, 3 inches fell, and 3 inches more fell on 15th.

WOOLSTASTON.—Another month of continued frost. S fell on seven days. Mean temp. 30°·6.

ORLETON.—A very cold and dry month, with severe frosts almost every night, and slight falls of S at intervals till the 22nd, when the wind changed towards the S. for a few days, and the remainder of the month was milder. Fogs were frequent at the beginning of the month and there was a great darkness about 8.30 a.m. on the 10th. A great wind blew on the night of the 31st. Mean temp. more than 4° below the average of 26 years, and the lowest in that period with the exception of 1867 and 1883. The land was very dry and favourable for all farming operations, which were only checked by the severe frost. A little S on 12th, and the hills covered on 13th. About an inch of S on 14th, and another inch on 15th, an inch and a half on 22nd, and slight falls on other days.

ARDWICK.—March commenced rather cold, but fine, and there were many frosty mornings with low temperature; the latter part was cold, with snowfalls, E and wind.

HULL.—A cold month, with much frost and S, from 11th to 21st.

NORTH SHIELDS.—S on 11 days. Fog on four days.

WALES.

HAVERFORDWEST.—Great dryness of the air, much sunshine, and severe frosts were the characteristics of the month. Wind E. and E.N.E. Rainfall small, except on the mountains. No S.

LLANDUDNO.—The old adage as regards the weather in March, was literally fulfilled. It came in like a lamb, and went out like a lion. For the first ten days there was not a drop of R; though a few of these were dull, they were all decidedly calm and very enjoyable. A moderate S.W. gale blew on 22nd, but with this exception there was no noteworthy atmospheric disturbance till the 31st, when about 5 p.m. the wind which was W. gradually veered to N., and blew with great force during the whole night. Though S was visible on the distant hills during a considerable portion of the month, very little fell at Llandudno, and the little that did fall soon melted. S and sleet fell on 13th and 14th, and H on 22nd. The mean temp. (40°·3) is 3°·1 below the average. There was a fair amount of sunshine, and notwithstanding a somewhat low temperature the month as a whole was seasonable and fine.

SCOTLAND.

CARGEN.—Very cold weather prevailed for about ten days in the middle of the month, the mean temp. from 12th to 21st being $33^{\circ}6$. Mean temp. of the month, 1° below average. Sunshine 36 hours below average; E. winds prevailed on 15 days. S 3 inches deep on 11th.

JEDBURGH.—The weather as a whole was cold and ungenial, but while there was little vegetation the cold winds were favourable for drying the earth for seed sowing. S on six days, seven inches deep on 12th.

ABERDEEN.—For upwards of a week at the beginning of the month no R fell, but this was succeeded by a severe S storm, which continued for a week, with low night temp. Rainfall about the average. Aurora was seen on three nights, and a violent N.W. gale blew on 31st, accompanied by S and sleet.

LOCHBROOM.—The first nine days of the month were like summer, but the remainder of the month was very variable, and at times very severe, with S on several days.

CULLODEN.—The weather during the month was dry, no R falling between the 1st and 19th, and the temp. was low throughout.

IRELAND.

CORK.—March was fine and dry to the 10th, then "many weathers" during the remainder.

DROMORE.—A very fine month.

WATERFORD.—A hard dry month, good weather for farm work which is very forward. S on four days, and the Comeragh mountains covered from 23rd to 25th. Fog on four days.

O'BRIENSBRIDGE.—A month of extraordinarily fine weather.

DUBLIN.—The month was very cold—at first dry, then snowy and finally squally and showery with the exception of the 29th and 30th. Mean temp. $41^{\circ}3$, about 2° below the average, $1^{\circ}6$ below that of February, and $0^{\circ}2$ below that of January. Prevailing winds N.W., W., and N.E; mean humidity 82, mean amount of cloud 6.1.

BALLINASLOE.—Rainfall less than half the average of 14 years. A whirlwind and two waterspouts occurred on the 10th inst., one at 2.20 p.m., and the other at 4.15 p.m.

EDENFEL.—Up to the 9th the weather was of the unprecedentedly fine character that marked the month of February, many of the days were clear, calm and balmy, and even during the second week—a severe one in many parts—there was nothing here to disturb ordinary agricultural operations. From the 22nd to 27th, equinoctial disturbances with sleet and R squalls recalled for the first time the usual March character, but the month went out as fine as it began.

PAMPHLET EXCHANGE.

Copies of the following pamphlets can be had on application, provided the cost thereof be enclosed in the same cover. When all the copies have been distributed, the stamps (less postage) will be returned.

Author.	Title.	Price.
HANN, DR. J.	Bericht erstattet dem zweiten Internationalem Meteorologen-Congress ueber die Beobachtungen auf hohen Bergen und im Luftballon.....	2½d.
"	Theorie des Psychrometers	2½d.
HARTL, H. ...	Ueberden Zusammenhang zwischen der terrestri-schen Strahlenbrechnung und den Meteorolo-gischen Elementen	2½d.
"	Bemerkungen zur täglichen Oscillation des Barometers	2½d.

G. J. SYMONS.

62, Camden Square, N.W.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCLVI.]

MAY, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

SEVERE WINTERS AND VEGETATION.

WE picked up, a week or two since, from a Paris bookstall, the work by M. Baltet, mentioned below,* and on our return to London we found awaiting us Mr. Henslow's report upon the same subject.† The coincidence in time was remarkable, considering that nearly eight years have elapsed since the frost to which they refer, while the fact of both being 8vo., and one occupying 340 pages and the other 338, is a curious addition to the parallelism. It will be noticed, however, that the French report was published five years before the English one, and yet Prof. Henslow does not appear to have seen it. The style of the two books is as dissimilar as possible. M. Baltet's memoir was submitted for examination to M. J. A. Barral, and we can hardly give a better epitome than by translating M. Barral's report presented in August, 1881.

“A manuscript memoir on the action of frost on vegetation, has been forwarded to the Society by M. C. Baltet, nurseryman at Troyes (Aube), well known by important contributions to forestry and horticulture; the Commission considers that it is its duty to call special attention to this memoir, which is in all respects worthy of it.

“After comparing the severe winter of 1879-80 with the celebrated winters of 1709, 1788, 1795, 1829, 1838 and 1871, M. Baltet examines successively the condition of vegetation during the persistence of the cold, the effects traceable to snow, the action of sunshine on frozen vegetation, and the deterioration of its tissues.

“Then he considers the effects of the frost on trees and shrubs, in nurseries and gardens, in woods and forests, and on the vines. The chief part of the work is an alphabetical list of shrubs and trees,

* *Société Nationale d'Agriculture de France. De l'action du Froid sur les végétaux pendant l'hiver, 1879-80, par M. C. BALTET. 340 pages 8vo. J. Tremblay, Paris, 1882.*

† *Journal of the Royal Horticultural Society The Frost Report. On the effects of the severe frosts on vegetation during the winters 1879-80 and 1880-81, by Rev. G. HENSLOW, M. A., F.L.S. 338 pages 8vo. London, 1887.*

giving for each its popular and its botanical name with that of the family to which it belongs, and the country of its origin, and an account of its behaviour during the frost. This alphabetical arrangement renders it very easy to find all the data respecting any plant.

“The whole work shows profound knowledge and keen observation on the part of the author. The facts collected by M. Baltet as to the relative hardihood and frost-resisting power of various species and varieties of fruit trees will be of great value to agriculturists, and the same may be said with respect to decorative trees.

“Wherefore the Commission recommends the Society (1) to award a gold medal to the author, and (2) to print his memoir *in extenso*.”

So far M. Barral. For ourselves we own to a feeling of regret at not being able to quote many pages from this most pleasantly written book. We can hardly better indicate its character than by taking a few items from the table of contents—the head line of each chapter is in italics. I. *Principal causes of the severity of the frost of 1879-80*. Intensity of the cold in France. Temperatures of -22° F. (i.e. 54° below freezing point) are reported from five Departments, and in Aube -33° F. is reported, but M. Baltet quotes it with a caution, as he is not sure about the accuracy of the thermometer. Previous severe winters. Primary and secondary causes of the severity of the frost. II. *Effects of the persistency of the frost on vegetables and animals*. Temperatures and the number of consecutive days of frost in various parts of France. Comparison with previous winters in which the cold had been more intense, but of shorter duration. Effects on animals, birds, insects, and fishes. Influence on migratory birds. III. *Relation between altitude and cold*. Movement of cold air-currents. Effect on the firs in la Sologne and in the Vosges. Vegetation near stagnant and near running water. (IV). *Effect of snow*. Comparative experiments by M. Becquerel on bare and on snow-covered ground. Depth of frozen soil in various parts of France. (V). *Action of the sun on frozen plants*. Actinometry, Influence of aspect. Effects due to alternations of frost and of thaw. Effect of the drought in the spring of 1880. (VI). *Abnormal state of vegetation when the frost began*. The cold spring and wet summer of 1879, had rendered vegetation late. Relative state of vegetable tissues after dry and after wet seasons. (VII). *Deterioration of tissues by frost*. Mechanical effect of frost. Action upon evergreens. (VIII). *Effects of frost in nursery grounds*. (IX). *Effects in parks, gardens and along the roads*, also in the squares, &c., in the town of Troyes, and on the indigenous vegetation. (X). *Effects of the frost on woods and forests*. (XI). *Effects in orchards*. (XII). *Effects on the vines*. (XIII). *Alphabetical list of trees and shrubs destroyed, damaged, or uninjured, by the frost*. (XIV). *Meteorological observations at Troyes*.

We now turn to the English volume which is a wonderful mass of statistics rather than a memoir—the labour expended in getting it ready and in working it up has been immense, and as a storehouse of

facts it is without equal or precedent, but it seems as if one wanted another volume to summarize the information. First we have a preface of two pages explaining that the materials were collected by a sub-committee of the Royal Horticultural Society, and that other works have been referred to in order as far as possible to eliminate all doubtful records. Then follows an introduction of sixteen pages, which would more appropriately have been called the report, since there is nothing else in the way of a general summary. This introduction is really the only part of the volume that one can read straight away, all the rest is formed of tables or of reports from individual stations. It deals with—(1). An epitome of the characters of the severe winters from 1837 to 1881. (2). The distribution of temperatures. (3). The grouping of counties into divisions. (4). The effect of soils. (5). Subterranean frost and delayed evidence of injuries. (6). Age and its effects. This is followed by very carefully compiled indices of—(1). Counties. (2). Low temperatures. (3). Plants (arranged alphabetically), but (unfortunately we think) not in column. (4). Species, varieties and individuals, shewing different degrees of injury and hardiness. (5). Miscellaneous matters. These indices are perfect trophies of industry, and as far as we have examined them are wonderfully free from errors. In fact—the collecting and classifying of the data is exceptionally well done, and we want only a few short chapters with some such headings as those of M. Baltet, but dealing with the phenomena as observed in the British Isles.

By-the-by, neither author refers to details of injury by the frost of 1709, yet they are to be found in an 8vo. book published in 1717, with some such title as :—

“Lives of the French, Italian and German Philosophers, with abstracts of their choicest pieces; on the Feathers of Birds * * * Trees killed by the frost of 1709, &c.”

FLOODS IN DEMERARA.

Disastrous floods of an unprecedented kind have been experienced on the east coast of this Colony, by which the poor inhabitants of the district are suffering severe losses and indescribable privations. The following description of the scene is taken from the *Argosy* :— Many villages with their provision and pasture ground annexes are (or were, for we are glad to be able to say that the rains are abating) from two to four feet under water, the villagers' huts looking like bathing machines in a placid sea, water up to the doorstep, frequently above it, no road to be seen, not a blade of grass for cow or mule, or a dry foot of ground for the smaller stock. The people were helpless and no help could be extended to them in the way of relieving their lands of the deluge; they had simply to sit and suffer, to awake in the morning with nothing to do, their farms all lost to sight, crops ruined, and all attempts at cultivation impossible.

ROYAL METEOROLOGICAL SOCIETY.

At the meeting of this Society on April 20th, Mr. W. Ellis, F.R.A.S., President, in the chair, Mr. Robert Barnes, M.D., F.R.C.P., and Mr. L. L. La Trobe-Bateman were balloted for, and duly elected Fellows of the Society.

The following papers were read :—

(1.) "The Storm and Low Barometer of December 8th and 9th, 1886," by Mr. C. Harding, F.R.Met.Soc. This gale will long be remembered as the one in which 27 lives were lost in the lifeboat disaster off Formby through the capsizing of the Southport and St. Anne's lifeboats. The violence of the storm was felt over the whole of the British Islands, as well as over a great part of the Continent of Europe, a gale blowing simultaneously from Norway to Spain. The strongest force in the United Kingdom was experienced in the west and south-west, and the highest velocity recorded by any anemometer was 80 miles in the hour, registered at Fleetwood; while at Valencia, Scilly, and Holyhead the velocity reached 70 miles in the hour. The most exceptional feature of the storm was the extraordinarily low reading of the barometer and the long time that the mercury remained at a low level. The absolutely lowest authentic reading was 27·38 in. at Belfast, and the barometer fell below 28 inches over a great part of England, Scotland, and Ireland. At Aberdeen the mercury was below 28 inches for 18 consecutive hours, and below 29 inches for more than 60 hours, whilst in the north of England the barometer readings were equally exceptional.

(2.) "Report of the Wind Force Committee," drawn up by Mr. G. Chatterton, M.A., F.R.Met.Soc. In this report, which is a preliminary one, the Committee has dealt mainly with that portion of the investigation relating to Beaufort's Scale of Wind Force and the equivalent velocity in miles per hour. The Committee has compared the velocities recorded by the anemographs at Holyhead, Falmouth, and Yarmouth, with the entries of Beaufort's Scale in the logs of the neighbouring lightships and lighthouses for the year 1881, and gives the results in a table. After a careful consideration of the whole of the results of this investigation, the Committee is of opinion that the velocities shown by the Yarmouth anemograph, corresponding to Beaufort's Scale as recorded on board the lightships, are too high, and that the velocities shown by the Falmouth anemograph are probably too low. The Committee, however, has not yet had before it sufficient data to determine with any degree of certainty the relation between Beaufort's Scale of Wind Force and the equivalent velocity in miles per hour; neither is it able to recommend any existing scale that can be adopted or modified.

(3.) "A new form of Velocity Anemometer," by Mr. W. H. Dines, B.A., F.R.Met.Soc. In this instrument an attempt has been made to measure the velocity of the wind by the rotation of a small pair of windmill sails, the pitch of the sails being altered automatically,

so that the rate may always bear the same ratio to that of the wind. The mechanical details are briefly as follows—A helicoid is fixed at the front, and a small pair of sails of variable pitch at the back of a steel rod, and just behind the helicoid a light fan, which can turn on the same axis, but is independent of the helicoid and sails. If the rotation be too rapid the fan turns in the same direction as the helicoid, and by its motion alters the pitch of the sails, so that their motion is retarded; if, on the other hand, the friction be increased, or from any other cause the motion become too slow, the fan is turned in the other direction, and the rate is increased. The motion is communicated to a vertical rod which passes down the hollow pivot on which the instrument turns. It is kept facing the wind by a vane. It is convenient to connect the vertical shaft to the recording dial by a light flexible wire, all that is necessary being to place the dial approximately beneath the anemometer. By this means the trouble of ascending a high tower or ladder is avoided, except when oil is required.

(4). "Description of Two New Maximum Pressure Registering Anemometers," by Mr. G. M. Whipple, B.Sc., F.R.Met.Soc. The simplest instrument is a modification of the Lind's, Hagemann's, or Pitot's water pressure anemometer, provided with an apparatus for registering the maximum height the water attained during the period which elapsed since the last setting of the instrument. The second form of registering maximum pressure anemometer is derived from the ordinary pressure plate instrument. A circular metallic disc of $9\frac{5}{8}$ in. diameter, exposing a surface of half a square foot is kept at right angles to the wind by means of a suitable vane. This disc is perforated by eight circular apertures, each of $1\frac{3}{8}$ in. diameter. Behind each aperture a disc of $1\frac{1}{2}$ in. diameter is loosely held *in situ* by means of a bent lever loaded with a weight. These weights are arranged so as to press upon the different discs with pressures proportionate to the values usually assigned to wind pressures measured by the various degrees of the Beaufort scale. On noticing which is the most heavily weighted disc displaced, one sees at once the maximum pressure.

THE WINTER AT PAU.

We have been favoured by one of our correspondents who has been passing the winter at Pau, with a record of the total rainfall in each month. They have had as much in five months as London gets in a year.

1886.			1887.		Total
Oct.	Nov.	Dec.	Jan.	Feb.	
5·60	3·10	8·30	7·49	·54	25·03

The record shows a fall of 8 or 9 inches of snow on December 20th, and temperatures of 14° F and 20° F on December 22nd and January 3rd respectively.

REVIEWS.

Observations upon the Climate of Uckfield, Sussex, and its neighbourhood from 1843 to 1870. Second Edition, with some additional observations and statistics of rainfall to the end of the year 1885. By C. LEESON PRINCE, M.R.C.S., F.R.A.S., F.R.Met.Soc., &c. 8vo. Lewes, 1886.

ABOUT fifteen years since, we reviewed the first edition of this work, and all the praise it then received is equally due to this edition. And indeed the book is more valuable in the ratio of 14 to 9, because whereas the former dealt with the years 1843 to 1870, this deals with those years plus 1871 to 1885.

We need not again describe the work in detail; we will deal with only three items.

A rainfall record, quite continuous and only very slightly affected by change of position during 43 years, is rather a *rara avis*. It, therefore, becomes important to determine some of the constants:—

The mean 1850-9	=	30·025	=	99 per cent. of 43 years mean.
1860-9	=	31·236	=	104 " " "
1870-9	=	31·020	=	103 " " "
1843-63	=	29·207	=	97 " " "
1843-70	=	29·392	=	98 " " "
1843-85	=	30·060	=	100 " " "
1864-85	=	30·874	=	103 " " "
The wettest 1852	=	50·55	=	168 " " "
The driest 1847	=	17·58	=	58 " " "

A very useful table is given of all rains of 1 inch and upwards in 24 hours, which is remarkable for the few large entries; there are only four which reach or exceed 2 inches

1852, Oct. 4	.....	2·12 inches.
1856, Sept. 27	.....	2·38 "
1865, Oct. 18	.....	2·40 "
1868, July 11	.....	2·10 "

A remarkable record of a hailstorm on June 24th, 1872, is contributed by Coventry Patmore, Esq., who was then residing at Heron's Ghyll, near Uckfield. "The hailstorm was quite unlike anything I have ever before or since seen or heard of. The afternoon was fine and quiet, when I saw a dense grey veil, apparently a furlong or so in breadth, approaching the house from the south. It was about a mile off when I first noticed it, as I knew by its obscuring in its course certain objects which lay at that distance. Sunshine was on each side of it. In a few minutes it reached the house. There was one clap of thunder, whether at the time of its arrival or a little while before I cannot recollect. For somewhat less than two minutes the hail came down, with a sudden but not very violent blast of wind, in such quantities that nothing could be seen thirty yards from our windows. In those two minutes my rain gauge measured nearly 1½ in.—that is to say, about as much as falls in an ordinary heavy downpour of twenty-four hours' duration. The

forms of the hailstones and their way of falling were not less remarkable than their quantity. About half of them were ordinary hailstones as to spherical shape and construction, in concentric layers, only they were about the size of ordinary marbles. The other moiety were clear discs of ice of about the diameter of a penny piece and twice as thick, perfectly well formed, and in numberless cases having small projections on one or both sides, which made them look like the covers of small stewpans with their handles.* Here and there was a mass of clear ice of a different form. The largest I picked up was about the size of a bantam's egg, hollow, and formed with spiral ridges. I did not weigh any of these hailstones, but a neighbour told me that he had picked up eight which weighed an average of two ounces each. I do not think that I saw any of more than half that weight. But what surprised me more than their size was their way of coming down. In my eagerness to examine the stones, I hastened out of the window from which I was looking without my hat on. I felt the blows of the ice-balls almost as little as if they had been snow-flakes. No glass was broken, no trees or shrubs injured; and a friend who was driving two high-spirited horses through the thickest of it told me that they took no notice of it whatever, though he should have been sorry to have been driving them through an ordinary hailstorm. The only way I can see of accounting for this extraordinary fact is the supposition that these masses of ice were formed and sustained in a funnel of wind, of which the extreme point or nose did not reach the earth, although it passed close above it; so that when the weight of the stones overcame the sustaining force of the hurricane, they had only a hundred or two feet to fall through."

On page 271, Mr. Prince refers briefly to the phenomenal sunsets of the winter of 1883. He considers that dust alone would not explain the phenomena, but seems to think that they may be explained as due to dust *and* vapour jointly projected to a great height by the eruption of Krakatoa.

Katalog der Meteorologischen Beobachtungen in Russland und Finland.

VON E. LEYST. Vierter Supplementband zum Repertorium für Meteorologie. 4to, xxii.—435 pages. St. Petersburg, 1887.

THIS is a sort of life-history of the observations made at upwards of 1,100 towns and villages in Russia. We have tested it in sections with which we were familiar, and have not found a single error. In a few cases we think that a letter or a post card (if they have such handy things in Russia—we have had them from nearly every other country in Europe, but never saw a Russian one) would have solved difficulties now left in this book for future generations—but real errors seem very scarce.

* Almost identical with the pattern described and engraved in a letter from Col. Ward, from Bavaria.—See *Met. Mag.*, vol. xv. (1880) p. 134.—ED.

Concerning Nishne-Tagilsk,* M. Leyst says he has seen no later publication by Prince Demidoff (or Demidow as he prints it), than that for the year 1865, but that he is not sure whether subsequent years have been published or not. We believe that 1865 is the last; we have not seen anything later, and 1865 is the last at the Royal Meteorological Society, at the Royal Observatory Brussels, or on our own shelves. We had been hesitating the account of which station to translate so as to give our readers an idea of the mass of information given, and we decided upon Baku—known from time immemorial for its Fire-temples, and now of almost untold importance as the centre of a mineral oil trade of the magnitude of which not one Englishman in a thousand has the faintest idea. But we are confronted by $1\frac{1}{4}$ pages, quarto of small type—say 3 pages of this magazine—this is too much, so we will abridge it so as to give the general drift of it without the details.

BAKU (SOUTHERN CAUCASUS).

Lat. $40^{\circ}22'$ N. Lon. $49^{\circ}50'$ E. (of Greenwich). Altitude 7 ft. above sea.

Prof. Abich established a station in 1847 at the old hospital, the observations being taken by the dispenser, but after six months the instruments were transferred to the Customs, and the observations made by the director of Customs. In 1852, on the recommendation of Prof. Abich, they were returned to the hospital, and the original observer, E. Andreew, continued the records until his death in 1857.

After a short interruption the Director of Customs resumed the observations in 1857, and has continued them till the present time. Up to November 10th, 1858, the observations were made close to the Custom House, since that time they have been made at the observer's residence in the suburbs. Details are given of the observation hours, which were too frequently changed, but were generally 7 a.m., 1 p.m., 9 p.m. All the usual elements were observed. Then follows a list of the observations which have been published, stating when, where, how and by whom, and finally it is stated that the original observation books are in the observatory at Tiflis.

A second set of observations was established by the Navy on June 1st, 1850, which besides the usual elements included the level of the water, and the temperature at the surface and at $3\frac{1}{2}$ fathoms. The observations seem to have been at first carefully taken, but about 1874 they were so evidently untrustworthy that none have since been published.

A third series was started at the Naval Hospital in 1881, under the care of the Principal and Assistant Medical Officer, and these observations are in progress at the present time.

We should have been glad had the volume contained a series of maps showing the sites of all the stations, as although the latitude and longitude is given for nearly every station, it leaves a heavy task for readers to produce maps of the stations for themselves.

* This used to be written Nijné Taguilsk.

Lastly, we are glad to see that the author has adopted strict rules for the reproduction in ordinary type of Russian place names. This is a step in the right direction, and though it puzzles one to see Enisseisk where we used to have Yeniseisk, or Jenisseisk, Yakoutsk has definitely taken its place among the J's as Jakutsk, which curiously enough does not agree with either of the eight ways of spelling the name quoted in *Meteorological Magazine*, Vol. XX. (1885). p. 69. Again, Katharinenburg and Ekaterinenburg both disappear to be replaced by Ekaterinburg. A very large number of places of which the name began with hard C (like cup, which obviously ought to be spelled kup) have been removed from the C to the K, but we are puzzled to know why Catharina not far from Dorpat is left among the C's, while the compounds of Katharine, Katharinenburg, Katharinenlaw, and Katharinenstadt are all among the K's.

APRIL SNOW STORMS.

Snow fell at Shrewsbury for about two hours on 26th, and at times the fall was very heavy.

There was a heavy fall of snow, followed by rain, at Wolverhampton, and the weather was very cold.

In Birmingham on Tuesday, 26th, the weather was intensely cold, and shortly after noon snow commenced to fall heavily, and continued without cessation for two hours. On the roofs and in exposed places it lay, and gave the town a wintry appearance. Severe weather is also reported from several of the midland districts.

North-East Lancashire was visited by a heavy snowstorm on the night of the 26th. The flakes were large, but melted on the ground. The weather was bitterly cold.

A Kendal correspondent states that the whole of the Lake District presented quite a wintry aspect on Wednesday, 27th. Snow began to fall between six and seven o'clock, and continued for about an hour. The storm was a sharp one, two or three inches of snow having fallen. Coming after comparatively mild weather, much harm will be done to fruit trees and vegetation. From the hill districts of Cumberland very wild weather is reported, causing sheep farmers much anxiety.

The weather in Monmouthshire has been very severe, and heavy snowstorms have prevailed. The mountain ranges in North Wales were covered with snow on Tuesday.

Further downfalls of snow occurred in North Wales on Wednesday morning, covering the mountain ranges. Snow lies to the depth of many feet on Snowdon, Cader Idris, and the other lofty peaks.

A remarkably heavy storm of snow fell all over Western Perthshire on the 26th, and, although the snow melted on the lowground, there was a depth of from one to two inches on the hills. The temperature was very low.

INJURY BY LIGHTNING.

To the Editor of the Meteorological Magazine.

SIR,—You were kind enough to reprint as leading article in the last issue of your excellent Magazine a translation, published by the U.S. Signal Service, of the general conclusions drawn from my investigations into the injury done by lightning in Germany. The anonymous writer has translated pretty well, except Section VIII., where is stated just the contrary of what I wrote and meant. You and your readers may judge by the following juxtaposition :—

Translator.

8. In Hesse the parts protected best are regions along the Rhine, where the encircling hills and mountain sides are interposed to protect them. But the danger is increased where, as in the case of Rhine-Hesse, the country above is wooded.

Author (Translated by himself).

8. In Hesse the risk of danger from lightning is increased in the low-lands of the Rhine-valley, while the mountainous districts of the "Odenwald" and of the "Vogelgebirge," are the parts protected best. In the latter case the protection is due to the situation of the villages in deep valleys overtopped by higher objects (as peaks, rocks, trees, &c.,) but the danger becomes much greater for houses situated in the flat land along the Rhine, especially, if there are so few forests as in Rhine-Hesse.

I think your idea to establish a pamphlet exchange a most happy one, which I hope will be made much use of. I propose to send by the same post for this exchange, copies of some of my last papers.

Yours very truly,

GUSTAVUS HELLMANN.

Berlin, S. W. Ritterstr. 67.

 EARLY METEOROLOGY.

An almanac three thousand years old, found in Egypt, is in the British Museum. It is supposed to be the oldest in the world. It was found on the body of an Egyptian, who had doubtless regarded it with as much reverence as he did the Egyptian Bible—"The Book of the Dead"—and, indeed, it is strongly religious in character. The days are written in red ink, and under each is a figure, followed by three characters, signifying the probable state of the weather for that day. Like other Egyptian manuscripts, it is written on papyrus. It is written in columns. It is not in its integrity, but was evidently torn before its owner died. It clearly establishes the date of the reign of Rameses the Great, but contains nothing else of value.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOV., 1886.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.	
	Temp.	Date.	Temp.	Date.										
England, London	58·8	1	30·0	23	50·0	39·3	41·1	88	82·1	22·2	inches	2·71	14	6·0
Malta.....	76·8	14	48·0	24 ^c	68·6	56·9	53·8	79	125·7	42·3	4·07	13	5·2	
<i>Cape of Good Hope</i>
<i>Mauritius</i>	82·3	30	64·8	3	79·0	68·3	62·3	70	136·6	58·3	1·19	14	5·8	
Calcutta	85·8	1	60·0	30	82·8	67·1	65·9	76	147·3	47·9	·00	0	2·6	
Bombay.....	91·8	3	69·9	12 ^d	86·2	74·7	71·4	74	144·7	61·0	·61	2	2·6	
Ceylon, Colombo	92·0	27 ^a	71·6	26	86·6	73·8	71·0	73	146·0	65·0	6·45	14	6·6	
Melbourne.....	95·4	24	43·8	15	73·2	51·4	49·2	65	146·8	33·5	2·67	6	5·5	
Adelaide	99·1	10	46·5	14	79·9	55·8	47·5	48	156·3	36·8	1·07	6	3·7	
Wellington	69·3	28	39·0	11	62·1	49·7	50·3	83	145·0	35·0	4·27	12	4·3	
Auckland	75·0	20 ^b	47·0	12	68·0	54·0	52·4	74	150·0	36·0	1·41	11	6·4	
Jamaica, Kingston.....	95·8	3	63·8	29	91·9	69·5	69·5	77	...	...	·05	3	3·0
Barbados	83·0	1	69·0	26	80·0	71·0	71·3	80	145·0	...	19·01	21	7·0	
Toronto	62·0	2	14·5	30	42·0	29·0	29·4	75	...	12·0	2·65	17	7·0	
New Brunswick, Fredericton	62·7	7	10·2	28	42·1	27·7	30·4	78	...	...	6·07	18	7·0
Manitoba, Winnipeg.....	55·9	1	— 22·0	29	27·6	5·3	13·8	79	...	...	·57	8	5·0
British Columbia, Victoria	57·0	3	28·0	8	50·0	36·4	...	...	...	...	1·92	14	...

a And 28. b And 25. c And 26. d And 24.

REMARKS, NOVEMBER, 1886.

MALTA.—Mean temp. 61°·4 ; mean hourly velocity of wind 8·4 miles. TSS on 9th, 16th and 21st, the last accompanied by H. Etna visible on 27th, covered with S to the sea line. Sea temp. fell from 71° to 66°. J. SCOLES.

Mauritius.—Mean temp. of air and of dew point each 1°·1, and rainfall 20 in. below average ; pressure slightly above average ; mean hourly velocity of wind 11·7 miles, 0·3 miles above average ; extremes 27·2 miles on 6th, and 3·3 miles on 9th ; prevailing direction E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·7, of dew point 0°·8, rainfall 17 in., and pressure slightly above their respective averages ; mean humidity and mean amount of cloud slightly below average. Prevailing winds S. and S.W., strong on five days ; L on 3rd, 24th, and 29th ; TS on 12th ; H on 12th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·1, rainfall 11 in., and pressure 041 in. above their respective averages ; mean amount of cloud 1·0 below average. C. TODD.

Wellington.—Weather generally fine, but very strong N.W. wind prevailed with frequent gales, and showers at intervals during the month ; rainfall average ; mean temp. 0°·6 below, and pressure 181 in. above average. Slight earthquakes were felt on 10th and 14th, and a smart shock on 26th. R. B. GORE.

Auckland.—An unusually fine month, with less than half the average R ; pressure considerably, and mean temp. slightly above the average. T. F. CHEESEMAN.

Barbados.—Pressure steady ; mean temp. (76°) 2°·2 below the average ; rainfall greatly above the average, and only once exceeded in 35 years ; max. fall 4·75 in. on 3rd. Prevailing wind N.E. on 25 days, S.E. on five days ; mean hourly velocity seven miles, one mile below the average ; extremes 15·2 miles and one mile. TSS on 7th and 19th. Eleven days were overcast. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
APRIL, 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	1·94	XI.	Castle Malgwyn	1·42
„	Margate, Birchington...	1·60	„	Rhayader, Nantgwillt..	2·50
„	Littlehampton	1·02	„	Carno, Tybrith	2·14
„	Hailsham	1·60	„	Corwen, Rhug	1·38
„	Ryde, Thornbrough	1·21	„	Port Madoc	1·96
„	Alton, Ashdell.....	1·66	„	I. of Man, Douglas	1·45
III.	Oxford, Magdalen Col...	1·11	XII.	Stoneykirk, ArdwellHo.	2·92
„	Banbury, Bloxham	1·43	„	New Galloway, Glenlee	3·52
„	Northampton	1·18	„	Melrose, Abbey Gate...	1·33
„	Cambridge, Beech Ho...	1·04	XIII.	N. Esk Res. [Penicuik]	1·60
„	Wisbech, Bank House..	1·20	XIV.	Ballantrae, Glendrishaig	2·69
IV.	Southend .....	...	„	Glasgow, Queen's Park.	2·06
„	Harlow, Sheering	1·08	XV.	Islay, Gruinart School..	2·28
„	Rendlesham Hall	1·39	XVI.	St. Andrews, PilmourCot	1·59
„	Diss	1·21	„	Balquhider, Stronvar..	2·28
„	Swaffham	1·29	„	Dunkeld, Inver Braan..	1·89
V.	Salisbury, Alderbury...	1·13	„	Dalnaspidal H.R.S.	2·37
„	Warminster	1·42	XVII.	Keith H.R.S.	1·92
„	Calne, Compton Bassett	1·21	„	Forres H.R.S.	1·81
„	Ashburton, Holne Vic..	2·01	XVIII.	Strome Ferry H.R.S....	3·94
„	Holsworthy, Clawton...	·96	„	Tain, Springfield.....	1·47
„	Hatherleigh, Winsford.	...	„	Loch Shiel, Glenaladale	5·37
„	Lynmouth, Glenthorne.	1·57	„	S. Uist, Ardkenneth ...	2·14
„	Probus, Lamellyn	·90	„	Invergarry	1·90
„	Wincanton, Stowell Rec.	1·21	XIX.	Lairg H.R.S. ....	...
„	Taunton, Lydeard Ho...	1·36	„	Forsinard H.R.S.	1·83
„	Wells, Westbury.....	1·33	„	Watten H.R.S.	1·88
VI.	Bristol, Clifton	1·96	XX.	Dunmanway, Coolkelure	2·38
„	Ross	1·21	„	Fermoy, Gas Works	2·07
„	Wem, Clive Vicarage ...	1·30	„	Tralee, Castlemorris ...	2·46
„	Cheadle, The Heath Ho.	·85	„	Tipperary, Henry Street	1·54
„	Worcester, Diglis Lock	·73	„	Newcastle West .....	...
„	Coventry, Coundon	·94	„	Miltown Malbay.....	1·97
VII.	Melton, Coston	·88	XXI.	Gorey, Courtown House	1·01
„	Ketton Hall [Stamford]	1·13	„	Navan, Balrath	1·64
„	Horncastle, Bucknall ...	1·02	„	Mullingar, Belvedere ...	1·35
„	Mansfield, St. John's St.	1·34	„	Athlone, Twyford	2·23
VIII.	Macclesfield, The Park.	·91	„	Longford, Currygrane...	1·53
„	Walton-on-the-Hill.....	·89	XXII.	Galway, Queen's Coll...	2·19
„	Lancaster, South Road.	1·76	„	Clifden, Kylemore	3·76
„	Broughton-in-Furness ..	2·49	„	Crossmolina, Enniscoe..	2·78
IX.	Wakefield, Stanley Vic.	·55	„	Collooney, Markree Obs.	2·03
„	Ripon, Mickley	1·10	XXIII.	Rockcorry.....	1·41
„	Scarborough, West Bank	1·01	„	Warrenpoint	1·36
„	EastLayton[Darlington]	·97	„	Newtownards .....	...
„	Middleton, Mickleton..	1·57	„	Belfast, New Barnsley..	2·27
X.	Haltwhistle, Unthank..	1·54	„	Cushendun	1·47
„	Shap, Copy Hill	3·51	„	Bushmills	2·19
XI.	Llanfrechfa Grange	1·75	„	Stewartstown	1·52
„	Llandoverly	2·53	„	Buncrana	1·81

APRIL, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which $\frac{1}{10}$ or more fell.	Max.		Min.		In shade.	On grass.
				Dpth	Date.		Deg.	Date	Deg.	Date.		
I.	London (Camden Square) ...	1.41	-.61	.30	24	10	68.2	19	26.2	17	218	
II.	Maidstone (Hunton Court)...	1.65	-.20	.39	6	11	...	...	...	...	...	...
III.	Strathfield Turgiss	1.17	-.74	.43	23	9	70.3	19	21.9	17	10 20	
III.	Hitchin	1.18	-.77	.36	23	12	62.0	19	25.0	16	9 ...	
IV.	Winslow (Addington)	1.28	-1.03	.38	23	9	65.0	19	23.0	15	e 11 19	
IV.	Bury St. Edmunds (Culford)	1.19	-.60	.54	28	11	64.0	19	21.0	16	16 ...	
IV.	Norwich (Cossey)	1.30	-.56	.52	27	10	...	...	...	...	...
V.	Weymouth (Langton Herring)	.77	...	.30	23	7	60.0	19	29.0	15	3 ...	
V.	Barnstaple	1.46	-.92	.47	26	7	64.0	13	28.0	15	...	
V.	Bodmin	1.09	-2.24	.44	26	9	58.0	12	29.0	15	... 25	
VI.	Stroud (Upfield)	1.65	-.80	.69	26	10	66.0	19	28.0	14	6 ...	
VI.	Church Stretton (Woolstaston)	1.22	-1.10	.41	26	9	62.0	18c	27.5	8, 14	10 24	
VI.	Tenbury (Orleton) .....	.76	-1.41	.18	26	9	66.7	18c	21.2	15	16 22	
VII.	Leicester	1.00	...	.61	26	10	63.5	18	29.0	17f	9 ...	
VII.	Boston .....	.85	-1.04	.35	23	8	70.0	17	26.0	17	9 ...	
VII.	Hesley Hall [Tickhill] .....	.90	...	.30	28	11	64.0	1	28.0	16e	10 ...	
VIII.	Manchester (Ardwick)	1.49	-.54	.33	29	9	57.0	...	30.0	...	...
IX.	Wetherby (Ribston Hall) ...	.52	-1.99	.16	27	7	...	...	...	...	...
IX.	Skipton (Arncliffe)	2.38	-.68	.38	27	16	59.0	13	26.0	23	13 ...	
IX.	Hull (Beverly Road)	1.37	-.34	.52	26	15	66.0	19	29.0	10	5 14	
X.	North Shields .....	.72	-1.28	.27	21	12	63.0	19	26.5	15	10 11	
X.	Borrowdale (Seathwaite)	9.22	+ 4.28	2.40	20	12	64.0	12	27.0	8	12 ...	
XI.	Cardiff (Ely)	1.46	-.88	.32	26	10	...	...	...	...	...
XI.	Haverfordwest	1.14	-1.68	.38	25	9	64.0	12	23.0	14e	17 24	
XI.	Plinlimmon (Cwmsymlog) ...	2.30	...	.55	4, 26	10	...	...	...	...	...
XI.	Llandudno	1.02	-.86	.33	4	10	53.8	12	30.5	15	1 ...	
XII.	Cargen [Dumfries]	1.17	-1.12	.29	4	8	62.0	11	26.0	5	14 ...	
XII.	Jedburgh (Sunnyside)	1.00	-.70	.25	20	11	61.0	11	25.0	10	17 ...	
XIV.	Old Cumnock	2.52	+ .86	.53	20	11	65.0	11	24.0	7	17 ...	
XV.	Lochgilthead (Kilmory)	2.93	+ .30	.70	20	13	...	...	...	...	...
XV.	Oban (Craigvarren)	2.72	...	.68	20	11	61.6	11	29.0	7	5 ...	
XV.	Mull (Quinish)	3.53	...	.93	22	14	...	...	...	...	...
XVI.	Loch Leven Sluices	1.50	-.71	.50	22	6	...	...	...	...	...
XVI.	Arbroath	1.60	-.31	.57	20	8	59.0	18	30.0	8	5 ...	
XVII.	Braemar	1.61	-.47	.35	20	14	61.2	11	23.0	8	16 24	
XVII.	Aberdeen	1.82	...	.52	21	16	67.0	17	29.0	7g	7 ...	
XVIII.	Lochbroom	2.53	...	.32	19a	15	...	...	...	...	...
XVIII.	Culloden	1.26	-.09	...	...	...	58.0	17	30.0	5, 27	8 23	
XIX.	Dunrobin	2.07	...	.48	4	12	55.7	19	29.7	26	7 ...	
XIX.	Kirkwall (Swanbister) .....	...	...	...	...	...	...	...	...	...	...
XX.	Cork (Blackrock) .....	.93	-2.17	.20	22	12	67.0	19	26.0	14	11 ...	
XX.	Dromore Castle	2.48	...	.34	23	13	65.0	12	28.0	3	...	
XX.	Waterford (Brook Lodge) ...	1.07	...	.26	21	12	60.0	12	23.5	15	7 ...	
XX.	O'Briensbridge (Ross)	1.33	...	.25	21	12	58.0	18	30.0	...	19 ...	
XXI.	Carlow (Browne's Hill)	1.59	-.98	.36	24	14	...	...	...	...	...
XXI.	Dublin (FitzWilliam Square)	1.76	-.35	.44	29	10	62.2	18	31.5	15	1 20	
XXII.	Ballinasloe	1.64	-.62	.56	25	13	56.0	12d	26.0	7	20 ...	
XXIII.	Waringstown	1.98	+ .09	.28	20b	12	64.0	19	25.0	8h	16 23	
XXIII.	Londonderry (Creggan Res.) ..	2.39	...	.52	25	16	...	...	...	...	...
XXIII.	Omagh (Edenfel)	2.64	+ .64	.48	23	14	57.0	18	28.0	8, 30	17 21	

a And 20. b And 21. c And 19. d And 23. e And 17. f 30. g And 14, 15. h And 13, 15.
 + Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON APRIL, 1887.

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.—With the exception of a few showers of sleet, the first three weeks were fine, dry and cold, with brilliant sunshine by day and white frosts at night. Vegetation, therefore, was at a standstill, although no damage was done to the crops. Towards the end of the month a much softer atmosphere prevailed and a general though light rainfall. The nights were still frosty, so that vegetation made no progress. Humble bee seen on 6th, thrush's nest with four eggs on 14th, brimstone butterfly on 17th, swallow on 27th, cuckoo heard on 17th, and nightingale on 25th.

ADDINGTON.—A dry cold month, all the nights being cold, the highest min. temp. being 44° on 22nd and 23rd. Vegetation was very backward. Swallow seen on 13th, cuckoo heard on 22nd. S, R and high wind on 1st, very high wind all day on 6th.

CULFORD.—The coldest April remembered; vegetation very backward; mean temp. 42°.

LANGTON HERRING.—The third dry month in succession and the coldest April in 16 years, the mean temp. at 9 a.m. being only 44°·9; the next coldest was April, 1879, with a mean temp. of 45°·2. The mean min. temp. was as low as 36°·3, which is 0°·4, lower than that of January for 15 years, and as much as 1°·2 lower than the mean min. of April, 1879. Mean temp. 2°·6 below the average. The weather was, on the whole, very fine, but the want of R and the cold seriously retarded the growth of grass.

BODMIN.—Mean temp. (44°·5) 5°·9 below the average of 38 years. The mean of 25 nights min. temp. on grass was 28°·3, which is very remarkable and quite unprecedented in my long experience.

STROUD.—A very cold, dry month. Slight S on the hills on 6th; T, L and H on 24th.

WOOLSTASTON.—A cold, dry, and very backward month; mean temp. 42°·7. S on 5th, 25th, 26th and 27th. [The mean temp. for March was 37°·2, not 30°·6 as printed.]

ORLETON.—A very cold and dry month, with much sun in the daytime and clear frosty nights. The mean temp. was 3°·5 below the average of 26 years, and was lower only in 1879, and equal in 1877. The prevailing wind was strong from N. and E. Rainfall very small, and pressure generally high and steady. All vegetation was very late, plums, damsons and cherries coming into blossom about the 28th. The cuckoo was generally heard about the 21st, but the other summer birds were later than usual, the swallow and willow wren not appearing till after the 23rd. No L was seen or T heard. High wind on 1st. Hills covered with S on 27th.

LEICESTER.—A dry, cold month.

BOSTON.—Very cold, with constant frosts at night; all vegetation very backward. The 17th was a remarkable day, pressure very high, max. temp. 70°, min. temp. 26°, a difference of 44° in 12 hours. This is the lowest temp. recorded in April during 23 years. S on 13th.

MANCHESTER.—Fine but cold, with several night frosts and a cold E. wind, keeping vegetation in a backward state.

HULL.—A cold and ungenial month. S on 14th and 27th; T and L on 25th.

WALES.

HAVERFORDWEST.—April commenced cold and cloudy, with E. wind. From 4th to 11th the wind was very strong, almost reaching the force of a gale from N.E. on the 8th, the air being very cold and dry. Three days of bright warmth then occurred with frosty nights, followed by a sudden change back to weather of the bleakest character, with keen blasts from E. and N.E.; severe night

frosts, and very low temp. Most of the days were magnificently fine, the air being exceedingly dry. After the 21st, the weather broke up with E and H, and on the 26th, 27th and 29th S covered the Precelly range. The month maintained its wintry character to the end. I never before registered so many frosty nights or such low temperatures in the month of April. Mean temp. $42^{\circ}8$. One of the driest Aprils in the last 39 years, with no growth of grass.

LLANDUDNO.—As regards Llandudno, April is the driest month of the year, this year the E was 41 per cent. below the average. From the 6th to the 20th, inclusive no R fell. Polar winds were rather prevalent, but owing to the extreme dryness of the air and the large amount of sunshine (167 hours), the cold was not much felt, and the weather was altogether very enjoyable. Vegetation was very backward at the close. The storm which began on March 31st, ended on April 1st, and there was another moderate gale from N.E. on the 6th, continuing about 24 hours. The storm which was prognosticated for the 23rd to 25th, was scarcely felt, though pressure fell considerably. The mean temp. ($44^{\circ}1$) was $4^{\circ}4$; the mean daily range ($10^{\circ}6$) $2^{\circ}8$, and the monthly range ($30^{\circ}5$) $2^{\circ}1$ below the average.

SCOTLAND.

CARGEN.—The temp. of the month was remarkably low, the mean ($41^{\circ}2$), being $5^{\circ}3$ below the average, and the lowest recorded here during 27 years. The mean min. temp. was only $30^{\circ}5$, and it is a rare occurrence even in pretty severe winters that this low mean min. temp. is reached; only nine or ten times during 27 years has the mean min. been lower in any month. The average mean min. for January is $33^{\circ}7$, and the same for December. E. winds prevailed on 15 days. Sunshine a little above the average. H showers on 24th and 26th. T on 29th. S on surrounding hills on 25th.

JEDBURGH.—Rainfall $\cdot59$ in. below the average of 22 years, and temp. lower than for many years. Little or no growth of pastures occurred, while cereals and all tree and bush fruits were very backward. The seed was well got in, and as the land was dry it was easily cleaned. Heavy S showers fell on 5th, the ground was covered on the morning of 13th, and S fell for about three hours on 25th. The river Jed was frozen over on the morning of 15th, and there was ice on pools on 5th, 6th, 16th and 29th. Frequent H showers occurred on 25th and 27th, and T and L on 24th.

ABERDEEN.—With the exception of the rainfall, which was below the average, there is little to note, the weather having been of the usual character for April. S on 4th, H on 30th. Brilliant aurora on 15th.

LOCHBROOM.—A very cold, dry month. Frost prevailed almost every night, and S lay on the low ground frequently (on six days to some depth), while it was almost every day on the heights, and the high hills were deeply covered with it at the close, and the air was dry, cold and piercing from E. or N.E.

CULLODEN.—Very dry, no R falling from 6th to 21st. The nights were cold, with considerable frost, and vegetation was backward at the close. S fell to a depth of some inches on 5th.

IRELAND.

BLACKROCK.—April weather prevailed to the 5th, followed by 14 days without R, but bright and cold; thence to the end it was bright and cold, with some H. T on 29th and 30th. Mean temp. ($45^{\circ}1$) $3^{\circ}4$ below the average of 11 years.

DROMORE.—The beginning of the month was very fine, but in the last week the weather turned very cold, with N.N.W. winds, heavy S showers and H.

WATERFORD.—S on 6th and 25th. H showers daily, from 23rd to 29th. T on 29th and 30th. Swallows seen on 24th. Cuckoo on 28th. Severe frost on 15th.

O'BRIENSBRIDGE.—The general character of the month was adverse to all vegetation. Frequent, but not severe frosts prevailed, and there was a

deficiency of genial spring showers. Frequent H showers occurred from 20th to the close. Prevailing winds E. and N.E.

DUBLIN.—A cold, generally bright, dry month with high pressure and frequently a large diurnal range of temperature, amounting to 20° or upwards on five days. The precipitation was almost entirely in the form of H or sleet, but was limited to ten days, an absolutely dry period accompanying an anticyclone from the 6th to the 20th inclusive. With the exception of 1879, this was the coldest April since records were commenced in 1860. Lunar corona on 22nd, auroræ on 11th and 25th. Fog on five days, electrical disturbances on five; high winds on seven days, but on no occasion attaining the force of a gale. S or sleet on five days; H on ten. Prevailing winds N.E. and W.N.W.; mean humidity 76; mean amount of cloud 4.8.

EDENFEL.—Up to the 20th, the weather was fine, dry and generally clear, with E. and N.E. winds and night frosts, an excellent seed time, but with no vegetation. The remainder of the month was raw, cold and unsettled with R, H, sleet and S in varying succession.

PAMPHLET EXCHANGE.

Copies of the following pamphlets can be had on application, provided the cost thereof be enclosed in the same cover. When all the copies have been distributed, the stamps (less postage) will be returned.

Author.	Title.	Price.
HANN, DR. J.	Bericht erstattet dem zweiten Internationalem Meteorologen-Congress ueber die Beobachtungen auf hohen Bergen und im Luftballon.....	2½d.
" "	Theorie des Psychrometers	2½d.
" "	Bemerkungen zur täglichen Oscillation des Barometers	2½d.
HELLMANN, DR. G. ...	Die täglichen Veränderungen der Temperatur der Atmosphäre in Norddeutschland	2½d.
" " "	Feuchtigkeit and Bewölkung auf der Iberischen Halbinsel	3½d.
" " "	Vorschläge an den Meteorologencongress	3d.
" " "	Der zweite internationale Meteorologencongress abgehalten zu Rom in April, 1879	2½d.
" " "	Ueber den jährlichen Gang der Temperatur in Norddeutschland.....	3d.
" " "	Ueber gewisse Gesetzmässigkeiten im Wechsel der Witterung aufeinanderfolgender Jahreszeiten	2½d.
" " "	Klima des Brocken.....	2½d.
SCOTT, R. H.....	Notes on the Reports of Wind Force and Velocity during the Tay Bridge Storm, December 28th, 1879	2½d.
" " "	On a Series of Barometrical Disturbances which passed over Europe between the 27th and the 31st of August, 1883	2½d.
" " "	On the History of Thermometers	2½d.
" " "	Climatology of the Sea	2½d.
WALLIS, H. SOWERBY	The Snow Storm of January 18th and 19th, 1881	3d.

G. J. SYMONS.

62, Camden Square, N.W.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCLVII.]

JUNE, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.

SOME NEW WEATHER CHARTS.*

WE have received the first two parts of the above work from the Council of the Meteorological Office in the form of two great cardboard rolls, each 26 in. long and 4 in. in diameter. Each of these contains the charts for three months and one week in the form of separate sheets. This is an extremely inconvenient form, especially as each separate chart is only about 8 by $6\frac{1}{2}$ inches, while every sheet measures no less than 24 by 19 inches. The only way to make them handy for reference is to cut each sheet into three.

The materials for every day are plotted on two charts, one of which gives isobars, wind and weather; the other isotherms for air and sea surface temperatures, with the weather symbols repeated. Three of each kind of chart are printed on each sheet, but we cannot see any advantage in the employment of such unwieldy sheets of paper when smaller ones would have been equally efficient.

The charts are well reproduced in three-colour lithography, and though we cannot think that they equal in clearness or artistic appearance the maps that were published by Le Verrier as long ago as 1869, still they are an immense improvement on the last set of big maps issued by the Meteorological Office.

The conical projection is, however, still retained, and this is much to be regretted. If charts are to be of any use to seamen, they must be on the Mercator's projection, to which sailors are accustomed. If the scientific meteorologist wishes to study the lie and motion of depressions round the world, he may perhaps prefer a stereographic projection. The conical projection has the disadvantages of both the above, without the advantages of either. The shapes of cyclones are no doubt better delineated near the central meridian of the chart by a conical than by any other projection, but the great defect is that the distortion of any figure—say a circle—is not the same at every place in the same latitude. The distortion, say in latitude 50° ,

* *Synchronous Weather Charts of the North Atlantic for every day, from 1st August, 1882, to 31st August, 1883.* Published under the authority of the Meteorological Council.

will be the same everywhere on a stereographic projection; but on a conical one the deformation varies according to the distance from the central meridian.

The isobars and winds are all truly synchronous for noon at Greenwich, but the isotherms have been dealt with in a most unsatisfactory manner. The designers of these charts have of course had to face the problem of diurnal range of temperature, and their solution is as follows: The isotherms over America are for Greenwich noon; those over the sea for local noon; those over Europe for about 8 a.m. local. The consequence is that all the labour which has been put on the temperature charts is practically wasted, as the three systems of isotherms do not join into one another, and it is hardly possible to draw any deductions about anything from the lines as they are drawn. The object of isotherms is to show:—(1). The distribution of temperature over the world; and (2), the causes of the fluctuations of heat and cold from day to day; but none of these phenomena can be studied when the three portions of the same map—Europe, the Atlantic, America—are charted on different systems.

The fears of the designers are clearly indicated in the prefatory explanatory notes: "The diurnal changes of temperature, though not great would, if synchronous observations at Greenwich noon were used, introduce an appearance of permanent higher temperature to the east as compared with the west . . . a difference of temperature which would not have any true physical significance so far as probable consequent changes of pressure or general weather were concerned."

The attempted cure is worse than the original disease. The charts as now constructed represent no physical fact at all. If they had been constructed synchronously for any hour we should have had an accurate picture of the distribution of temperature over the world at that particular moment; and, with a little practice, it is comparatively easy to realise how the diurnal isotherms, as explained by Abercromby, *Quar. Jour. Roy. Met. Soc.* X., p. 247, modify the changing distribution of temperature due to the radiation of cyclones and anti-cyclones, or of hot and cold winds. We can allow for diurnal isotherms, but we can do nothing with the supposed-to-be-corrected-isotherms we find on these charts.

In the weather symbols, we find drizzle grouped with hail and passing showers, and not with rain or snow. This we think is a mistake. Drizzle is usually the prelude of steady cyclonic rain, and is rarely associated with either hail or passing showers.

But though we think this publication, like every other, is open to some criticism, we must draw the attention of our readers to the enormous amount of careful and accurate work contained in these charts, and to the exceptional value of the isobaric portion of the maps. Any one who compares these charts with those of Le Verrier in 1869 or those of the Meteorological Office for August, 1873, will

be struck with the much greater accordance between the direction of the wind as recorded by ships not far from one another. In the older charts it was nothing uncommon to see two ships close by, reporting winds from exactly opposite directions; now we often find 5 or 10 neighbouring ships recording directions of wind that are practically identical.

It is gratifying to know that this improved result is greatly due to the efforts of our own Meteorological Office, and it remains only to express the hope that now that the Council have collected so much valuable material they will take care to have the information discussed by some competent person.

REDIER'S SMALL MERCURIAL BAROGRAPH.

OUR readers have doubtless seen from time to time in the reports of the meetings of the Royal Meteorological Society, notices of the marvellous accuracy with which the barograph constructed for Mr. E. T. Dowson, of Beccles, by M. Redier, of Paris, works. (By-the-by we are glad to see that in the *Meteorological Magazine* for April, 1875, we said "We have not had an opportunity of testing the instrument ourselves, but from an examination of the curves we incline to believe that (excepting only the desperately expensive King's barograph) it is much the best non-photographic barometer yet known"). Our original opinion was, therefore, not far wrong.

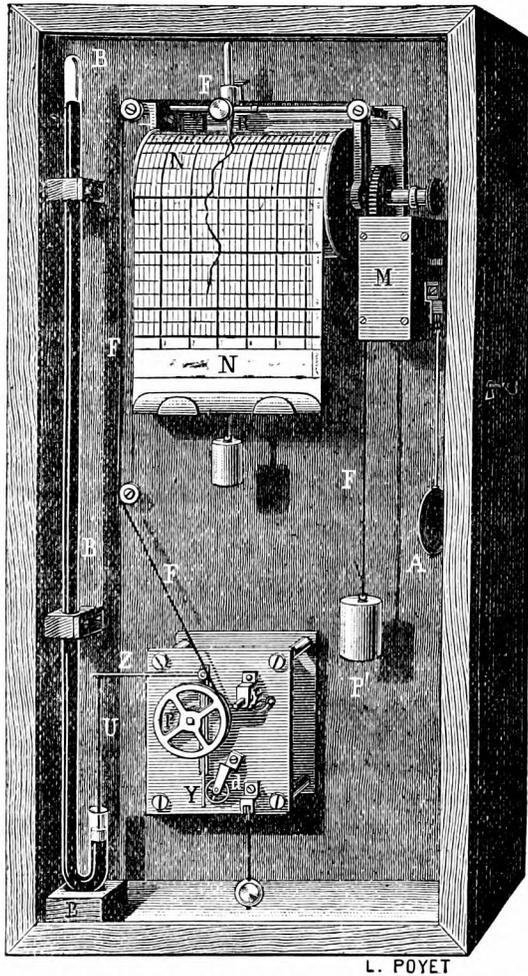
M. Redier has recently brought out a smaller instrument at 220 francs (say £9), of which the following engraving gives an accurate representation. In general principle, as regards the small and constant work thrown upon the barometer, the differential train, &c., the new pattern closely resembles the old; the only essential difference being that the barometer tube is now fixed, and not moved by clockwork as in the original pattern.*

We shall, therefore, describe only cursorily its mode of action. BBB is a syphon barometer; when the atmospheric pressure decreases, the mercury rises in the short leg and carries up the rod U, this lifts the bell-crank-lever Z, which allows certain clockwork to turn the large wheel, and so pay out more of the cord FFFF, and as this cord is kept tight by the weight P', the pencil in the carriage R is drawn towards the clock M. When the pressure increases precisely the reverse action ensues. The clock M is solely occupied in unrolling the paper N from the cylinder on which it is wound. Each sheet of paper lasts a week, and the clock runs for the same time. In the diagrams from the small pattern here described, the variations of pressure are represented twice their natural scale, *i.e.*, each barometric inch is represented by 2 in., and each day by 2·84 in.

We think that in order to facilitate transport, a steel tube should

* *Quar. Jour. Roy. Met. Soc.*, Vol. II., p. 412, and *Met. Mag.*, Vol. X., p. 33.

be used instead of a glass one, and then the instrument could with ease and safety be sent anywhere.



REDIER'S BAROGRAPH (SMALL PATTERN.)

ROYAL METEOROLOGICAL SOCIETY.

The usual Monthly Meeting of this Society was held on May 18th, at the Institution of Civil Engineers, 25, Great George Street, Mr. W. Ellis, F.R.A.S., president, in the chair.

Mr. A. S. Marriott and Captain Paul Mordovin were balloted for and duly elected Fellows of the Society.

The following Papers were read :—

(1.) "Brocken Spectres, and the Bows that often accompany them," by Mr. H. Sharpe. The author has collected all the original

descriptions of the Brocken spectre, which is really the shadow of the observer cast by the sun upon clouds. In some cases the shadow is surrounded by a bow, which the author shows is like the rainbow in colour, and in the order of colours. The head of a shadow is sometimes surrounded by another sort of phenomenon touching the head, and which the author names the "glory."

(2). "Results of Thermometrical Observations made at 4ft., 170ft., and 260 ft. above the ground at Boston, Lincolnshire, 1882—86," by Mr. W. Marriott, F.R.Met.Soc. These observations were made on Boston Church Tower, which rises quite free from any obstructions in a very flat country, to the height of 273 ft. A Stevenson screen, with a full set of thermometers, was placed 4ft. above the ground in the churchyard; a similar screen and thermometers was fixed above the belfry at 170ft. above the ground, while a Siemens electrical thermometer was placed near the top of the tower, the cable being brought down inside and attached to a galvanometer on the floor of the church, where the indications were read off. The results showed that the mean maximum temperature at 4ft. exceeds that at 170ft. in every month in the year, the difference in the summer months amounting to 3° ; while the mean minimum temperature at 4ft. differs but little from that at 170ft, the tendency however being for the 4ft. to be slightly warmer in the winter and colder in the summer than the latter. The electrical thermometer showed that during the day hours the temperature at 4ft. was considerably warmer than at 260ft. The author, however, detailed several sets of readings which had been made during the night as well as the day, the results from which were of a very interesting character, dependent on fog, on the state of the ground, &c.

(3). "Snowstorm of March 14th and 15th, 1887, at Shirenewton Hall, near Chepstow," by Mr. E. J. Lowe, F.R.S.

During the evening the President presented to Dr. J. W. Tripe on behalf of the Fellows, a silver tea and coffee service, in acknowledgment of the many services which he had rendered to the Society during a period of over 30 years.

LIGHTNING.

The following circular has just been issued, and the object is so good that we with pleasure recommend it to the attention of all our readers. There are endless puzzles respecting lightning yet to be solved, and, as Prof. Tait stated some years since that the subject of thunderstorms was "scarcely understood at all," it is clear that there is much to be done. We notice that the Royal Meteorological Society suggest the employment of a "rapid plate;" and this seems rather necessary, as electricians tell us that a million consecutive flashes might occur between the two beats of a seconds-clock, and

therefore the plate has to be acted upon in less than $\frac{1}{1,000,000}$ of a second.

Royal Meteorological Society.

ESTABLISHED 1850. INCORPORATED BY ROYAL CHARTER, 1866.

30, GREAT GEORGE STREET,
WESTMINSTER, S.W.

June, 1887.

PHOTOGRAPHS OF LIGHTNING.

SIR,—The Council of the Royal Meteorological Society are desirous of obtaining photographs of flashes of lightning, as they believe that a great deal of research on this subject can only be pursued by means of the camera.

The Council would esteem it a great favor if you, or the Institution which you represent, could give them any assistance in this matter either,—

1. By sending them copies of any photographs of flashes of lightning that may have been already taken.

2. By endeavouring to procure them yourself; or to interest others in the work.

It may perhaps be well to mention that the photographing of lightning does not present any particular difficulties. If a rapid plate and an ordinary rapid doublet with full aperture be left uncovered at night during a thunderstorm for a short time, flashes of lightning will after development be found in some cases to have impressed themselves upon the plate. The only difficulty is the uncertainty whether any particular flash will happen to have been in the field of view.

The Council hope that now that the thunderstorm season is approaching, many photographers may be found willing to take up this interesting branch of their art.

I am, Sir,

Your obedient Servant,

WILLIAM MARRIOTT,

Assistant Secretary.

EAST WINDS IN SPRING.

To the Editor of the Meteorological Magazine.

SIR,—It is almost proverbial that we have east winds for six weeks every spring. In order to test the accuracy of this supposed fact, I instructed my gardener to compile the enclosed table from the record which he keeps for ordinary gardening purposes. It shows the number of days on which the wind was blowing from the north-east, east or south-east, during the first five months of ten com-

plete years and part of the current year. It appears that the average does not fall very far short of six weeks, but is extremely variable, the maximum being 63 days in 1879, minimum 21 days in 1882. The direction of the wind has been taken every morning at 9 a.m.

Excluding the present year, the average for 10 years gives—

N.E.	16·2
E.	12·4
S.E.	11·1
Total	
	39·7

Faithfully yours,

JOSEPH PAGET.

Stuffywood, Mansfield, Notts, June 9th, 1887.

Year	JANUARY.			FEBRUARY.			MARCH.			APRIL.			MAY.			TOTAL.		
	N.E.	E.	S.E.	N.E.	E.	S.E.	N.E.	E.	S.E.	N.E.	E.	S.E.	N.E.	E.	S.E.	N.E.	E.	S.E.
1877	2	1	...	1	...	...	2	..	2	5	13	5	11	3	6	21	17	13
1878	1	.	...	1	...	1	4	1	...	6	7	6	3	3	6	15	11	13
1879	5	8	5	...	3	2	...	7	5	8	3	5	10	2	...	23	23	17
1880	1	1	3	1	...	2	9	7	2	8	1	...	9	...	...	28	9	7
1881	...	2	...	2	2	4	...	3	4	8	3	1	5	1	...	15	11	9
1882	1	1	1	...	...	1	...	...	...	2	2	5	3	4	1	6	7	8
1883	...	3	5	...	...	5	3	2	2	1	4	1	1	...	1	5	9	14
1884	2	...	2	2	6	1	3	...	4	6	5	1	6	3	1	19	14	9
1885	1	3	8	...	...	1	1	1	1	5	...	2	2	...	1	9	4	13
1886	3	4	1	6	5	..	1	5	4	7	1	2	4	4	1	21	19	8
Mean	1·6	2·3	2·5	1·3	1·6	1·7	2·3	2·6	2·4	5·6	3·9	2·8	5·4	2·0	1·7	16·2	12·4	11·1
1887	...	3	...	2	2	...	5	5	2	9	2	...	13	1	...	29	13	2

[Similar data to the above must exist for many stations, and it would be interesting to compare them. It seems to us that although, as Mr. Paget remarks, his average of 39·7 days is very near the traditional six weeks, it is less than might have been expected. As the observations are made to only eight points, it is probable that any winds between N.E. and N.N.E. have been set down as N.E., and any between S.S.E. and S.E. as S.E., therefore the table really includes six out of the sixteen points. There are 151 days from January 1st to May 31st; therefore, if all winds were equally frequent, we ought to find 57 entries for N.E., E., and S.E., but we get only 40, so that after all, although the preponderance of westerly winds is less marked in the spring than in other seasons, easterly are not in the majority even then.—ED.]

REVIEWS.

Further Results of Meteorological Observations made at the Bath Royal Literary and Scientific Institution. By the Rev. LEONARD BLOMEFIELD, M.A., F.L.S., F.G.S., &c., President. 8vo, 16 pages and 3 folding tables, *Herald Office*, Bath, 1887.

IT has been our privilege on several occasions to review pamphlets by this author, and we have never, as far as we can recollect, had anything to say except that which was in praise of them. And now the venerable author (in his 88th year) sends us the above pamphlet, which is in all respects the equal of its precursors, and which undoubtedly contains more trustworthy values respecting the climate of Bath than have ever before been published, and we do not make this assertion without having reworked some of the tables and checked them by cross-casting, the surest way of picking up errors if any exist.

We may give a few facts, but must refer our readers to the pamphlet itself, for it is impossible to quote all that is worthy of quotation:—Mean sea level pressure, 1875—85 = 29·976 in. ; max. 30·978, January 18th, 1882 ; min. 28·337, December 4th, 1876 ; range 2·641 in. Temperature—mean, 1866—85, 50°·5 ; and as this period, if divided into two of 10 years each, gives 50°·5 for each, there cannot be much doubt about that value. Mr. Blomefield examines in detail the mean temperatures of the winters, which certainly seem very variable, that of 1878-79 being only 36°·4, and that of 1868-69 being 46°·3. The author then gives tables of rainfall, calling special attention to the wet period (1875-79), and concludes with a paragraph, which we reproduce partly because of its truthfulness, and also as a singular proof how firmly fixed is an author's mode of writing—the paragraph might be a verbatim quotation from some of the author's writings of 50 years back.* By-the-by, it would be interesting and useful to give a list of them, of course omitting those on Natural History, otherwise we should fill some pages:—

“This leaves little more to be said on the present occasion. I have nothing further to state with respect to the temperature, rainfall and humidity, of Bath compared with other places, beyond what I stated in my former paper. Nor need I add anything to what was therein said respecting the general conditions of the Bath climate. I believe the results given in that paper are, as a whole, correct. Of course the longer the term of years for which the observations are continued, the more trustworthy they become ; while there are anomalous states of weather, in one or other of its aspects, sure to recur from time to time during long periods, which it is of interest to record ; while also they not unfrequently serve to correct former views as to the causes that combine to bring about the very variable states of weather characteristic of the English climate.”

- WORKS BY THE REV. LEONARD BLOMEFIELD (previously to 1871 known as REV. LEONARD JENYNS.)
1830. Some remarks upon the late winter of 1829-30, and upon the general character of the weather which preceded and followed it. *Mag. Nat. Hist.* 1830, pp. 538—544.
1846. Observations in Natural History, with an Introduction on habits of observing, Calendar of Periodic Phenomena, &c. Post 8vo.
- [One of the earliest standard works on Phenological observation.]
1858. Observations in Meteorology, . . . being . . . the results of a Journal kept for nineteen years at Swaffham Bulbeck in Cambridgeshire. Post 8vo.
1864. The temperature and rainfall at Bath. *Brit. Ass. Rep.*, 1864. Sections, pp. 17—19.
1866. Report respecting the Meteorological Observations—41st *Rep. of the Committee of the Bath Roy. Lit. & Scien. Inst.*, pp. 16—17.
1869. Notes on the summer of 1868, particularly the temperature as observed in Bath, and compared with that of Greenwich and some other places. *Bath Nat. Hist. Club Proc.* I, pp. 43—70.
1871. St. Swithin and other Weather Saints. *Bath Nat. Hist. Club. Proc.* II. pp. 161—188.
1876. Results of Meteorological Obs. made at the Bath R. Lit. and Sci. Inst. March, 1865—Feb., 1875. *Bath Nat. Hist. Club. Proc.* III. p. 205.
1878. Gales of Wind. *Bath Nat. Hist. Club Proc.* IV.
1880. The Winter of 1878—79 in Bath, and seasons following. *Bath Nat. Hist. Club. Proc.* IV.
1887. Further Results of Met Obs. made at the Bath R. Lit. and Sci. Inst. *Bath Nat. Hist. Club Proc.*

TREES FROM A SANITARY ASPECT*.

As this is the usual time of the year for planting, pruning, and removing forest trees and shrubs, it is a fit time for considering the influence which trees exert on the sanitary surroundings of dwelling places. The recent Parliamentary Report on Forestry shows that trees are now of little commercial value in this country; and we may conclude, therefore, that they are chiefly grown for picturesque effect, and for the shelter from the sun and winds which they afford. The relation of forests to rainfall has been studied by meteorologists, but little attention has been given by medical climatologists to the share which trees take in determining local variations of climate and the sanitary condition of dwellings, notwithstanding they play as important a part as differences of soil, of which so much is said and written nowadays. This remark does not apply to large towns, where trees grow with difficulty and are comparatively few in number, and where they afford a grateful relief to the eye, shade from the sun, and to a very slight extent temper the too dry atmosphere, but to suburban and country districts, where it is the custom to bury houses in masses of foliage—a condition of things which is deemed the chief attraction, and often a necessary accompaniment of country life.

* By CHARLES ROBERTS, F.R.C.S., &c., in the *Lancet*.

Trees of all kinds exercise a cooling and moistening influence on the atmosphere and soil in which they grow. The extent of these conditions depends on the number of trees and whether they stand alone, in belts, or in forests; on their size, whether tall trees with branchless stems or thickets of underwood; on their species, whether deciduous or evergreen; and on the season of the year. The cooling of the air and soil is due to the evaporation of water by the leaves, which is chiefly drawn from the subsoil—not the surface—by the roots, and to the exclusion of the sun's rays from the ground, trees themselves being little susceptible of receiving and radiating heat. The moisture of the atmosphere and ground about trees is due to the collection by the leaves and branches of a considerable portion of the rainfall, the condensation of aqueous vapour by the leaves, and the obstruction offered by the foliage to evaporation from the ground beneath the trees. The experiments of M. Faurat show that the leafage of leaf-bearing trees intercepts one-third, and that of pine trees half of the rainfall, which is afterwards returned to the atmosphere by evaporation. On the other hand, these same leaves and branches restrain the evaporation of the water which reaches the ground, and that evaporation is nearly four times less under a mass of foliage in a forest, and two and one-third times under a mass of pines, than in the open. Moreover, trees prevent the circulation of the air by lateral wind currents and produce stagnation. Hence as Mr. G. J. Symons has truly observed. "a lovely spot embowered in trees and embraced by hills is usually characterised by a damp, misty, cold, and stagnant atmosphere," a condition of climate which is obviously unfavourable to good health and especially favourable to the development of consumption and rheumatism, our two most prevalent diseases.

Now, if we examine the surroundings of many of our suburban villas and country houses of the better sort, we shall find them embowered in trees, and subject to all the insanitary climatic conditions just mentioned. The custom almost everywhere prevails of blocking out of view other houses, roads, &c., by belts of trees, often planted on raised mounds of earth, and surrounded by high walls or close palings, from a foolish ambition of seeming to live "quite in the country." This is the most unwise proceeding from a sanitary point of view, and should be protested against by medical men as strongly as defective drainage and bad water supply. Many houses stand under the very drip and shadow of trees, and "the grounds" of others are enclosed by dense belts of trees and shrubs, which convert them into veritable reservoirs of damp, stagnant air, often loaded with the effluvia of decaying leaves and other garden refuse, a condition of atmosphere very injurious to health, and answerable for much of the neuralgia of a malarious kind, of which we have heard so much lately. A very slight belt of trees suffices to obstruct the lateral circulation of the air, and if the sun be also excluded, the natural upward currents are also prevented. As far back as 1695 Lancisi recognised the influence of slight belts of trees in preventing the spread of malaria in Rome, and the cold, damp, stagnant air of spaces enclosed by trees is easily demonstrated by the wet and dry-bulb thermometer, or even by the ordinary sensations of the body. A dry garden, on gravel, of three acres in extent in Surrey, surrounded by trees, is generally three or four degrees colder than the open common beyond the trees; and a large pond in a pine wood twenty miles from London afforded skating for ninety consecutive days in the winter of 1885-6, while during the greater part of that time the lakes in the London parks were free from ice.

The speculative builder has more sins to answer for than the faulty construction of houses. He generally begins his operations by cutting down all the fine old trees which occupy the ground, and which from their size and isolation are more beautiful than young ones and are little likely to be injurious to health, and ends them by raising mounds and sticking into them dense belts of quick-growing trees like poplars, to hide as speedily as possible the desolation of bricks and mortar he has created. It is this senseless outdoor work of the builder and his nurseryman which stands most in need of revision from time to time in suburban residences, but which rarely receives it, from a silly notion, amounting to tree worship, which prohibits the cutting down of trees, no matter how injudicious may have been the planting of them in the first instance from a sanitary or picturesque point of view.

The following hints for planting and removing trees may be useful to those persons who have given little attention to the subject. A tree should not stand so near a house that, if it were to fall, it would fall on the house; or in other words, the root should be as far from the house as the height of the tree. Belts of trees may be planted on the north and east aspects of houses, but on the east side the trees should not be so near, nor so high, as to keep the morning sun from the bedroom windows in the shorter days of the year. On the south and west aspects of houses, isolated trees only should be permitted, so that there may be free access of the sunshine and the west winds to the house and grounds. High walls and palings on these aspects are also objectionable, and should be replaced by fences, or better still open palings, especially about houses which are occupied during the fall of the leaf, and in the winter. Trees for planting near houses should be chosen in the following order:—Conifers, birch, acacia, beech, oak, elm, lime and poplar. Pine trees are the best of all trees for this purpose, as they collect the greatest amount of rainfall and permit the freest evaporation from the ground, while their branchless stems offer the least resistance to the lateral circulation of the air. Acacias, oaks and birches are late to burst into leaf, and therefore allow the ground to be warmed by the sun's rays in the early spring. The elm, lime, and chestnut are the least desirable kinds of trees to plant near houses, although they are the most common. They come into leaf early and cast their leaves early, so that they exclude the spring sun and do not afford much shade in the hot autumn months, when it is most required. The lime and the elm are, however, beautiful trees, and will doubtless on this account often be tolerated nearer houses than is desirable from a purely sanitary point of view.

Trees are often useful guides to the selection of residences. Numerous trees with a rich foliage and a rank undergrowth of ferns or moss, indicate a damp, stagnant atmosphere; while abundance of flowers and fruit implies a dry sunny climate. Children will be healthiest where most flowers grow, and old people will live longest where our common fruits ripen best, as these conditions of vegetation indicate a climate which is least favourable to bronchitis and rheumatism. Pines and their companions, the birches, indicate a dry, rocky, sandy, or gravel soil; beeches, a dryish, chalky, or gravel soil; elms and limes, a rich and somewhat damp soil; oaks and ashes, a heavy clay soil; and poplars and willows, a low, damp, or marshy soil. Many of these trees are found growing together, and it is only when one species predominates in number and vigour that it is truly characteristic of the soil and that portion of the atmosphere in connection with it.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DEC., 1886.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London	53·9	6	19·7	20	41·3	31·3	31·9	82	66·4	12·2	4·34	18	5·2
Malta	67·8	19	45·5	30	62·3	50·8	48·5	81	114·8	40·0	3·98	15	5·1
<i>Cape of Good Hope</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Mauritius</i>	86·0	24	65·5	6	82·8	71·3	66·1	72	141·2	57·0	6·31	19	5·5
Calcutta	84·8	9	52·1	18	78·2	58·2	57·9	73	143·7	40·9	·00	0	1·7
Bombay	87·9	18	66·6	9	83·0	70·0	65·7	70	140·9	53·3	·00	0	2·5
Ceylon, Colombo	90·0	26	68·0	27	86·0	71·8	68·9	71	145·5	60·0	2·35	13	5·1
<i>Melbourne</i>	96·8	26	46·7	22	73·5	54·5	52·1	68	146·2	37·3	3·54	10	5·7
<i>Adelaide</i>	102·3	14	46·9	9	83·3	59·6	48·6	44	155·1	40·4	·61	4	3·3
<i>Wellington</i>	76·0	26	41·0	13	65·9	51·3	50·4	76	141·0	36·0	1·45	8	3·2
<i>Auckland</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Kingston	95·8	3	65·0	23	87·9	67·9	68·9	83	...	...	·70	...	8·3
Barbados	81·0	10 ^a	68·0	21	79·0	71·0	66·8	77	141·0	...	2·63	16	5·0
Toronto	44·1	16	0·2	30	27·7	14·0	19·4	81	...	-6·7	2·00	15	7·0
New Brunswick, Fredericton	47·8	1	-22·5	31	25·5	4·9	16·3	85	...	...	5·84	15	6·0
Manitoba, Winnipeg	33·5	9	-36·0	26	5·1	-12·7	1·0	94	...	...	·39	7	4·0
British Columbia, Victoria	57·0	13	21·0	26	48·1	38·8	...	...	...	...	7·16	25	...

^a And 17.

REMARKS, DECEMBER, 1886.

MALTA.—Mean temp. 55°·4; mean hourly velocity of wind 10·6 miles. Sea temp. fell from 66° to 60°. TSS on 7th and 31st; H on 2nd, 30th and 31st. J. SCOLFS.

Mauritius.—Rainfall ·87 in. above, mean temp. of air 0°·8, and of dew point 1°·7, below their respective averages; mean hourly velocity of wind 7·7 miles, 3·6 miles below the average; extremes 17·7 on 23rd, and 0·0 on 10th; prevailing direction E. by N. to N.E. by E. T and L on 24th; T on 25th, 30th and 31st; L on 26th.

COLOMBO.—TSS on 7 days.

C. MELDRUM, F.R.S.
F. C. H. CLARKE, Lt.-Col. R.A.

Melbourne.—Mean temp. of air average, of dew point 1°·7, rainfall 1·18 in., mean humidity 8, mean amount of cloud and mean pressure slightly above their respective averages. Prevailing winds S. and S.W., strong on 10 days; TSS on 8th and 15th; T on 3rd and 13th; L on 12th and 13th; aurora on 23rd. R. L. J. ELLERY, F.R.S.

Adelaide.—Pressure rather unsteady, especially during the latter half of the month. Mean temp., 71°·4, slightly above the average; mean amount of cloud below the average, the sky being clear on 11 days. Nice rains fell over the colony during the early part of the month, heavy in the north, and fine rains fell over the interior and northern territory between the 16th and 24th. C. TODD.

Wellington.—Fine up to 9th, but with strong N.W. wind; from 10th to 20th showery, with N.W. and S.E. wind, often strong. Thence very fine, warm and dry to the close, with light winds, chiefly S.E. Rainfall 2·47 in., and mean temp. (58°·6) 2°·3, below their averages. R. B. GORE.

Barbados.—Pressure steady; mean temp. 1°·5 below the average; rainfall greatly below the average. Prevailing wind N.E.; mean hourly velocity 11 miles, 1·6 miles above the average. Five days were more or less overcast. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
MAY, 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	1·74	XI.	Castle Malgwyn .....	...
„	Margate, Birchington...	1·82	„	Rhayader, Nantgwillt..	3·50
„	Littlehampton	1·06	„	Carno, Tybrith	2·67
„	Hailsham	1·32	„	Corwen, Rhug	2·09
„	Ryde, Thornbrough	1·31	„	Port Madoc	2·91
„	Alton, Ashdell.....	1·90	„	I. of Man, Douglas	1·64
III.	Oxford, Magdalen Col..	1·59	XII.	Stoneykirk, ArdwellHo.	1·47
„	Banbury, Bloxham	1·67	„	New Galloway, Glenlee	1·70
„	Northampton	2·40	„	Melrose, Abbey Gate...	1·52
„	Cambridge, Beech Ho...	2·09	XIII.	N. Esk Res. [Penicuik]	2·35
„	Wisbech, Bank House..	1·60	XIV.	Ballantrae, Glendrisaig	1·79
IV.	Southend .....	...	„	Glasgow, Queen's Park.	·94
„	Harlow, Sheering	2·44	XV.	Islay, Gruinart School..	1·81
„	Rendlesham Hall	1·61	XVI.	St. Andrews, PilmourCot	·88
„	Diss	2·01	„	Balquhider, Stronvar..	·69
„	Swaffham	1·96	„	Dunkeld, Inver Braan..	·42
V.	Salisbury, Alderbury ...	1·39	„	Dalnaspidal H.R.S. ...	1·13
„	Warminster	2·21	XVII.	Keith H.R.S.	3·04
„	Calne, Compton Bassett	...	„	Forres H.R.S.	1·61
„	Ashburton, Holne Vic..	2·64	XVIII.	Strome Ferry H.R.S....	2·96
„	Holsworthy, Clawton...	1·56	„	Tain, Springfield.....	·52
„	Hatherleigh, Winsford.	3·43	„	Loch Shiel, Glenaladale	3·45
„	Lynmouth, Glenthorne.	2·92	„	S. Uist, Ardkenneth ...	1·40
„	Probus, Lamelloy	1·75	„	Invergarry	1·31
„	Wincanton,StowellRec.	2·05	XIX.	Lairg H.R.S.	·61
„	Taunton, Lydeard Ho ...	2·47	„	Forsinard H.R.S.	·80
„	Wells, Westbury.....	...	„	Watten H.R.S.	1·42
VI.	Bristol, Clifton	2·34	XX.	Dunmanway, Coolkelure	1·94
„	Ross .....	...	„	Fermoy, Gas Works ...	·80
„	Wem, Clive Vicarage ...	1·64	„	Tralee, Castlemorris ...	...
„	Cheadle, The Heath Ho.	1·70	„	Tipperary, Henry Street	1·29
„	Worcester, Diglis Lock	2·09	„	Newcastle West	1·04
„	Coventry, Coundon	1·31	„	Miltown Malbay.....	1·61
VII.	Melton, Coston	1·71	XXI.	Gorey, Courtown House	·94
„	Ketton Hall [Stamford]	1·89	„	Navan, Balrath	1·12
„	Horncastle, Bucknall ...	1·23	„	Mullingar, Belvedere..	1·46
„	Mansfield, St. John's St.	2·22	„	Athlone, Twyford	1·46
VIII.	Macclesfield, The Park.	1·64	„	Longford, Currygrane...	1·58
„	Walton-on-the-Hill.....	2·09	XXII.	Galway, Queen's Coll...	1·56
„	Lancaster, South Road.	2·06	„	Clifden, Kylemore	2·51
„	Broughton-in-Furness...	2·29	„	Crossmolina, Enniscoe..	2·17
IX.	Wakefield, Stanley Vic.	1·75	„	Collooney, Markree Obs.	2·36
„	Ripon, Mickley	2·46	XXIII.	Rockcorry.....	1·55
„	Scarborough, West Bank	1·89	„	Warrenpoint	1·02
„	EastLayton[Darlington]	...	„	Newtownards .....	...
„	Middleton, Mickleton..	1·83	„	Belfast, New Barnsley .	2·71
X.	Haltwhistle, Unthank..	1·50	„	Cushendun	3·16
„	Shap, Copy Hill	1·53	„	Bushmills	2·78
XI.	Llanfrechfa Grange ...	2·78	„	Stewartstown	1·49
„	Llandoverly	2·50	„	Buncrana	2·70

MAY, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which .01 or more fell.	Max.		Min.		In shade.	On grass.
				Dpth.	Date.		Deg.	Date.	Deg.	Date.		
I.	London (Camden Square) ...	1.45	— .47	.28	19	21	71.2	8	32.8	1	0	2
II.	Maidstone (Hunton Court)...	1.57	— .45	.31	21	12	...	...	...	...	...	...
III.	Strathfield Turgiss	1.52	— .16	.46	21	18	70.0	8	30.8	15	1	4
IV.	Hitchin	2.39	+ .40	.43	31	21	68.0	31	34.0	14	0	...
V.	Winslow (Addington)	2.09	— .14	.32	6	21	69.0	8	30.0	1	2	8
VI.	Bury St. Edmunds (Culford)	1.95	+ .05	.37	6	18	73.0	31	28.0	14	2	...
VII.	Norwich (Cossey)	2.43	+ .62	.60	6	17	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	1.93	— .93	.29	2	11	67.0	29	38.0	14	0	...
IX.	Barnstaple	1.17	— .89	.49	19	18	64.0	31	33.0	5	0	3
X.	Bodmin	1.95	— .41	.33	2	20	67.0	9, 31	36.0	13	0	...
XI.	Stroud (Upfield)	1.89	— .03	.56	19	19	68.0	8	32.0	15	1	6
XII.	Church Stretton (Woolstaston)	2.42	+ .23	.47	19	20	72.0	8	29.2	1	2	3
XIII.	Tenbury (Orleton)	2.20	— .32	.21	22	22	70.5	8	29.8	1	1	...
XIV.	Leicester	2.18	— .17	.39	27	16	72.0	8	29.0	1	2	...
XV.	Boston	1.60	— .95	.19	12	6	65.0	8	35.0	2	0	...
XVI.	Hesley Hall (Tickhill)	1.28	— .54	.20	9	9	...	...	...	...	...	...
XVII.	Manchester (Ardwick)	2.40	+ .20	.19	16	16	...	...	...	...	...	...
XVIII.	Wetherby (Ribston Hall)	1.62	— .65	.19	16	16	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	2.47	— .38	.19	17	17	71.0	8	30.0	1	2	2
XX.	Hull (Beverly Road)	1.61	— .95	.19	14	14	74.0	8	31.0	1	2	3
XXI.	North Shields	1.49	— .70	.19	13	13	...	...	...	...	...	...
XXII.	Borrowdale (Seathwaite)	5.55	— .37	.19	13	13	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	2.23	— .42	.19	12	12	68.0	31	35.0	4, 6	0	7
XXIV.	Haverfordwest	1.62	— .49	.19	10	10	...	...	...	...	...	...
XXV.	Plinlimmon (Cwmsymlog)	2.67	— .44	.19	14	14	64.0	31	36.2	1	0	...
XXVI.	Llandudno	1.51	— .51	.19	12	12	67.2	31	28.8	2	1	...
XXVII.	Cargen (Dumfries)	1.13	— .51	.19	16	16	67.0	17	29.0	5	3	...
XXVIII.	Jedburgh (Sunnyside)	1.28	— .21	.19	12	12	71.0	17a	31.0	22	2	...
XXIX.	Old Cumnock	2.19	— .37	.19	10	10	...	...	...	...	...	...
XXX.	Lochgilhead (Kilmory)	1.61	— .22	.20	8	8	67.5	26	32.8	21	0	...
XXXI.	Oban (Craigvarren) .....	.93	— .29	.18	13	13	...	...	...	...	...	...
XXXII.	Mull (Quinish)	1.39	— .70	.20	11	11	66.0	15	34.0	2, 21	0	...
XXXIII.	Loch Leven Sluices .....	.90	— .31	.19	13	13	64.9	25	26.3	2	6	16
XXXIV.	Arbroath	1.33	— .60	.21	16	16	67.0	8	31.0	20	2	...
XXXV.	Braemar	1.11	— .97	.21	17	17	...	...	...	...	...	...
XXXVI.	Aberdeen	1.95	— .83	...	...	...	67.0	16	43.0	31	0	9
XXXVII.	Lochbroom	3.16	— .79	.21	19	19	58.7	25	33.4	20	0	...
XXXVIII.	Dunrobin	1.87	— .25	.31	13	13	75.0	25	36.0	1	0	...
XXXIX.	Kirkwall (Swanbister)	1.87	— .50	.19	11	11	76.0	13	35.0	1	0	...
XL.	Cork (Blackrock) .....	.95	— .35	.31	10	10	68.0	25	31.0	1	0	...
XLI.	Dromore Castle	2.02	— .57	.19	10	10	68.0	29	32.0	1, 2	2	...
XLII.	Waterford (Brook Lodge) .....	.89	— .46	.19	10	10	...	...	...	...	...	...
XLIII.	O'Briensbridge (Ross)	1.25	— .52	.19	10	10	66.6	25	36.2	1	0	7
XLIV.	Carlow (Browne's Hill)	1.10	— .70	.19	11	11	66.0	25	30.0	1	1	...
XLV.	Dublin (Fitz William Square)	.88	— .49	.19	9	9	75.0	6	32.0	3	1	6
XLVI.	Ballinasloe	1.89	— .95	.19	12	12	...	...	...	...	...	...
XLVII.	Waringstown	1.47	— .78	.19	13	13	66.0	...	34.0	...	0	3
XLVIII.	Londonderry (Creggan Res.)	3.11	— .39	...	...	...	...	...	...	...	...	...
XLIX.	Omagh (Edenfel)	1.96	— .78	...	...	...	...	...	...	...	...	...

α And 31.

+ Shows that the fall was above the average ; — that it was below it.

METEOROLOGICAL NOTES ON MAY, 1887.

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

ENGLAND.

STRATHFIELD TURGISS.—On the whole the temperature of the first part of the month was of an unseasonable character, with a continuance of harsh and cold N.E. winds and storms and short spells of great heat. In the middle of the month the nights were very cold. The close of the month was much more genial. House martin seen on 2nd, swift on 13th, orange tip butterfly on 31st. Gale on 19th and 20th, T and H on 20th, T, L, and H on 21st.

ADDINGTON.—A cold, backward month, but with very little frost. The number of days on which a northerly wind was registered at 9 a.m. (28) was much in excess of any previous record for May. The warmest night was the 12th, with min. temp. 49°. H on 20th and 21st, high wind on 20th, T on 21st.

CULFORD.—Unusually cold and sunless; wind very high on 19th, doing considerable damage to fruit blossom.

LANGTON HERRING.—Rainfall slightly above the average. Mean temp. at 9 a.m. 2°·1 below the average of 15 years; the fifth month in succession with temp. below the average, and the first May in 16 years in which the highest min. has been below 50°. On the night of the 19th there was a great storm, which is very unusual for May. T on 21st; solar halos on 5 days.

BODMIN.—Mean temp. 52°·5.

STROUD.—N.W. gale with H showers on 20th; T and L on 21st, T nearly all day on 26th.

WOOLSTASTON.—The first half of the month was cold, dry, and very backward, the latter part was wet. Mean temp. 48°·0. Very violent H storms occurred on 20th and 21st, doing immense damage to fruit trees in blossom.

ORLETON.—The mean temp. at 9 a.m. was lower than that of any other May for the last 26 years, except in 1879 and 1885. Nevertheless there were only three frosty nights, although the wind blew steadily from N. and E. with only a variation to the southward for a few hours on two days, for the sky was generally covered with clouds at night. There was very little sunshine or clear sky. The first half of the month was very dry, but in the latter half there was wet mist or small R almost every day. Pressure was generally high and steady. A great wind occurred on 20th and 21st, with showers of H and R, but there was no L or T during the month. Solar halos on 10th and 23rd. Plums and damsons in full bloom about 8th, and cherries on 12th.

LEICESTER.—Another very cold month; wind N. or N.E. on 22 days.

BOSTON.—Very cold throughout, with prevalence of N.E. winds and frosty nights. Vegetation was three weeks late, and neither May Laburnum nor Lilac were in flower at the end of the month. Cuckoo on 4th.

MANCHESTER.—Temperature was low and vegetation backward owing to the prevalence of cold E. winds. A severe storm of wind, R and sleet occurred on the 19th and 20th.

HULL.—The month was unsettled and cold.

WALES.

HAVERFORDWEST.—The month was characterized by deficiency of R and by absence of frost, except a few nights of very slight white frost. Vegetation looked much better at the close than could reasonably have been expected after such a drought and such a moderate amount of sunshine, with N.E. wind. A great storm of wind, very destructive in its effects on vegetation, occurred on the night of the 19th. Chesnut trees fully exposed presented the appearance of blasted trees on the following morning, potatoes suffered, and the whitethorn, where exposed, lost all its leaves; happily the apple blossoms were not in an advanced state, those that were exposed perished. The oak leafed from 14 to 21 days in advance of the ash.

LLANDUDNO.—The month was exceptionally dry, contrasting with a May of exceptional wetness last year. It was also exceptionally cold, and that notwithstanding a fair amount of bright sunshine. Cyclonic conditions prevailed from the 19th to the 21st inclusive, with heavy R on the 19th, and a gale of considerable force from the N.W. beginning in the afternoon of the 20th, and ending in the evening of the 21st. During the rest of the month the condition of the atmosphere was mostly anti-cyclonic, associated with rather keen polar winds. The mean temp, ($49^{\circ}\cdot 5$) was 3° , the mean daily range ($10^{\circ}\cdot 2$) 4° , and the monthly range ($27^{\circ}\cdot 8$) $5^{\circ}\cdot 4$ below the average. Relative humidity (75), slightly below the average. Vegetation was very backward, and the May flower, which ought to have appeared about the beginning of the month was not seen anywhere till quite near the end.

SCOTLAND.

CARGEN.—S on hills on 20th ; H on 19th.

JEDBURGH.—Very cold and ungenial ; wind mostly E., N., or N.E. ; still, owing to the heat of the sun, vegetation progressed wonderfully. The fruit blossom was remarkably luxuriant, and, as its development was much retarded by cold weather in April, the slight frosts of this month did not materially injure it. The border hills were all white on the 20th ; H showers on 20th, 21st and 22nd. Cuckoo on 16th ; cornrake on 18th.

OBAN.—The driest month for several years, consequently the crops were very backward, especially hay. The temperature was above the average ; it increased daily to 16th ; then followed the usual cold period, with S and H on 20th, succeeded by a very warm fine period lasting to the end of the month.

ABERDEEN.—Fine seasonable weather, as a whole. Rainfall about the average.

LOCHBROOM.—On the whole a very fine month. Its beginning, middle, and end were very fine, indeed at times most lovely ; but from the 18th to the 23rd, very wild weather prevailed, more like winter than summer. There were S and sleet in the valleys, and deep fresh S covered the hills and heights, even at the close.

CULLODEN.—Long dry periods occurred during the month, with stormy and cold E. winds.

IRELAND.

BLACKROCK.—With the exception of three slight showers the weather was fine and mostly bright, with a few warm days, to the 17th, then showery to the end with S and H on the 20th. Vegetation was backward, and R much wanted at the close. Mean temp. ($53^{\circ}\cdot 9$) $0^{\circ}\cdot 7$ below the average of 11 years.

WATERFORD.—The driest May since 1876, and the total R from January 1st the smallest in any year since 1860, when observations commenced. H on 20th and 21st.

O'BRIENSBRIDGE.—Brilliant sunshine prevailed for the greater part of the month, with cool N. and N.E. winds, but no serious frost. Vegetation was slow, and all flowering shrubs were late in blooming, whitethorn opening on 28th.

DUBLIN.—A generally fine, dry, but rather dull month with high pressure, and a remarkable preponderance of polar winds. As in April, the precipitation was limited to ten days, and was usually in the form of cold showers. There were no electrical disturbances. Mean temp. slightly below the average. Lunar corona on 7th ; solar halos on 5th and 7th ; slight fog on 3rd ; S or sleet on 20th and 21st ; high winds on 5 days, attaining the force of a gale on 19th and 20th.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCLVIII.]

JULY, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

THE RECENT DROUGHT.

PROBABLY every one is prepared for the statement that the six months of the present year, already elapsed, have been unprecedentedly dry, and June especially so. But this is not the case as regards the British Isles generally, and for England we do not have to look far back to find a month as dry as or drier than June, and only about ten years to find the corresponding six months much drier.

To consider June first. The really remarkable—and, we believe, almost unprecedented—phenomenon is the long spell of absolutely rainless weather, for of the 150 stations whose results are printed in this magazine there are scarcely 20, at which the absolute drought did not extend for 14 days. This has been put into tabular form on the rules laid down in *British Rainfall*, 1884, p. [166], the “Absolute Droughts” being periods of 14 or more days absolutely without rain, and the “Partial Droughts” periods of 28 or more days with not more than .25 in. of rain.

STATION.	ABSOLUTE.			PARTIAL.		
	began	ended	days	began	ended	days.amt.
Camden Square	June 9	June 30	22	...	...	... ..
Abinger	6	30	25	...	...	... ..
Hunton	4	30	27	...	...	... ..
Birchington	4	30	27	...	...	... ..
Littlehampton	4	30	27	...	...	... ..
Hailsham	5	30	26	June 3	June 30	28 .15
Ryde, Thornbrough.....	7	30	24	...	...	... ..
Alton, Ashdell	4	30	27	3	30	28 .21
Strathfield Turgiss	4	18	15	...	...	... ..
Hitchen	4	24	21	June 3	June 30	28 .25
Addington	4	30	27	...	...	... ..
Oxford, Magd. Coll.....	4	30	27	...	...	... ..
Banbury, Bloxham Grove	4	30	27	...	...	... ..
Northampton, Hazlewood Road	4	30	27	...	...	... ..
Cambridge, Beech House	4	30	27	June 3	June 30	28 .16
Wisbech, Bank House	9	30	22	3	30	28 .03
Southend	4	30	27	3	30	28 .12
Sheering	9	30	22	3	30	28 .20
Rendlesham	4	30	27	3	30	28 .02
Culford	4	30	27	May 28	30	34 .17

STATION.	ABSOLUTE.			PARTIAL.			
	began.	ended.	days.	began.	ended.	days.	amt.
Diss	June 9	June 30	22	June 2	June 30	29	·18
Swaffham	9	23	15	May 28	30	34	·20
Cossey	9	30	22	June 3	30	28	·03
Alderbury	4	30	27	3	30	28	·17
Warminster	7	30	24	3	30	28	·10
Langton Herring	7	30	24	3	30	28	·02
Holne Vic.	8	30	23	1	30	30	·21
Holsworthy, Clawton	6	30	25	1	30	30	·11
Winsford	1	30	30	No daily	observat	ions	
Barnstaple	10	30	21	June 2	June 30	29	·13
Lynmouth, Glenthorne	9	30	22	1	30	30	·17
Probus	May 30	30	32	May 30	30	32	·00
Bodmin	June 8	30	23	June 1	30	30	·10
Temple Combe, Stowell	9	30	22	3	30	28	·03
Taunton, Lydeard Ho.	4	30	27	3	30	28	·01
Wells, Westbury	9	30	22	3	30	28	·08
Clifton	9	30	22	3	30	28	·21
Stroud	7	30	24	3	30	28	·14
Ross, The Graig	7	30	24	3	30	28	·13
Woolstaston	9	30	22	...	...	...	...
Wem, Clive Vic.	9	30	22	...	...	...	...
Cheadle, Heath House	10	30	21	...	...	...	...
Worcester, Diglis	9	30	22	...	...	...	...
Orleton	9	30	22	...	...	...	...
Coventry, Coundon	4	30	27	...	...	...	...
Leicester	9	30	22	...	...	...	...
Melton, Coston	4	30	27	June 3	June 30	28	·17
Stamford, Ketton Hall	9	30	22	..	...	...	...
Boston	3	30	28	May 29	June 30	33	·18
Horncastle, Bucknall	4	30	27	28	30	34	·14
Mansfield	4	30	27	June 3	30	28	·17
Hesley Hall	4	30	27	May 28	30	34	·22
Macclesfield	10	30	21	...	...	...	...
Liverpool, Breeze Hill	9	30	22	...	...	...	...
Ardwick	8	30	23	...	...	...	...
Broughton-in-Furness	8	30	23	...	...	...	...
Wakefield, Stanley Vic.	12	30	19	May 26	June 30	36	·19
Wetherby, Ribston	11	30	20	26	30	36	·15
Arncliffe	8	30	23	26	30	36	·23
Ripon, Mickley	4	30	27	28	30	34	·23
Hull	4	30	27	25	30	37	·25
Scarborough	12	30	19	28	30	34	·19
East Layton	May 27	30	35	25	30	37	·07
Mirkleton	June 14	30	17	...	...	...	...
Unthank Hall	13	30	18	...	...	...	...
Shap, Copy Hill	9	30	22	June 2	June 30	29	·24
Llanfrechfa	9	30	22	3	30	28	·17
Cardiff, Ely	9	30	22	3	30	28	·16
Llandoverly	9	30	22	3	30	28	·21
Haverfordwest	8	30	23	...	...	...	...
Castle Malgwyn	13	30	18	...	...	...	...
Cwmsymlog	8	30	23	...	...	...	...
Rhayader, Nantgwillt	9	30	22	June 3	June 30	28	·25
Carno, Tybrith	9	30	22	...	...	...	...
Corwen, Rhug	4	30	27	...	...	...	...
Port Madoc	8	30	23	...	...	...	...
Llandudno	9	30	24	...	...	...	...
Douglas, Victoria Road	8	30	23	...	...	...	...

STATION.	ABSOLUTE.			PARTIAL.			
	began.	ended.	days.	began.	ended.	days.	amt.
Stoneykirk, Ardwell	June 8	June 30	23	May 22	June 30	40	·12
Cargen	9	30	24	...	...	...	...
New Galloway, Glenlee	14	30	17	...	...	...	...
N. Esk Reservoir.....	14	30	17	...	...	...	...
Glendrishaig	14	30	17	...	...	...	...
Old Cummock	15	30	16	...	...	...	...
Glasgow, Queen's Park	15	30	16	...	...	...	...
Lochgilthead, Kilmory	15	30	16	...	...	...	...
Oban, Craigvarren	15	30	16	...	...	...	...
Islay, Gruinart.....	14	30	17	...	...	...	...
Loch Leven	15	30	16	...	...	...	...
Stronvar.....	15	30	16	...	...	...	...
Forres H. R. S.	15	30	16	...	...	...	...
Lochbroom	14	30	17	...	...	...	...
S. Uist, Ardkenneth	12	30	19	...	...	...	...
Invergarry.....	12	30	19	...	...	...	...
Dunrobin	14	30	17	...	...	...	...
Laing, H. R. S.	15	30	16	...	...	...	...
Dunmanway, Coolkelure	8	30	23	...	...	...	...
Cork, Blackrock	8	30	23	...	...	...	...
Fermoy	8	30	23	June 2	June 30	29	·24
Dromore.....	8	30	23	...	...	...	...
Waterford	8	30	23	...	...	...	...
Tipperary	8	30	23	May 23	June 30	39	·25
Newcastle West	11	30	20	...	...	...	...
Miltown Malbay	13	30	18	...	...	...	...
Gorey, Courtown.....	8	30	23	June 1	June 30	30	·19
Carlow, Browne's Hill	10	30	21	2	30	29	·25
Dublin	8	30	23	1	30	30	·25
Navan, Balrath.....	6	30	25	May 23	30	39	·21
Mullingar, Belvedere	8	30	23	June 1	30	30	·21
Athlone, Twyford	9	30	22	2	30	29	·24
Edgworthstown	8	30	23	May 23	June 30	39	·19
Ballinasloe.....	9	30	22	...	...	...	...
Clifden, Kylemore	14	30	17	...	...	...	...
Markree	14	30	17	...	...	...	...
Rockcorry	14	30	17	May 23	June 30	39	·19
Warrenpoint.....	4	30	27	...	...	...	...
Waringstown	7	30	24	...	...	...	...
New Barnsley	13	30	18	...	...	...	...
Bushmills, Dundarave	15	30	16	...	...	...	...
Londonderry, Creggan Res. ..	15	30	16	...	...	...	...
Stewartstown	14	30	17	...	...	...	...
Omagh, Edenfel	14	30	17	...	...	...	...
Buncrana	15	30	16	...	...	...	...

It will be seen that nearly all stations appear except some in Scotland—even Shap in the Lake district is there, and so are eight stations in Wales. Reference to the “Drought” tables in *British Rainfall*, 1884, 1880 and 1868, shows nothing to compare with this year, for we have for average duration—

	Absolute Droughts.	Partial Droughts.
1868	14 days	...
1880	18 „	32 days
1884	17 „	30 „
1887 June.....	22 „	31 „

This very clearly emphasizes our statement that the really remarkable feature was the length of the absolute drought, and it should be borne in mind that the period included is only to the end of June, and in many, if not most cases, one or two days at the beginning of July will have to be added.

As regards the total rainfall of the month, the usual table of rainfall and temperature exhibits the smallness of the amounts registered and the difference from the average in inches, but for the sake of greater clearness we have also worked them out as per centages and taken the mean, and they give the fall as—

England.....	·70 in. or 28 per cent. of the average.
Wales.....	·78 „ 28 „ „ „
Scotland ...	·79 „ 24 „ „ „
Ireland	·63 „ 17 „ „ „
Mean	·73 „ 24 „ „ „

To find a month so uniformly dry over the whole of the British Isles would, perhaps, be impossible, but as far as England is concerned, to find a near parallel, we have to go only to February of this year, and to July, 1885, when—omitting Seathwaite, whose gigantic rainfall distorts calculation—we have—

FEBRUARY, 1887.		JULY, 1885.	
England...	·68 in. or 30 per cent.	England...	·66 in. or 24 per cent.
Wales.....	1·23 „ 27 „	Wales.....	1·73 „ 40 „
Scotland..	2·73 „ 84 „	Scotland..	1·76 „ 43 „
Ireland ...	1·50 „ 47 „	Ireland ...	1·85 „ 60 „
Mean	1·54 „ 47 „	Mean	1·50 „ 42 „

Scotland and Ireland show great excesses, and for those countries we have to go back to June, 1884, to find anything comparable to June last, and even then the excess is considerable.

To describe clearly the local distribution of the drought is not easy, but we may say that over Yorkshire, Lincolnshire, and part of Suffolk and Cornwall, the fall appears to have been less than 10 per cent. of the average, and over the Southern half of Ireland less than 20 per cent. The following table gives all falls of less than 25 per cent. of the average :—

Div.	Station.	Per cent. of average.	Div.	Station.	Per cent. of average.
IX.	Hull}	2	XI.	Haverfordwest	13
V.	Bodmin	3	X.	N. Shields	15
IX.	Wetherby, Ribston ...	5	XII.	Jedburgh	15
IV.	Culford	6	XX.	Cork, Blackrock	15
IX.	Skipton, Arncliffe	6	XVII.	Braemar	18
VII.	Boston	8	IV.	Norwich, Cossey	21
XXI.	Carlow, Browne's Hill..	10	XII.	Cargen [Dumfries]	21
„	Dublin	11	XXIII.	Omagh, Edenfel	21
XVIII.	Inverness, Culloden .	11	XVI.	Loch Leven	22
XXII.	Ballinasloe	13	XI.	Cardiff, Ely	24

Comparing the actual rainfalls with the amounts recorded in previous Junes, we find that of the following 27 stations, at which the observations extend over a long series of years, ten of the falls are unprecedented, while others are by no means exceptional.

RAINFALL IN JUNE, 1887, COMPARED WITH PREVIOUS DRY JUNES.

DIV.	STATION.	Fall in June 1887.	Smallest Fall in June.		No of Smaller Falls.	NextSmallest Fall.	
			Amount	Date.		Amt.	Date.
I.	London, Camden Square ...	.91	.42	1877	3		
III.	Hitchen .....	.87	.42	1868	6		
IV.	Bury St. Edmunds, Culford	.14				.73	1867
"	Norwich, Cossey .....	.46				.51	1884
V.	Bodmin.....	.10				.54	1869
VI.	Tenbury, Orleton	1.36	.45	1868	Many		
VII.	Boston .....	.18				.45	1868
VIII.	Manchester, Ardwick	1.24	.55	1868	Many		
IX.	Skipton, Arncliffe .....	.22				.60	1865
"	Hull, Beverley Road.....	.04				.57	1874
X.	Borrowdale, Seathwaite ...	2.20	1.25	1865	3		
XI.	Haverfordwest .....	.38				.44	1884
"	Llandudno .....	.96	.15	1868	6		
XII.	Cargen [Dumfries].....	.66	.46	1868 ^a	3		
"	Jedburgh, Sunnyside .....	.35	.07	1865	2		
XIV.	Old Cumnock .....	.95	.79	1884	1		
XV.	Lochgilthead, Kilmory.....	1.74	1.35	1884	3		
XVI.	Loch Leven Sluice .....	.60	.30	1884	4		
"	Arbroath ... ..	.72	.37	1884	4		
VII.	Braemar .....	.56	.24	1865	1		
XVII.	Culloden .....	.25	.08	1865	1		
XX.	Cork, Blackrock.. ..	.53	.05	1869	3		
XXI.	Carlow, Browne's Hill .....	.26				.80	1866
"	Dublin, FitzWilliam Square	.25				.40	1874
XXII.	Ballinasloe .....	.42				.63	1884
XXIII.	Waringstown .....	.76	.54	1865	1		
"	Omagh, Edenfel .....	.64	.40	1865	1		

^a and 1884.

We may, perhaps, summarise by saying that the absolute drought of June appears to be unprecedented, and perhaps the smallness of the rainfall over the whole of the United Kingdom is the same, but that, taking the countries individually, we can find for each, at no distant date, months with a rainfall almost as small.

This exceptionally dry month, coming after several others with a rainfall below the average, has naturally tried the resources of water-works all over the country; some of them have apparently failed, others are expected to do so, and there is a general cry of unprecedented drought. How far this cry is justified is open to question, though there is, no doubt that, in some districts, the deficiency of rainfall is considerable. There is, however, up to the present time no reason for supposing that July may not also be dry, we therefore purpose deferring the discussion of the question till our next issue.

We append one or two letters with which we have been favoured by our correspondents.

To the Editor of the Meteorological Magazine.

SIR, — The long continued drought of the past half year, and more especially of the month of June, seems worth recording. From the 4th of June to the 3rd of July inclusive, I have registered only 0·01 in. of rain ; this shower occurred on June 8th, thus giving an absolutely dry period twenty-five days, and a period of thirty days without any rain worth speaking of. The above facts would be unusual even in the driest part of the country ; but, occurring as they have done, in a district where the annual fall averages over forty inches, they are very remarkable. The total for June is only 0·37 in., the smallest amount I have registered for any month since I commenced, in December, 1880.

Further, from January 1st to June 30th, only 9·27 inches have fallen, each month having had less than the average of the preceeding six years, and some considerably so, as will be seen from the annexed table :—

	Average 1881-6.		1887.		Per cent. of average.
January	4·74	.....	1·95	.....	41
February	3·39	.....	·96	.....	28
March	3·06	.....	2·40	.....	78
April	2·70	.....	1·25	.....	46
May	2·66	.....	2·34	.....	88
June	3·21	.....	·37	.....	12
	<hr/>		<hr/>		<hr/>
Total	19·76	.....	9·27	.....	47

The fall has thus been less than half the average. How long is it, since the amount in this district for the first half of the year, has been so small ?

Concurrently with this, the barometer has remained consistently high. The average at 9 a.m. has been above thirty inches for every month, except January, which was only slightly below. Out of the 181 days to the end of June it has stood above thirty inches on no fewer than 122 days.

Trusting that the above notes are of sufficient interest to warrant insertion in your magazine.

I remain, yours truly,
CHARLES L. BROOK.

Harewood Lodge, Meltham, July 5th 1887.

To the Editor of the Meteorological Magazine.

SIR,—The late long drought at Beckford lasted from Friday afternoon, June 3rd, to 12 o'clock on Monday night, July 4th, or for a period of thirty-one days without any rain at all.

From 12 o'clock midnight on July 4th to 2 a.m. July 5th 0·11 in. of rain fell, and no rain has fallen since.

Yours truly,
FREDERICK SLADE.

Beckford, Tewkesbury, July 6th, 1887.

ROYAL METEOROLOGICAL SOCIETY.

The concluding meeting of this Society for the present session was held on Wednesday evening, June 15th, at the Institution of Civil Engineers, 25, Great George Street, Westminster, Mr. W. Ellis, F.R.A.S., President, in the chair.

The following papers were read:—

(1) *Amount and Distribution of Monsoon Rainfall in Ceylon generally, with remarks upon the Rainfall in Dimbula.* By Mr. F. J. WARING, M.Inst.C.E. The principal feature in Ceylon which determines both the amount and the distribution of rainfall is a group of mountains situate in the south central portion of the island, equidistant from its eastern, western, and southern shores. The south-west and north-east Monsoons in Ceylon may be said respectively to blow steadily from May to August inclusive, and from November to February inclusive. In March and April, and in September and October, the weather is more or less unsettled, and no regular Monsoon or direction of the air current is usually experienced. After giving details of the rainfall at 25 stations, the author concludes by remarking upon—(1) The effect of the mountain zone in determining the amount and distribution of the rainfall. (2) The apparent gradual veering of the rain-bearing currents of air as each Monsoon progresses. (3) The relative insignificance of the south-west Monsoon as compared with the north-east Monsoon in inducing rainfall. (4) The cause of the large general rainfall of the north-east Monsoon throughout the island generally as compared with that of the south-west Monsoon. (5) The influence of the gaps in the external ring of the mountain zone, and of the central as well as the other ridges in it, in determining the amount of rainfall within the zone, and in the neighbouring districts outside it.

(2) *Note on a Display of Globular Lightning at Ringstead Bay, Dorset, on August 17th, 1876.* By Mr. H. S. EATON, M.A., F.R.Met.Soc. Between 4 and 5 p.m. two ladies who were out on the cliff saw, surrounding them on all sides, and extending from a few inches above the surface to two or three feet overhead, numerous globes of light, the size of billiard balls, which were moving independently and vertically up and down, sometimes within a few inches of the observers, but always eluding the grasp; now gliding slowly upwards two or three feet, and as slowly falling again, resembling in their movements soap bubbles floating in the air. The balls were all aglow, but not dazzling, with a soft, superb iridescence, rich and warm of hue, and each of variable tints, their charming colours heightening the extreme beauty of the scene. The subdued magnificence of this fascinating spectacle is described as baffling description. Their numbers were continually fluctuating; at times thousands of them enveloped the observers, and a few minutes afterwards the numbers would dwindle to perhaps as few as twenty, but soon they

would be swarming again as numerous as ever. Not the slightest noise accompanied the display.

(3) *Ball Lightning Seen during a Thunderstorm on July 11th, 1874*, by Dr. J. W. Tripe, F.R.Met.Soc. During this thunderstorm the author saw a ball of fire of a pale yellow colour rise from behind some houses, at first slowly, apparently about as fast as a cricket ball thrown into the air, then rapidly increasing its rate of motion until it reached an elevation of about 30°, when it started off so rapidly as to form a continuous line of light, proceeding first east then west, rising all the time. After describing several zigzags it disappeared in a large black cloud to the west, from which flashes of lightning had come. In about three minutes another ball ascended, and in about five minutes afterwards a third, both behaving as the first, and disappearing in the same cloud.

(4) *Appearance of Air Bubbles at Kemenham, Berkshire, January, 1871*, by Rev. A. BONNEY.—Between 11 a.m. and noon a group of air-bubbles of the shape and apparent size of the coloured india-rubber balls that are carried about the streets were seen to rise from the centre of a level space of snow within view of the house. The bubbles rose to a considerable height, and then began to move up and down within a limited area, and at equal distances from each other, some ascending, others descending. These lasted about two minutes, at the end of which they were borne away by a current of air towards the east and disappeared. Another group rose from the same spot, to the same height with precisely the same movements, and disappeared in the same direction and after the same manner.

Mr. H. C. Russell, F.R.S., of Sydney, described a fall of red rain which occurred in New South Wales, and exhibited under the microscope specimens of the deposit collected in the rain-gauges.

EAST WINDS IN SPRING.

To the Editor of the Meteorological Magazine.

SIR,—The author of the article in your June number on “East Winds in Spring” might like to have his attention drawn to what I have said in my “*Observations in Meteorology*,” pp. 113—119, on the subjects of Easterly winds and their relative frequency in the different months of the year.—Truly yours,

LEONARD BLOMEFIELD (LATE JENYNS.)

Bath, June 18.

SIR,—I send you a table of “East Winds in Spring,” observed here by me similar to that of Mr. Paget, published on p. 71 of the last number of your *Meteorological Magazine*. I believe a local excess of N.E. winds occurs here, as, owing to the configuration of the country, S.E. and E. winds in the English Channel often get deflected into N.E. winds here. The average duration of easterly winds in the first five months of the 10 complete years (ending May 31st, 1886), was just over 7 weeks, and was 12 days more than that observed in Nottinghamshire. The maximum was 68 days in 1880, the minimum 33 days in 1878. The average for 10 years—

N.E.	25 0
E.	19 1
S.E.	7 8

Total.....	51 9

If I had computed the winds at 9 a.m. only, instead of combining them with the 9 p.m. observations (as I have done), the days of easterly winds would have been many more than appear in the table, as such winds are more frequent here in the morning than in the evening.

Yours truly,

EDWIN E. GLYDE.

Kirkham, Babbacombe, Torquay, Devon, July 1st, 1887.

MEAN OF 9 A.M. AND 9 P.M., EASTERLY WIND DIRECTION AT BABBACOMBE, TORQUAY, DEVON. (NO. OF DAYS.)

Year.	January.			February.			March.			April.			May.			Total.		
	N.E.	E.	S.E.	N.E.	E.	S.E.	N.E.	E.	S.E.	N.E.	E.	S.E.	N.E.	E.	S.E.	N.E.	E.	S.E.
1877	1	1	1	1	...	...	2	1	2	6	6	4	5	5	3	15	13	10
1878	3	...	..	2	4	1	4	1	...	4	8	...	2	3	1	15	16	2
1879	8	8	3	2	3	2	8	3	...	7	2	1	7	1	2	32	17	8
1880	5	9	3	3	...	1	7	12	...	9	3	...	12	3	1	36	27	5
1881	7	8	2	6	4	1	3	6	2	10	6	1	9	2	...	35	26	6
1882	3	5	3	1	4	4	2	...	...	5	3	4	4	9	1	15	21	12
1883	1	5	4	1	1	2	7	5	1	5	6	2	9	2	...	23	19	9
1884	1	1	2	...	6	5	4	4	2	10	5	1	8	2	...	23	18	10
1885	4	5	4	2	...	1	9	4	2	5	3	3	2	2	...	22	14	10
1886	3	1	...	6	6	2	5	7	2	11	3	...	9	3	2	34	24	6
Mean	3·6	4·3	2·2	2·4	2·8	1·9	5·1	4·3	1·1	7·2	4·5	1·6	6·7	3·2	1·0	25·0	19·1	7·8
1887	3	2	2	6	6	2	7	5	1	6	5	1	10	3	1	32	21	7

HEAT IN JUNE.

To the Editor of the Meteorological Magazine.

SIR,—I append a record of the temperatures reaching 80 degrees and upwards in the shade during the recent hot weather here, the thermometers used are Negretti and Zambra's, and the readings were verified by a standard instrument by the same makers, with a Kew certificate.

					Max.		Min.
June	16th	...	...	...	80°	.....	57°
	17th	...	...	...	81	.....	58
	18th	...	...	...	83	.....	60
	19th	...	...	...	82	.....	56
	22nd	...	...	...	80	.....	54
	23rd	...	..	...	80	.....	56
	24th	...	...	...	84	.....	60
	25th	...	...	...	83	.....	50
	26th	...	...	...	81	.....	54

This record is remarkable for several reasons.

It seems to be above the average for the same period for all British stations to the south and east of this.

A shade temperature of 80 degrees has not been reached here in the month of June during the past 25 years, nor, as far as I can ascertain, for a very much longer period; nor even in the months of July nor August, except in the years 1867, once; 1868, nine times; 1869, once; 1870, once; 1876, once; 1878, twice; and 1880, once; yet it will be seen that it has been reached or exceeded nine times this year already.

The temperature of Friday, the 24th June—max. 84°, min. 60°, mean 72°—has I think hardly been reached here before; although, curiously enough, I have a record for the 24th June, 1826, of 87° in the shade, but it requires verification. Both in that year and in 1820 the greatest summer heat occurred here in June. They were both most prosperous years, as to which I am glad to say this year gives a like promise.—Yours faithfully,

L. M. BUCHANAN,

Lieut.-Col., F.R.Met.Sec.

Edenfel, Omagh, Co. Tyrone, July 4th, 1887.

SHOWER OF BLACK RAIN.

A very strange atmospherical phenomenon was witnessed at Castlecomer, Ireland, on April 30th. A general depression was felt all over the district in the afternoon, accompanied by lightning and thunder and a tremendous rainfall, which continued till about seven o'clock. At about 7.50 p.m., a thick black rain fell, sufficiently black to stain any white cloth, and apparently impregnated with an insoluble dust. The water of the local streams and cisterns was discoloured, and in many places could not be used for domestic purposes.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JAN., 1887.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London	52·2	19	14·5	2	40·3	30·6	33·0	89	67·6	11·0	1·26	13	7·8
Malta.....	61·6	27	43·0	11	59·0	46·6	44·7	84	120·2	36·0	2·31	14	4·7
<i>Cape of Good Hope</i> ...	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Mauritius</i>	85·0	11	71·0	15	82·6	74·5	70·6	79	138·0	64·3	9·84	20	7·7
Calcutta.....	81·1	6, 7	47·1	24	75·2	55·2	54·8	72	140·9	36·4	1·49	3	1·3
Bombay.....	83·3	16	60·0	22	79·9	66·4	63·8	72	138·2	45·9	·00	0	1·2
Ceylon, Colombo	90·7	14	67·3	30	88·0	71·8	66·9	65	150·2	58·0	2·31	6	5·0
<i>Melbourne</i>	104·9	10	47·9	1	80·6	59·7	56·3	65	154·2	36·3	1·11	6	5·9
<i>Adelaide</i>	111·2	9	51·0	19	88·8	62·3	51·9	44	164·0	41·2	·69	3	2·7
<i>Wellington</i>	83·0	26	47·0	3	75·4	59·1	59·8	78	143·0	41·0	·18	3	3·0
<i>Auckland</i>	81·5	17	58·5	9	78·0	63·7	63·8	78	146·0	50·0	1·29	5	6·2
<i>Falkland Isles</i>.....	...	...	36·2	9	...	42·7	46·0	83	133·0	29·0	4·36	24	7·6
Jamaica, Kingston.....	90·8	23	61·2	16 ^a	87·5	65·9	67·9	79	...	...	·46	...	3·6
Barbados	80·0	11	67·0	15	78·0	69·0	66·9	76	141·0	...	3·32	18	6·0
Toronto	44·1	23	-16·6	3	26·7	8·5	17·3	83	...	-21·0	3·21	18	7·0
New Brunswick, } Fredericton	45·9	29	-34·1	9	22·4	-4·1	9·7	79	...	...	6·45	21	6·0
Manitoba, Winnipeg } British Columbia, } Victoria	23·2	10	-42·7	7	-3·6	-26·7	-11·0	97	...	...	·71	12	4·0
	52·0	4	30·0	19	46·3	35·8	...	...	...	...	6·68	21	...

^a And 25.

REMARKS, JANUARY, 1887.

MALTA.—Mean temp. 51°·5; mean hourly velocity of wind 8·3 miles. Sea temp. varied between 58°·5 and 60°·0. TS on 3rd; H on 1st and 3rd. J. SCOLLES.

Mauritius.—Rainfall 3·81 in. and mean temp. of dew point 1°·1 above their averages; mean temp of air 0°·2, and mean pressure ·053 in. below their averages; mean hourly velocity of wind (10·4 miles) 0·9 mile below the average; extremes 23·8 on 28th and 2·7 on 14th; prevailing direction E.N.E. T and L on 9 days, L alone on 5 days. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 3°·0, of dew point 3°·7, mean humidity 1, and mean amount of cloud ·8 above their averages; rainfall ·57 in. below average. Prevailing winds S. and S.E., strong on 4 days. Very sultry and oppressive from 4th to 11th. T and L on 4th, 14th, and 18th; L alone on 7th. R. L. J. ELLERY, F.R.S.

Adelaide.—Pressure ·043 in., and rainfall slightly below their averages; mean temp. 1°·1 above the average. Very hot at the commencement of the month, colder in the latter half. C. TODD.

Wellington.—A very fine month, with very small rainfall, 3·33 below the average. Prevailing wind N.W., at times fresh, but on the whole moderate; strong on 12th from N.E. Mean temp. (67°·2) 0°·6 above the average. T and L on 1st, slight earthquakes on 16th and 31st, fog on 29th. R. B. GORE.

AUCKLAND.—A hot and dry month, the mean temp being more than 2° above, and the rainfall hardly half the average; violent TS on 19th. T. F. CHEESEMAN.

BARBADOS.—Pressure not steady; mean temp. (77°·3) average; rainfall 25 per cent. below the 25 years average. Prevailing wind N.E.; mean hourly velocity 13 miles; extremes 17·3 miles and 6·5 miles; 6 days were overcast. R. BOWIE WALCOTT.

VICTORIA.—A very wet and stormy month.

SUPPLEMENTARY TABLE OF RAINFALL,
JUNE, 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	1·13	XI.	Castle Malgwyn	·48
"	Margate, Birchington...	·42	"	Rhayader, Nantgwillt..	·70
"	Littlehampton	1·20	"	Carno, Tybrith	·95
"	Hailsham	·94	"	Corwen, Rhug	1·16
"	Ryde, Thornbrough	1·24	"	Port Madoc	1·27
"	Alton, Ashdell.....	·82	"	I. of Man, Douglas	·57
III.	Oxford, Magdalen Col...	1·56	XII.	Stoneykirk, Ardwell Ho.	·11
"	Banbury, Bloxham	2·03	"	New Galloway, Glenlee	·74
"	Northampton	1·19	"	Melrose, Abbey Gate ...	·83
"	Cambridge, Beech Ho...	·62	XIII.	N. Esk Res. [Penicuick]	·70
"	Wisbech, Bank House..	·35	XIV.	Ballantrae, Glendrishaig	·73
IV.	Southend	·39	"	Glasgow, Queen's Park.	·72
"	Harlow, Sheering	·50	XV.	Islay, Gruinart School..	·77
"	Rendlesham Hall	·37	XVI.	St. Andrews, Pilmour Cot	·88
"	Diss	·28	"	Balquhider, Stronvar..	1·88
"	Swaffham	·15	"	Dunkeld, Inver Braan..	·50
V.	Salisbury, Alderbury ...	·96	"	Dalnaspidal H.R.S. ...	1·17
"	Warminster	·99	XVII.	Keith H.R.S.	·56
"	Calne, Compton Bassett	...	"	Forres H.R.S.	·44
"	Ashburton, Holne Vic..	·21	XVIII.	Strome Ferry H.R.S....	2·26
"	Holsworthy, Clawton...	·11	"	Tain, Springfield	·46
"	Hatherleigh, Winsford.	·00	"	Loch Shiel, Glenaladale	5·40
"	Lynmouth, Glenthorne.	·17	"	S. Uist, Ardkenneth ...	2·01
"	Probus, Lamellyn	·00	"	Invergarry	1·35
"	Wincanton, Stowell Rec.	1·01	XIX.	Lairg H.R.S.	·38
"	Taunton, Lydeard Ho ...	·27	"	Forsinard H.R.S.	·95
"	Wells, Westbury.....	·93	"	Watten H.R.S.	1·38
VI.	Bristol, Clifton	1·00	XX.	Dunmanway, Coolkelure	1·10
"	Ross	·95	"	Fermoy, Gas Works ...	·40
"	Wem, Clive Vicarage ...	1·67	"	Tralee, Castlemorris ...	...
"	Cheadle, The Heath Ho.	1·31	"	Tipperary, Henry Street	·25
"	Worcester, Diglis Lock	1·38	"	Newcastle West	·29
"	Coventry, Coundon	1·86	"	Miltown Malbay.....	·43
VII.	Melton, Coston	·61	XXI.	Gorey, Courtown House	·19
"	Ketton Hall [Stamford]	1·03	"	Navan, Balrath	·21
"	Horncastle, Bucknall ...	·06	"	Mullingar, Belvedere ...	·21
"	Mansfield, St. John's St.	·43	"	Athlone, Twyford	·32
VIII.	Macclesfield, The Park.	·91	"	Longford, Currygrane...	·17
"	Walton-on-the-Hill.....	1·17	XXII.	Galway, Queen's Coll...	·46
"	Lancaster, South Road.	...	"	Clifden, Kylemore	1·39
"	Broughton-in-Furness ..	·58	"	Crossmolina, Enniscoe..	·59
IX.	Wakefield, Stanley Vic.	·08	"	Collooney, Markree Obs.	·43
"	Ripon, Mickley	·23	XXIII.	Rockcorry.....	·19
"	Scarborough, West Bank	·18	"	Warrenpoint	·54
"	East Layton [Darlington]	·00	"	Newtownards .....	...
"	Middleton, Mickleton ..	·44	"	Belfast, New Barnsley..	·78
X.	Haltwhistle, Unthank..	·36	"	Cushendun	1·19
"	Shap, Copy Hill	·28	"	Bushmills	1·12
XI.	Llanfrechfa Grange ...	·82	"	Stewartstown	·97
"	Llandovery	·36	"	Buncrana	·66

JUNE, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which .01 or more fell.	Max.		Min.		On grass	In shade.
				Dpth	Date.		Deg.	Date	Deg.	Date.		
I.	London (Camden Square) ...	.91	- 1.76	.51	3	3	85.3	15	43.0	27	0	0
II.	Maidstone (Hunton Court)...	1.06	- 1.01	.56	2	2	...	...	...	...	...	...
III.	Strathfield Turgiss	1.31	- .79	.95	2	2	85.3	15	40.6	21	0	0
IV.	Hitchin .....	.87	- 1.26	.32	1	4	80.0	15a	42.0	26	0	...
V.	Winslow (Addington)	1.16	- 1.35	.50	2	3	83.0	15	41.0	21a	0	0
VI.	Bury St. Edmunds (Culford)	.14	- 2.13	.12	2	2	88.0	13	36.0	20d	0	...
VII.	Norwich (Cossey) .....	.46	- 1.76	.26	2	3	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	.36	...	.34	2	3	77.0	16	45.0	9	0	...
IX.	Barnstaple .....	.92	- 1.80	.79	1	6	88.0	17	44.0	11	0	...
X.	Bodmin .....	.10	- 3.11	.06	6	4	77.0	19	60.0	9	0	...
XI.	Stroud (Upfield)	1.14	- 1.24	1.00	2	3	85.0	16	47.0	2, 3	0	...
XII.	Church Stretton (Woolstaston)	1.17	- 1.70	.70	2	5	78.5	16	39.0	1	0	0
XIII.	Tenbury (Orleton)	1.36	- 1.38	.95	2	4	87.2	27	39.0	21	0	0
XIV.	Leicester	1.44	...	.66	2	4	83.6	15	40.6	1	0	...
XV.	Boston .....	.18	- 2.07	.12	2	2	91.0	15	37.0	21	0	...
XVI.	Hesley Hall [Tickhill] .....	.22	...	.11	3	3	81.0	18b	39.0	1, 22	0	...
XVII.	Manchester (Ardwick)	1.24	- 1.92	.60	3	4	80.0	17c	43.0	1	0	...
XVIII.	Wetherby (Ribston Hall) ...	.15	- 2.72	.10	10	2	...	...	...	...	...	...
XIX.	Skipton (Arncliffe) .....	.22	- 3.60	.11	3	6	92.0	18	38.0	9	0	...
XX.	Hull (Beverley Road) .....	.04	- 2.08	.03	3	2	84.0	21	42.0	28	0	0
XXI.	North Shields .....	.31	- 1.72	.16	4	7	78.8	13	40.5	21	0	0
XXII.	Borrowdale (Seathwaite)	2.20	- 5.61	.79	19	9	...	...	...	...	...	...
XXIII.	Cardiff (Ely) .....	.74	- 2.32	.58	2	5	...	...	...	...	...	...
XXIV.	Haverfordwest .....	.38	- 2.65	.20	7	5	83.0	19	40.0	...	0	...
XXV.	Plinlimmon (Cwmsymlog) ...	1.02	...	.39	7	3	...	...	...	...	...	...
XXVI.	Llandudno .....	.96	- 1.04	.61	3	6	80.0	17	45.0	1	0	...
XXVII.	Cargen [Dumfries] .....	.66	- 2.51	.36	3	5	83.4	25	36.4	1	0	...
XXVIII.	Jedburgh (Sunnyside) .....	.35	- 2.05	.17	5	4	83.0	18	34.0	21	0	...
XXIX.	Old Cumnock .....	.95	- 1.97	.20	7	11	85.0	18	36.0	20	0	...
XXX.	Lochgilphed (Kilmory)	1.74	- 2.10	.56	6	12	...	...	...	...	...	...
XXXI.	Oban (Craigvarren)	1.91	...	.40	6	12	79.8	24	46.2	3	0	0
XXXII.	Mull (Quinish)	2.65	...	.44	11	13	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices .....	.60	- 2.17	.20	7, 8	4	...	...	...	...	...	...
XXXIV.	Arbroath .....	.72	- 1.89	.20	6	7	76.0	18	40.0	1	0	...
XXXV.	Braemar .....	.56	- 2.53	.25	13	8	81.5	22	33.0	2	0	7
XXXVI.	Aberdeen .....	.66	...	.26	13	10	80.0	18	41.0	3	0	0
XXXVII.	Lochbroom	1.40	...	.46	8	10	...	...	...	...	...	...
XXXVIII.	Culloden .....	.25	- 2.00	...	...	...	81.0	18	41.0	14e	0	I
XXXIX.	Dunrobin .....	.87	...	.33	4	7	76.5	18f	40.0	2	0	...
XL.	Kirkwall (Swanbister) .....	...	...	...	...	...	...	...	...	...	...	...
XLI.	Cork (Blackrock) .....	.53	- 3.02	.21	1	4	89.0	26	49.0	16	0	...
XLII.	Dromore Castle .....	.69	...	.23	7	4	90.0	27	43.0	9	0	...
XLIII.	Waterford (Brook Lodge) ...	.48	...	.24	7	3	87.0	27	40.0	4	0	...
XLIV.	O'Briensbridge (Ross)	1.37	...	.89	3	8	83.0	23	45.0	2	0	...
XLV.	Carlow (Browne's Hill) .....	.26	- 2.40	.11	7	7	...	...	...	...	...	...
XLVI.	Dublin (Fitz William Square)	.25	- 1.95	.09	3	5	78.4	17	47.4	10	0	0
XLVII.	Ballinasloe .....	.42	- 2.77	.11	6	6	78.0	23	39.0	3	0	...
XLVIII.	Waringstown .....	.76	- 1.90	.68	3	4	90.0	18	44.0	9, 29	0	0
XLIX.	Londonderry (Creggan Res.) ..	.91	...	.26	3	9	...	...	...	...	...	...
L.	Omagh (Edenfel) .....	.64	- 2.41	.28	6	7	84.0	24	45.0	9	0	0

a And 27, b and 19, 27, c and 18, d and 26, e and 21, f and 30.
 + Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON JUNE, 1887.

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

ENGLAND.

STRATHFIELD TURGISS.—Brilliant, fine and hot weather prevailed throughout the month. The wheat crop was immensely improved by the sunshine. Roots and pulse crops wanted R at the close and the water supply was getting short. Hay was cut on the 23rd. Small copper and blue butterflies were seen on 11th and meadow brown butterfly on 14th.

HITCHEN.—The longest drought since July, 1868, and, with only five exceptions, the hottest June since our record began in 1849.

ADDINGTON.—A month of fine, dry weather, with no measurable quantity of R after the 3rd; 27 consecutive days without R in one month is by far the longest period I have any record of. With the drought there was much sunshine, and many things were suffering at the close in consequence. T on 1st; much R on the first three days, causing a large flood.

CULFORD.—Our register, which dates back 15 years, shows this to have been the driest June recorded in that period.

LANGTON HERRING.—The jubilee month will be remembered for its exceptionally bright, fine weather. The mean temp, at 9 a.m. was $1^{\circ}4$ above the average of 15 years. The mean max. temp. was $1^{\circ}5$ above the average. The 16th was a very hot day, the temp. at 9 a.m. being 70° and the max. 77° . There was more or less fog from 4th to 9th; from 13th to 28th the range of pressure was only $\cdot 10$ in.; from 16th to 26th the wind was N.E. No T was heard. For the first six months of the year the rainfall is only $8\cdot 21$ in. on 59 days, the deficiency being as much as $6\cdot 21$ in. and the number of rainy days 25 below the average.

STROUD.—Very hot sun prevailed on most days, but the nights generally were cool. R was much wanted at the close.

WOOLSTASTON.—A very dry month, with continued easterly winds and intense heat. Mean temp. $60^{\circ}0$.

ORLETON.—The first three days were cold and cloudy, with heavy R after noon on the 2nd, continuing all night. On the 4th the sky became clear and the temp. rose, the remainder of the month being characterised by brilliant sunshine without any measurable R except on the 8th, when $\cdot 12$ in. fell. The max. temp. was much higher than the average and the min. lower, the mean at 9 a.m. being about $2^{\circ}5$ higher than the average of the last 26 years, and only exceeded in 1865, 1868, and 1870. The prevailing wind was N.E. and the sky was generally cloudless but hazy. Pressure was generally much above the average and the fluctuations were very trifling. No T or L.

LEICESTER.—Very dry; no R after the 3rd, except $\cdot 07$ in. on the 8th. R much needed for gardens and fields at the close.

BOSTON.—The smallest rainfall, with one exception, and the longest period without R during 23 years. On the 15th the range of shade temp. was 42° . Lilac came into flower on 3rd, and May and Laburnum a few days afterwards. Wheat was in ear at the close.

MANCHESTER.—The temp. at the commencement of the month was rather low, and there were rather heavy showers during the first three days; the weather then cleared up and continued fine and dry to the end. R is much wanted; the reservoirs of waterworks in Lancashire are getting very low, and unless R comes speedily, a scarcity of water will be severely felt in the manufacturing districts.

ARNcliffe.—R on only six days, and the total fall less than a quarter of an inch. I never made such a return before. Everything suffering from drought, fishes dying from want of water in the beck; and pastures, and even meadows scorched up.

HULL.—A remarkably dry month, the driest since April, 1852, when only $\cdot 02$ in. fell. The days were generally fine, with cold nights. In the six months only $6\cdot 52$ in. of R fell, $4\cdot 97$ in. below the average of ten years.

WALES.

LLANDUDNO.—Judging by the heat of June, we appear to be entering on an old fashioned summer in succession to an old fashioned winter. The mean temp. ($60^{\circ}0$) was $2^{\circ}0$ above the average, and the highest registered at Llandudno in any year from 1861 to 1887 inclusive. The nearest approach to it occurred in 1877, when the mean June temperature was $59^{\circ}6$, but from 1878 to 1886 inclusive, our Junes were uniformly cold, averaging only $56^{\circ}0$. The mean daily range ($13^{\circ}8$) was $0^{\circ}6$ below, and the monthly range ($35^{\circ}0$) was $2^{\circ}2$ above the average. The rainfall was 51 per cent. below the average. In consequence of this and the large amount of sunshine (250 hours) the atmosphere was remarkably dry, the relative humidity being 68 in comparison with an average of 76. The greater part of the R fell on the first three days which were also cold, but from 4th to 30th, the max. temp. was always above 60° , and it exceeded 70° on no less than nine days. From 1861 to 1886 inclusive, a period of 26 years, there were seven different occasions in June, when the temp. rose to 80° or upwards, viz., 1865, 1867, 1868, 1876, 1877, 1878 and 1884, but on these occasions the heat was less persistent and the air was cooled from time to time by T and R. This year, however, we have had no T and no R from the 7th, while the earth, intensely heated by the solar rays during the day, gave off its accumulated heat from sunset to sunrise, and so maintained the night temperature at a high level, exceeding 60° on several occasions. But notwithstanding the persistently high temp. the air never felt close or oppressive, partly because of its extreme dryness, and partly because of a tempering breeze which more or less prevailed throughout. Though the month was unusually dry, it was by no means the driest since 1861. In 1868, R fell on one day only, and the amount was only $\cdot15$ in.; in 1869 it was $\cdot82$ in., in 1873 $\cdot66$ in., in 1874 $\cdot35$ in., and in 1885 $\cdot96$ in. It was altogether a most enjoyable month for the seaside.

SCOTLAND.

CARGEN.—The latter half of the month was unusually hot, the max. thermometer registering from $75^{\circ}0$ to $83^{\circ}4$ on 13 days. On two or three occasions the daily range was very great, as much as 36° or 37° . Rainfall very deficient. Sunshine 72 hours above the average; pressure $\cdot277$ in. above average. E. winds on 15 days. During the last five months only 6.27 in. of R has fallen, $8\cdot53$ in. less than the average. This long continuance of dry weather is telling most injuriously on all crops; many pasture fields in the district are quite burnt up, and in many places the failure of the usual water supply has led to serious inconvenience.

JEDBURGH.—Only twice during 23 years has the rainfall been less, viz., in 1865 and 1868. East winds for about a fortnight tended to keep the temperature down, and the night temperature was below the average. Crops on the whole looked well, but pastures were beginning to get brown at the close, and springs were getting low. T and L on 18th.

BRAEMAR.—A very dry, scorching month. Solar halo on 20th.

CULLODEN.—Rainfall almost nil. On many days the heat was very great. The crops and all pasture land suffered greatly. Distant T on 18th.

IRELAND.

BLACKROCK.—Slight showers fell on 1st, 5th, 6th and 7th, then fine, bright weather prevailed to the end; hot from 16th. Mean temp. ($63^{\circ}4$) $3^{\circ}2$ above the average of 11 years. The rainfall for the six months ($10\cdot27$ in.) was $11\cdot32$ in. less than the average of 22 years for the same period.

DROMORE.—Rivers running dry. We have not had such a June for years.

WATERFORD.—A very parching month with a good deal of E. wind. The driest June since 1869, when only $\cdot32$ in. was registered.

O'BRIENSBRIDGE.—Brilliant weather prevailed throughout, the shade temp. reaching 80° and upwards on several days, and the min. temp. being as high as 60° on several nights. The country was much parched and grass burned up, especially on limestone soils.

BROWNE'S HILL.—This neighbourhood is very much dried up; rivers are very low, and wells failing. We have had only 5 inches of R during the last five months.

DUBLIN.—June 1887, will be long remembered as one of the driest and warmest months on record in Dublin. Pressure was high almost throughout, and remarkably steady. As in May, there was a preponderance of polar (N.E. and E) winds which were, however, of little strength, and partook more of the nature of day-sea breezes than of real or very decided air currents. There were no electrical disturbances in Dublin, and after the 7th not a drop of R fell. The mean temp. ($62^{\circ}3$) was much above the average ($57^{\circ}7$). In the preceding 22 years, June was warmest in 1865 ($61^{\circ}0$) and in 1868 ($60^{\circ}5$). Lunar corona on 27th; solar halo on 5th; fog on 4th and 18th; high winds on three days. Temperature reached or exceeded 70° in screen on no fewer than 17 days. Mean humidity 72; mean amount of cloud 4.2; prevailing winds N.E. and E. The rainfall for the six months was only 6.74 in. on 67 days compared with an average of 12.50 in. on 96 days.

BALLINASLOE.—Very hot and dry; bogs on fire all round at the close.

WARINGSTOWN.—The most continuously hot month ever experienced here; no R after 6th; there was great scarcity of water at the close, and grass was much burnt up; but crops, except late turnips, were not much damaged.

EDENFEL.—The weather of June was very remarkable. With the smallest monthly rainfall since June 1865, there was a longer continuance of higher temperature than had been experienced here during the 25 years recorded, and, as far as I can ascertain, during a much longer period.

PAMPHLET EXCHANGE.

Copies of the following pamphlets can be had on application, provided the cost thereof be enclosed in the same cover. When all the copies have been distributed, the stamps (less postage) will be returned.

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G. J. SYMONS.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCLIX.]

AUGUST, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.

THE DRY SUMMER.

WE dealt last month with the June drought. A dry June has been followed in many places by a dry July, and in London the first fourteen days of August have been rainless. It will therefore probably be well to leave the discussion of the July and August drought until it is over. Meanwhile we welcome Mr. Baldwin Latham's report on the results of his numerous well measurements, and insert a few letters on the drought; and we add a short note on the fall of rain, based upon the monthly totals only.

In the first place, however, we shall say a few words about the temperature, because there has been some very wild exaggeration with reference to that subject. We purpose dealing with only the values for Camden Square, because they are handy and because they are continuous for 30 years without any break or change of position or of instruments which could affect the records by half a degree.

9 a.m. Shade Temperature.—This, as is well known, is very nearly the same as the true mean temperature. Here are the values—

	June.		July.
Mean 1859-78.....	61·7	.....	64·9
1887	61·9	.....	67·4
Excess	0·2	.....	2·5
Hottest 1859-87	66·0	.....	70·4
} Temp.	1868	.....	1868
} Year			
Number of years out of the previous			
29 in which the temp. was equal to,	11	.....	3
or higher than in, 1887.....			

Therefore, as regards average temperature, June was not at all remarkable; July, though it has been once equalled (1876) and twice exceeded (1859 and 1868), was a very hot one.

Absolute Maximum.—The maxima this year have been quite unimportant; the highest in June was 85°·3, but only four years since it was higher (85°·6 in June, 1883). There are eight out of the twenty-nine Junes with higher max., June 1870 heading the list with 91°·2. July tells a similar tale; the max. in 1887 was 88°·8, but even so recently as 1885 we had 90°·4, and the present year's

value has been surpassed in ten out of the twenty-nine years, 1881 heading the list with 94°·6.

Frequency of High Maxima.—A very good idea of the character of a season may be obtained by noting how often the maxima exceed certain fixed points. The following are the facts as to this—

	Instances between			Above	Above	Above
	70° & 80°	80° & 90°	90°	70°	80°	90°
Mean 1858-86	38	10	1	49	11	1
1887	37	16	0	53	16	0
Difference	-1	+6	-1	+4	+5	-1
Number of years out of the previous 29 in which the instances in 1887 have been equalled or exceeded	19	7	10	8	8	10

Interval since similar Heat.—The above will have shown that though it has been hot, it has been nothing very exceptional. Another set of investigations shows that all the phenomena have been equalled within a comparatively recent period, mostly within eight years. The rarest phenomenon seems to be the high mean temperature of the two consecutive months of June and July (64°·6); this does not seem to have been equalled since 1872, but previous to that there are several cases—1870, 1868, 1865, 1859. In 1868 May was extremely warm, 10½° above May 1887. May to July 1868 had a mean 9 a.m. temperature of 66°·0, against 60°·2 in 1887.

Of course, we are neither suggesting that this is a cool nor a damp summer; all that we point out is, that at present we have not proved that it is in many respects, or at all stations, unprecedented. Take July 1868; we had in London 20 days above 80°, and of them 4 were above 90° (and 90° was also reached in September); this year there were only 11 days above 80°, and 88°·8 is the highest point reached.

Or again, take *British Rainfall* 1868 and look at the monthly falls in May, June, and July; here are the totals for the three months at a few places—

Camden Square	2·81	Rotherham	1·28
Chichester	2·41	Leeds	1·54
Wellingborough	1·29	Castle Newe, Aberdeen ...	1·72
Cossey, Norwich	2·04	Antrim	2·89
Branston, Lincoln.....	1·20		

At Camden Square the total rainfall was—

	May.	June.	July.	Total.
1868.....	1·58	·78	·45	2·81
1887.....	1·45	·91	1·07	3·43

Therefore both the temperatures and the above monthly totals of rain indicate a more trying time in 1868 than in 1887.

END OF THE DROUGHT.—A CENTURY'S DROUGHTS.

(From the YORK HERALD of July 9th, 1887.)

The welcome rain has come at last in North-east Yorkshire, terminating the long drought which had lasted just a month. The genial showers which fell

on Monday afternoon came just in the nick of time, as the parched ground was showing disastrous proof of the extreme heat and long absence of moisture. Saturday and Sunday were the hottest days experienced in the district for a long time, and were, it seems, the culminating point of a very hot cycle. The thermometer at Messrs. Slaters', Malton, on Saturday registered 90 deg. in the shade, a record which takes us back to some of the hottest periods of the present century. We read of unusually hot summers in 1718, 1723, 1750, 1778, and the following year; and then in the present century July, 1808, was the first excessive case. Again, the whole of the summer of 1818 and July and August of 1819 were very hot. In July, 1825, both men and horses died from the heat, as they did also in 1750 and 1808. The entire summer of 1826 was notably hot and dry, and 1835 was nearly the same. August 1842, was a month of awful heat, and in 1846 the entire summer was intensely hot and dry. Next were 1857-8-9, remarkably hot, especially August, 1857; June, 1858; and July, 1859. September, 1865, was the hottest September on record. Next was 1868, from May to September, most excessive of all, with many deaths from the great heat. There was nevertheless, a very good harvest in that year, especially of wheat and barley. Then July, 1873, and July 1874, showed a temperature nearly equal to that of 1868; and in 1876 most excessive heat also prevailed, July and August of that year being respectively $2\frac{1}{2}$ deg. and $3\frac{1}{2}$ deg. above the average, the maximum on August 14th being 90 degrees, or exactly the same temperature as was registered at Malton on Saturday. In the last decade we have had occasional waves of heat, but as a rule our summers have been short, and generally wet and unproductive; in fact, since 1878 we have not had in Yorkshire one harvest up to average all round. It is feared that of 1887 will be no exception, as oats have already suffered almost past redemption by the long drought. Wheat, however, looks well, and given favourable weather till August we should have a good wheat and pulse harvest, as peas and beans also look well. The small rainfall of only 0.14 inch for June was the lowest ever recorded in that month; the nearest approach being in June, 1865, when 0.44 inch fell.

To the Editor of the Meteorological Magazine.

SIR,—The present drought seems worthy of special notice. An absolute drought reigned here for 28 days in June, and 5 in July, making a total period of 33 days. On the 5th inst. 0.11 in. fell, and on the 10th, 0.05 in.; total, 0.16 in. This is all the rain we have had for 52 days. This long spell of dry weather was broken this morning by 0.15 in. only, up to 9.30 a.m. On Saturday, the 16th inst., a violent TS occurred in the neighbourhood, when nearly an inch of rain was measured at Ifield, a station only four miles from here. We did not have a drop here. I have no record to compare with the above. The nearest approach to it being from June 25th to August 4th, 1885, with 0.24 in. giving a partial drought of 40 days. Our rainfall for the 6 months ending June this year is 8.30 inch.—Yours faithfully,

A. F. PARBURY.

Rusper, Horsham, Sussex, July 25th, 1887.

To the Editor of the Meteorological Magazine.

SIR,—The rainfall for this year having been exceptional, I send you herewith fuller particulars.

	1887.	Average 29 years.
January.....	1·57	1·85
February.....	·41	1·69
March.....	1·52	1·88
April.....	1·37	1·64
May.....	1·61	1·79
June.....	·04	2·01
1st half year...	6·52	10·86
July.....	1·10	2·27
	<u>7·62</u>	<u>13·13</u>

On the 3rd June '03 in. fell, and no more till July 4th, being 30 days absolutely without rain. The month of June was the driest since April, 1852.

The half-year is, however, by no means the driest six months we have had. In the six months, October, 1857, to March, 1858, only 3·58 inches fell. In the first half of 1874, 6·70 inches.

One feature of the year is the remarkable absence of thunderstorms, of which there have been very few and very slight. Is it only a coincidence that this should happen at the minimum period of sunspots?—I remain, Sir, yours very truly,

HAROLD SMITH.

Fulford House, Hull, 6th August, 1887.

To the Editor of the Meteorological Magazine.

SIR,—the rainfall for the first half of this year, measured here, was 0·43 inch *less* than I have ever before recorded for the corresponding period of the year since 1860 (inclusive); but to the end of July it was 0·44 inch *more* than for 1870.

The amounts up to the ends of months June and July were :—

	1887.	1870.
To end of June	6·61 inches.	7·04 inches.
„ July	7·87 „	7·43 „

T. W. BACKHOUSE.

*West Hendon House, Sunderland.
Aug. 8th, 1887.*

To the Editor of the Meteorological Magazine.

SIR,—So much has been said and written about the drought of this year, that I have ventured to send a comparison with former years.

We had a glorious rain last night (0·76), with intense T & L. If it had not been for last night's rain, 1868 and 1887 would have been nearly equal.—Very truly yours.

HENRY FFOLKES.

Hillington Rectory, King's Lynn, August 1st, 1887.

	1887.	1868.	+ or — mean 1866-86.	Max. Min. in 21 years.			
January	2·52	2·06	0·59+	1867	3·97	1880	0·21
February	0·73	1·76	1·13—	1866	3·10	1886	0·50
March	1·68	1·75	0·17+	1869	3·31	1875	0·57
April	1·15	2·07	0·73—	1876	4·18	1875	0·58
May	1·81	0·32	0·04—	1878	3·94	1868	0·32
June	0·20	0·47	2·05—	1883	4·79	1868	0·47
July	*1·36	0·07	1·42—	1875	6·90	1868	0·07
	9·45	8·50					

* Of which 0·76 on 31st.

Total for first seven months 1887 9·45
 1868 8·50
 Mean 1866-86 14·08

To the Editor of the Meteorological Magazine.

SIR,—I am again keeping a correct register of the rainfall, which I hope to forward you at the proper time. I may add that so far I believe this to be the driest year on record—that is in this immediate neighbourhood. The dry years remembered around here are 1826, 1842, 1859, 1868, 1869, and so far the present one. My rainfall to the end of July has been 12·90 in., and only ·15 in. more up to the present date, or total up to August 11th 13·05 in. ; in 1886 up to that date the fall was 24·24 in.—Yours faithfully,
 JOHN CHARLTON.

*Denton House, Low Row, Carlisle.
 Aug. 11th, 1887.*

UNDERGROUND WATER.

To the Editor of the Meteorological Magazine.

SIR,—It is over eleven years since I began to observe, and collect statistics with reference to, the stores of underground water in this country.

The almost general deficiency of the rainfall since the commencement of the present year naturally leads to an enquiry as to what is the present state of the water supply in the underground stores which furnish the perennial flow to our rivers ?

Now, although there has been a very marked deficiency in the rainfall of the present year, it should be observed that the quantities of water in store in the ground generally, throughout the country, were larger than usual in the spring of the present year—hence we have had in the Croydon district a bourne-flow, a phenomena connected with abundance of rainfall.

The large amount of water in store at the commencement of the year was due to the fact that there was really no low water of any consequence last year, so that we started the year with a surplus store. At the present time, if we compare the stores of water throughout the country with the past records, it will be found that in many parts the stores of water in the ground on the last day of July of the present year are absolutely greater than at the same period in the low water year of 1885. In other parts of the country there is a marked deficiency in the store of underground water as compared with the same period.

The waters are generally very much lower throughout the country than they were at the corresponding period last year, with the exception of some parts of the Midland district, in which the store of water in the new red sandstone is greater than in the corresponding period of last year, and vastly greater than in the low water period of 1885.

The greatest deficiency of water in store, as compared with the low water year of 1885, is in Herefordshire, a large part of Devonshire, the chalk districts of Yorkshire and Sussex, and parts of Cumberland.

In the chalk districts of Wiltshire, one of the principal sources of the Thames, the waters at the present time are about equal in volume to what they were at the corresponding period of 1881, 1883, and 1885.

In the chalk districts of Surrey, Kent, Berks, Bucks, and Hertfordshire, there is rather more water in store than in the corresponding period of 1885.

In the oolite districts of Northamptonshire the waters are lower than at the corresponding period of 1885; but in a similar district in Gloucestershire, there is now a greater quantity in store than in 1885.

The present state of underground waters does not indicate such a marked deficiency as occurred in the corresponding periods of 1844, 1845, 1847, 1854, 1855, 1865, and 1875. Still, the present indication clearly points to the fact that we may anticipate very low water this autumn.

It has been curious to observe that during the past hot weather the ground has received a very considerable amount of moisture from the atmosphere. This is clearly indicated by my new earth hygrometer, and also from the fact that a measurable quantity of water has passed through the gravel percolation gauges every day during July, and water is still passing through these gauges—the total quantity passed in July being small, .035 inch in depth.

I am, Sir, yours faithfully,

BALDWIN LATHAM.

7, Westminster Chambers, Westminster, S. W.
6th August, 1887.

BLACK RAIN.

To the Editor of the Meteorological Magazine.

SIR,—I see in *Symons's Monthly Meteorological Magazine* for the present month, July, 1887, that mention is made on page 90 of a shower of *Black Rain* which fell at Castlecomer, in Ireland, on *April 30th* of this year. We had a similar Shower of *Black Rain on the same day*—April 30th—here at Newport, in Monmouthshire, according to the meteorological journal which I keep. It fell on the same day, about 4 o'clock (wind N.E.) in the afternoon, which made it so dark that it was necessary to have candles and lamps. The black rain fell heavily for some time, staining the yellow gravel walks and leaving a black deposit in the hollows where it rested, some of which is visible at this day, and the rain water that persons caught in tubs and pans and cisterns could not be used. The description in the Magazine described exactly what happened here. Newport is a large town of some 40,000 inhabitants, with various manufactories, railways and docks on a large scale. There was a very dark, heavy cloud over the town, and it seemed to me as if the falling rain had become charged with the fine particles of soot from the chimneys of the town, which it held in suspension as a thick dark London fog does the London smoke which gave it its peculiar dark colour. I have lived here for the last 40 years. My house is on the outskirts of the town, about 150 feet above it, and I have never seen anything of the kind before; the air was highly electric and there was thunder. It was a fine but cold day till this storm came on. Barometer stood at 29·93, having slightly risen from 29·75, and the wind N.E., and it was stormy and unsettled. The water in the rain gauge was quite black, and I send you in a paper some of the deposit which settled from it. What seems curious to me is that similar showers or storms should have fallen in Ireland on the same day, only a few hours later. It is a phenomenon I never saw or heard of before, and it is curious that it should have occurred at the same time at two places so distant from each other. It could hardly be a travelling storm, but the concurring circumstances are very curious. No one seems to have noticed it, but those persons who caught the rain water in tubs and cisterns could not use it. I enclose some of the black deposit from the water which dried up and was not evaporated by heat.

I remain, Sir, yours faithfully.

OCTAVIUS MORGAN, F.R.S., F.S.A.

The Friars, Newport, Monmouth.

[This is a very curious coincidence. An anticyclone appears at the time to have covered both localities, its centre being over the Isle of Man, and the winds were light or calm. There does not appear to have been any connection between the two cases, but similar causes produced similar results. We forwarded the deposit which Mr. Morgan was so kind as to send us to Prof. Meldola, F.R.S., and he

reports "Nothing but the deposit from coal smoke." Mr. Morgan had already anticipated this verdict in the above letter, one which we think most persons who know Newport would have anticipated. We have never been at Castlecomer, but on turning to the excellent *Gazetteer of the British Isles*, recently published by A. and C. Black, we find, among other details respecting Castlecomer, "Coal is worked in the district." Given two towns with coal industries, given similar anticyclonic conditions, given a thunderstorm at each place, the similarity of the result is not very surprising. Possibly there may be a hint as to the formation of rain around smoke particles or of thunderstorms which may be worthy of Mr. Aitken's attention.]
—ED. M.M.

REVIEWS.

Results of the Meteorological Observations made at the Blue Hill Meteorological Observatory, Massachusetts, U.S.A., in the year 1886, under the direction of A. LAWRENCE ROTCH, S.B. 4to ix.—45 pages, 8 plates, Mudge and Sons, Boston, 1887.

THIS the first complete annual report on the highest, and probably the best private meteorological observatory in the United States, is both interesting and instructive. As already mentioned in this magazine, Mr. Rotch came to Europe, and personally visited many of the high mountain stations, thus obtaining many hints for his own guidance. Therefore, when his report comes before us, we have to see not merely that there are the usual climatic data, but what are the special facts brought out by a high level station. We have been promised much from Ben Nevis, but we have as yet seen little. Perhaps Mr. Rotch's report may help us because though not at all lofty (only 635 ft. above the sea) it is stated to be the highest point within 10 miles of the Atlantic, from Maine to Florida, that is to say for somewhere about 2,000 miles or practically along the whole Eastern coast of the United States.

In one respect it may be urged that nothing like criticism should be passed on Mr. Rotch's work, because it is entirely honorary—nay more it is wholly at his cost. He does not tell us the cost of the freehold, but that of the building alone was about £730, and that of maintenance is over £500 a year.

We are, however, not in the habit of paying empty compliments, no one recognizes more heartily than we do Mr. Rotch's devotion of time, and of money to meteorology and we believe that no one would be more ready than he to profit by straightforward criticism should such be needed.

We are glad to see that he has successfully transported a fine Fortin barometer, Kew verified, to his observatory—we infer that the correction for scale error has been applied to all the readings on pages 2 to 7 inclusive, but the head line runs "Barom. Red. to 32°," we prefer "Barom. Corr. and Red. to 32°."

It seems that the Signal office standard, and the Kew standard differ by 0.006 in. the Kew being the lower. We are becoming convinced that thousandths of an inch of mercury are of little if any importance in meteorology, but if they were, we should consider this difference too large.

Mr. Rotch is both liberal and wise in having duplicates, or rather duplicate methods, for recording most of the elements, *e.g.*, he has a Draper Mercurial, and a Richard Aneroid, barograph. We see no intimation respecting the instruments used to supply the figures on pages 2 to 7 under the headings of "Dew Point" and "Relative humidity." In the introduction we are told that, "In cold weather a Koppe hair hygrometer made by Hottinger of Zurich has been used to determine the relative humidity and the dew point. In winter the mean relative humidity given by the hair hygrometer is about 6 % lower than that calculated from the readings of the wet and dry bulb thermometers, which are known to give erroneous results at low temperatures." Just so, but why not give the two values side by side, then the Blue Hill observations would contribute their quota towards that modification of the hygrometric tables which everybody admits to be necessary.

As regards anemometers, Mr. Rotch seems to have achieved some remarkable results, he has several, but two of them a Draper and a Robinson "differ less than one per cent."

Mr. Rotch is rather tantalising in the following paragraph:—

"The self-recording rain and snow gauge constructed, after the writer's design, by Richard Brothers, of Paris, has been in use since March, 1886. The receiver of this gauge rests upon a platform balance, and when rain falls its weight causes the balance to record the amount and time of occurrence of the rain upon a revolving drum, as in the other Richard instruments. . . . To adapt it to snow another receiver is used, which is deeper, with an inner shield to prevent clogging by sleet. The author believes this to be the first successful attempt to record snow automatically without first melting it. The records of the registering gauge agree fairly well with those of the standard with which they are compared. The former gauge has been surrounded by a flaring wire screen on the Nipher system to protect it from the wind, and more snow has thereby been caught in windy weather than before."

We called this paragraph tantalising because it seems to describe a most useful and valuable pattern of gauge, and yet does not enter sufficiently into details for one to form an opinion, and though Mr. Rotch is an expert photographer he has not given either a photograph or an engraving of it. We hope to hear more of this gauge in the future.

Mr. Rotch and his assistant, Mr. Clayton, seem to manage the Jordan sunlight recorder better than most persons, for Mr. Rotch says, "This generally records more sunshine than the burning

instrument, whose action is stopped when the sun is partly observed by cirrus clouds or light haze." That is exactly what it ought always to do, and we think that when it does not, the inference is irresistible that either the papers are deficient in sensitiveness or the observer is not a good manipulator.

The tables do not seem to call for much comment, values for one year are of little use as climatic constants, as years roll on their importance will gradually rise.

We note a few points which strike us. The hourly readings of the Draper Anemoscope give a great preponderance to W. winds. In fact S.W., W. and N.W. give 4483 hours against 2257 hours for S.E., E. and N.E.—or, practically, two of W. to one of E. The velocity of the wind seems to have less diurnal variation than usual; it only varies 10 per cent. being 18.1 miles from 7 to 8 a.m., and 19.9 miles from 3 to 4 p.m.—which by-the-by is later than usual, possibly 1887, may relegate the maximum nearer to 2 p.m.

In an appendix are given reproductions of the indications of some of the sheets from the recording instruments and explanatory notes by Mr. H. Helm Clayton. Here alone we find a trace of what we call true high-level-station work; we, therefore, quote the paragraph.

"Plate No. 3 shows some inversions of temperature between the summit and base of the hill. Curve 1 shows the tracing of the thermograph at the summit from noon of Aug. 22 to noon of Aug. 23. Curve 2 (dotted) shows the tracing of a Draper thermograph at the base, or rather on the slope of the hill, four hundred feet beneath [*sic. i.e.*, lower than] the summit. The time scale of this latter tracing is enlarged to make it correspond with the tracing at the summit. It is seen that the temperature was higher at the base during the day, and decidedly lower at night. The temperature at the base continued to fall until sunrise of the 23rd, while at the summit it rose after 11 p.m. of the 22nd. This inversion occurred on an unusually clear, quiet night, and is a marked example of what almost invariably occurs on such nights."

Le Climat de la Belgique en 1886. Par A. LANCASTER, Météorologiste-Inspecteur à l'Observatoire Royal de Bruxelles [Extrait de l'*Annuaire*]. 12mo, 74 pages and 2 plates. Bruxelles, Hayez, 1887.

If we were asked to name the writer who was the best able to pick out from a meteorological register the salient features, and to render them interesting and agreeable reading, we should treat M. Lancaster as the classical examiners at Cambridge have lately treated Miss Ramsay, put him in the first class by himself, and put all other writers in second, third, or other inferior classes.

The first page of this pamphlet, though not in any way exceptional, will serve to illustrate our meaning.

"The meteorological year 1885-86 commenced with a rigorous

and prolonged winter, especially noteworthy for the frequency and persistency of its frosts rather than for their intensity. From December to March there were, at Brussels, 71 days on which the temperature fell below freezing point, instead of 41, the usual number; on the high lands of the Ardennes, at Bastogne among other places, there were, from December to May, 132.

“These low temperatures marked the close of a long, cold period which had commenced in July, 1885. From that month up to March, 1886 inclusive, that is to say during nine consecutive months, the monthly mean temperature was always below the average, and by considerable amounts in August, October and February. The following table gives these differences [converted into Fahrenheit.—ED.] :—

1885.						1886.		
July.	Aug.	Sept.	Oct	Nov.	Dec.	Jan.	Feb.	March.
—0·4	—3·2	—1·6	—3·6	—2·0	—1·3	—1·4	—6·5	—2·0

But there is one subject upon which we feel bound to protest, and we hope that we shall not protest in vain. What is the use of holding International Congresses if, after all, only those decisions which please everybody are to be obeyed? We have nothing to do with Governmental work, have, therefore, no right to attend these gatherings, and therefore, of course, equally have no obligation to obey the instructions they issue. But there is nothing so essential to meteorological progress as uniformity, therefore, in our own little way, we obey the rules in the making of which we have no right to have a word. With Government establishments it is otherwise, and we must own to great regret at finding this pamphlet drawn up for what is called “the Meteorological year.” We could say much against this plan of beginning with December 1st, but we prefer to rest on the ground that the question was discussed and the civil year was adopted. We think that this decision should be loyally observed by all—especially in Brussels, the city in which, first of any in the world, a meteorological congress was held.

Report of the Marlborough College Nat. Hist. Soc. for the year ending Christmas, 1886. 8vo., 144 pages, 2 plates. Perkins: Marlborough, 1887.

FROM a strictly meteorological point of view this is the worst of the thirty-five reports that the Society has issued because it tells of a break of six months in the Marlborough record. We know not, and do not wish to know, on whose shoulders the blame for this interregnum is to rest, but *somebody* ought to have come to the rescue.

It is, however, useless to complain now, except as a warning to others, and it is far more pleasant to call attention to what is certainly a good feature in the report—viz., the printing of extracts from the Society's record-book under the title of “Notes and obser-

vations." We reprint three of them, which are of special meteorological interest.

White Mist-bow.

Poulton Downs, Feb. 10th.

During the frost a low layer of mist was blowing over the Downs, and during frequent breaks in the fog, the sun shining on it produced a white mist-bow. The width of the arc about equalled that between the primary and secondary ordinary rain-bow, but the colour was pure white.

It was seen on turning the back to the sun.

Time, 4—4.30 p.m. Altitude of sun, 15°—20°.—Altitude of top of bow, 35°—45°.

This phenomenon is probably due to the super-position of coloured bows ; or to the reflection of sunlight from vapour semicrystalline by frost.

LIEUT.-COL. SYKES, Poonah, *Philosophical Transactions*, 1855, writes—
 ".....I emerged from the fog which terminated abruptly in a wall some hundred feet high. Shortly after sunrise I turned homewards and discovered in the mural termination of the fog, a perfect rain-bow, defined in its outline, but destitute of prismatic colours."

The altitude of the sun, height of the mist, and wall-like termination of the fog are approximately similar in the two cases.—A.S.F.

Electricity on Glow-worm.

In the holidays when coming home from a party there happened to be a thunderstorm and as I was walking along a road I noticed and tried to catch several glow-worms, but while thus engaged I noticed that at every flash of lightning the light of the glow-worms so to speak went out and continued so for about quarter of a minute when they again gave forth their usual light. To test the truth of this I took up a couple in my hand when the same peculiar occurrence happened at each flash. I do not know if this has ever been noticed.—H. A. SLACK, Sep. 28th, 1886.

[Did the light diminish, or was it that Mr. Slack's retina was so affected by the blaze of the lightning as not to be sensitive to the feeble glow ?—ED. M.M.]

Fog on the Hills.

On Monday, Nov. 22nd, 1886, the curious effects of the masses of fog were worth observing. Early in the day the fog was very dense, but at 9 a.m. it lay like a vapour bath in the valley, while by ascending to the Common or Granham Hill the view over it was clear. As the sun grew powerful the fog left the valley, and at 3 p.m. was clinging like a wet blanket to all the hills on the downs. They seemed from a distance as if covered with soft wool a few feet thick. Towards evening the fog again descended into the valleys. I noticed the curious afternoon effect from near Rabley.—T.N.H.S.

SUPPLEMENTARY TABLE OF RAINFALL,
JULY, 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	1·01	XI.	Castle Malgwyn	2·44
„	Margate, Birchington...	·27	„	Rhayader, Nantgwilt..	2·92
„	Littlehampton	1·07	„	Carno, Tybrith	1·99
„	Hailsham	·42	„	Corwen, Rhug	2·01
„	Ryde, Thornbrough	·97	„	Port Madoc	4·21
„	Alton, Ashdell	·92	„	I. of Man, Douglas	2·33
III.	Oxford, Magdalen Col...	·71	XII.	Stoneykirk, Ardwell Ho.	3·43
„	Banbury, Bloxham	·50	„	New Galloway, Glenlee	6·16
„	Northampton	·71	„	Melrose, Abbey Gate ..	2·83
„	Cambridge, Beech Ho...	·59	XIII.	N. Esk Res. [Penicuick]	3·00
„	Wisbech, Bank House..	·88	XIV.	Ballantrae, Glendrisaig	3·53
IV.	Southend	1·35	„	Glasgow, Queen's Park.	2·33
„	Harlow, Sheering	·86	XV.	Islay, Gruinart School..	3·96
„	Rendlesham Hall	2·41	XVI.	St. Andrews, PilmourCot	2·38
„	Diss	1·25	„	Balquhitter, Stronvar..	4·60
„	Swaffham	1·15	„	Dunkeld, Inver Braan..	2·08
V.	Salisbury, Alderbury...	·67	„	Dalnaspidal H.R.S.	3·61
„	Warminster	·88	XVII.	Keith H.R.S.	1·97
„	Calne, Compton Bassett	...	„	Forres H.R.S.	1·95
„	Ashburton, Holne Vic..	2·55	XVIII.	Strome Ferry H.R.S....	4·75
„	Holsworthy, Clawton...	...	„	Tain, Springfield.....	2·76
„	Hatherleigh, Winsford.	...	„	Loch Shiel, Glenaladale	10·34
„	Lynmouth, Glenthorne.	1·63	„	S. Uist. Ardkenneth ...	2·95
„	Probus, Lamellyn	1·70	„	Invergarry	6·03
„	Wincanton, Stowell Rec.	·93	XIX.	Lairg H.R.S.	1·85
„	Taunton, Lydeard Ho...	·91	„	Forsinard H.R.S.	2·25
„	Wells, Westbury.....	1·22	„	Watten H.R.S.	2·54
VI.	Bristol, Clifton	1·13	XX.	Dunmanway, Coolkelure	3·71
„	Ross	1·68	„	Fermoy, Gas Works ...	1·74
„	Wem, Clive Vicarage ...	1·15	„	Tralee, Castlemorris ...	...
„	Cheadle, The Heath Ho.	1·87	„	Tipperary, Henry Street	1·61
„	Worcester, Diglis Lock	·98	„	Newcastle West	1·32
„	Coventry, Coundon	·80	„	Miltown Malbay.....	3·43
VII.	Melton, Coston	1·06	XXI.	Gorey, Courtown House	...
„	Ketton Hall [Stamford	·77	„	Navan, Balrath	1·75
„	Horncastle, Bucknall ...	1·35	„	Mullingar, Belvedere ...	3·21
„	Mansfield, St. John's St.	1·59	„	Athlone, Twyford	3·72
VIII.	Macclesfield, The Park.	1·16	„	Longford, Currygrane...	3·06
„	Walton-on-the-Hill.....	·99	XXII.	Galway, Queen's Coll...	4·10
„	Lancaster, South Road.	...	„	Clifden, Kylemore	6·45
„	Broughton-in-Furness..	2·65	„	Crossmolina, Enniscoe..	3·83
IX.	Wakefield, Stanley Vic.	·73	„	Collooney, Markree Obs.	3·48
„	Ripon, Mickley	1·22	XXIII.	Rockcorry.....	2·46
„	Scarborough, West Bank	·96	„	Warrenpoint	2·84
„	EastLayton[Darlington]	1·46	„	Newtownards .....	...
„	Middleton, Mickleton..	1·24	„	Belfast, New Barnsley..	3·65
X.	Haltwhistle, Unthank..	1·78	„	Cushendun	3·34
„	Shap, Copy Hill	2·96	„	Bushmills	2·26
XI.	Llanfrechfa Grange	2·00	„	Stewartstown	3·18
„	Llandoverly	3·26	„	Buncrana	3·56

JULY, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which $\frac{1}{10}$ or more fell.	Max.		Min.		On grass	In shade.
				Dpth	Date.		Deg	Date	Deg	Date.		
		inches.	inches.	in.								
I.	London (Camden Square) ...	1.07	- 1.40	.29	24	9	88.8	3	45.6	18	0	0
II.	Maidstone (Hunton Court)...	.73	- 1.31	.41	25	7	...	...	...	...	...	...
III.	Strathfield Turgiss .....	.80	- 1.50	.22	24	9	88.3	4	40.2	18	0	0
III.	Hitchin .....	.93	- 1.77	.28	14	7	84.0	3	45.0	17 ^a	0	0
IV.	Winslow (Addington) .....	.74	- 1.86	.21	15	8	87.0	3	40.0	18	0	0
IV.	Bury St. Edmunds (Culford)	1.00	- 1.97	.44	31	11	87.0	3, 13	35.0	18	0	...
V.	Norwich (Cossey)	1.95	- .80	1.25	31	8	...	...	...	...	...	...
V.	Weymouth (Langton Herring)	.97	...	.37	17	7	79.0	20	48.0	18	0	...
"	Barnstaple	1.86	- 1.69	.43	24	11	86.0	9	52.0	6 ^b	0	...
"	Bodmin	1.61	- 1.83	.66	27	12	76.0	3, 21	48.0	31	0	0
VI.	Stroud (Upfield) .....	.88	- 1.96	.34	26	8	87.0	4	51.0	31	0	0
"	Church Stretton (Woolstaston)	1.29	- 1.74	.36	26	11	83.0	3	47.0	6, 18	0	0
"	Tenbury (Orleton)	1.53	- 1.38	.50	26	9	87.3	3	39.0	18	0	0
VII.	Leicester .....	.77	...	.25	4	9	87.5	3	42.5	18	0	2
"	Boston	1.11	- 1.42	.56	31	9	95.0	3, 4	40.0	6, 18	0	...
"	Hesley Hall (Tickhill)	1.83	...	1.11	16	7	89.0	3	39.0	6	0	...
VIII.	Manchester (Ardwick) .....	...	...	...	...	...	...	...	...	...	...	...
IX.	Wetherby (Ribston Hall) ..	1.04	- 1.57	.48	27	5	...	...	...	...	...	...
"	Skipton (Arncliffe)	2.27	- 2.68	1.12	26	15	88.0	3	35.0	.5	0	...
"	Hull (Beverly Road)	1.10	- 1.52	.36	31	11	84.0	6	43.0	4	0	0
X.	North Shields .....	.80	- 1.75	.22	15	12	84.0	3	39.5	6	0	0
"	Borrowdale (Seathwaite)	10.04	+ 1.27	2.48	9	20	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
"	Haverfordwest	2.99	- .94	1.14	26	12	81.2	8	43.4	30	0	...
"	Plinlimmon (Cwmsymlog) ..	3.54	...	1.25	26	11	...	...	...	...	...	...
"	Llandudno	1.18	- 1.53	.28	24	10	84.0	8	45.8	6	0	...
XII.	Cargen [Dumfries]	4.28	+ 1.15	.95	9	19	79.0	20	38.0	6	0	...
"	Jedburgh (Sunnyside)	2.67	- .26	.47	9	18	79.0	1, 9	37.0	6	0	...
XIV.	Old Cumnock	4.00	+ .90	.55	12	20	81.0	8	37.0	5	0	...
XV.	Lochgilphed (Kilmory)	3.72	- .82	.76	26	26	...	...	...	...	...	...
"	Oban (Craigvarren)	4.85	...	.95	26	25	76.0	8	46.0	17	0	...
"	Mull (Quinish)	4.99	...	.92	13	24	...	...	...	...	...	...
XVI.	Loch Leven Sluices	2.60	- .45	.70	27	13	...	...	...	...	...	...
"	Arbroath	1.68	- .96	.30	4	12	74.0	3, 22	41.0	6	0	...
XVII.	Braemar	1.70	- 1.16	.22	4	20	75.8	1	36.3	6, 31	0	2
"	Aberdeen	1.94	...	.46	10	17	76.0	1, 9	39.0	5	0	...
XVII.	Lochbroom	3.40	...	.40	24	22	...	...	...	...	...	...
"	Culloden	2.29	- .49	...	...	...	76.0	1	39.0	6	0	1
XIX.	Dunrobin	1.80	...	.31	7	15	77.0	1	37.0	6	0	...
"	Kirkwall (Swanbister)	3.07	...	.46	8	27	66.1	27	35.8	7	0	...
XX.	Cork (Blackrock)	1.45	- 1.39	.41	12	13	82.0	2, 3	44.0	31	0	0
"	Dromore Castle	2.79	...	.56	9	17	81.0	19	45.0	24	0	...
"	Waterford (Brook Lodge) ...	2.40	...	.82	12	12	81.0	3	42.0	18	0	...
"	O'Briensbridge (Ross)	2.10	...	.65	9	16	80.0	1, 3	31.0	27	1	0
XXI.	Carlow (Browne's Hill)	1.69	- .87	.37	12	17	...	...	...	...	...	...
"	Dublin (Fitz William Square)	1.19	- 1.23	.53	31	13	77.0	7	50.3	18	0	0
XXII.	Ballinasloe	2.60	- .28	.77	9	18	72.0	2	46.0	9, 16	0	...
XXIII.	Waringstown	2.85	- .73	.58	9	16	83.0	1	45.0	25	0	...
"	Londonderry (Creggan Res.) ..	3.88	...	.67	26	26	...	...	...	...	...	...
"	Omagh (Edenfel)	3.16	- .09	.50	26	22	75.0	1	42.0	31	0	...

a And 18. b and 16, 19.

+ Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON JULY, 1887.

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

ENGLAND.

STRATHFIELD TURGISS.—Another dry month, with continued drought. There were a few slight and essentially local showers, but practically no rain. The ground is like iron, the skies like brass. From being a late season, it has become an early one; wheat, peas, winter oats and barley were being cut at the end of the month, and the country was "waiting for rain." TS on 4th and 15th.

HITCHEN.—The longest drought since 1868, only .70 in. of R in 8 weeks and 1 day; and the highest mean daily temp. (65°) since 1859.

ADDINGTON.—A month of splendid weather. The dry period which set in on June 4th, terminated with a slight shower on July 4th, giving an absolute drought of 30 days, and as very little R fell till the 15th, we had a partial drought of 41 days; in fact, the R of the month has done very little to help vegetation. The temp. rose above 80° on 11 days, a rather unusual occurrence. T on 15th and 31st; L on 16th.

CULFORD.—The small amount of R recorded was of little help to the root crops; wheat and barley good. T on 31st.

LANGTON HERRING.—Another very dry month, the R being 1.34 in. below the average, and making the total from the beginning of the year only 9.18 in. on 66 days, the average being 16.72 in. on 99 days; the fourth month of the year with less than an inch of R. The mean temp. at 9 a.m. ($65^{\circ}.8$) is $2^{\circ}.5$ above the average. Fogs and mist occurred on many days. TS on 17th.

BODMIN.—The showers of this month were most welcome after the disastrous drought. In 38 years, I have recorded no other year with so small a rainfall in the first 7 months.

STROUD, UPFIELD.—A very dry month, R much wanted. T on 14th, 15th and 17th; L on 31st.

WOOLSTASTON.—The continued drought was severely felt, pastures are burnt up, and water supplies very low. The heat at times was most oppressive.

ORLETON.—A very brilliant hot and dry month. The max. temps. were high and steady, averaging $76^{\circ}.2$; but the nights were cool, as the sky was generally clear. The mean temp. at 9 a.m. was $4^{\circ}.4$ above the average of 26 years, and was exceeded only by $0^{\circ}.4$ in 1868. A light shower with L and T passed from S. to N. on 14th; very distant T was heard on 15th, 16th and 31st, and very distant L seen on 31st. The bar. was high and steady; but the wind was frequently rough, and generally from N.W. to N.E. Hay crep below the average, but secured without R.

LEICESTER.—Another very dry and hot month, with the exception of two or three nights.

HULL.—A very fine month, with occasional gentle showers.

NORTH SHIELDS.—Thunder on 13th, 15th, 23th and 31st.

SEATHWAITE.—Besides the max. R of 2.48 in. on 9th, there were four days on which more than one inch fell.

WALES.

HAVERFORDWEST.—The magnificent weather of June, with its bright sunshine and great heat, continued into this month; but on the 8th the much wished for R came, too late to revive the grass, which in many places was completely burnt up. On 19 days the temp. rose above 70° , and on one day above 80° ; and the night temp. was much higher than that of June. From the 24th to the end high wind prevailed, with considerably lower temperature, and a strong gale blew on 26th. Prevailing winds W.S.W. and N.N.W. Corn crops looking well.

LLANDUDNO.—The fine weather of June continued with little interruption throughout July. The mean temp. ($62^{\circ}.0$) was $1^{\circ}.0$ above the average; the max. temp. was singularly steady, except on the 8th, when it bounded up to 84° , the readings for the preceding and following days being $71^{\circ}.2$ and $70^{\circ}.0$ respectively. The mean daily range was $2^{\circ}.0$ below, and the total range

7°·3 above the average. The greatest daily R barely reached a quarter of an inch, and the wet days being few, the air was very dry, and the mean humidity (72) was 7 below the average. From January to June inclusive, the R of each month was more or less below the average; the aggregate showing a deficiency of over four inches. Pressure was high the greater part of the month, with few and moderate fluctuations. On 12th and 13th strong westerly winds prevailed, and again from 26th to 28th. T on 17th and 31st. The atmosphere was at times remarkable for its transparency, and on the 24th, the Isle of Man, 60 miles distant, was distinctly seen from the Great Orme. The amount of bright sunshine (205 hours) was large, and the month was altogether a most enjoyable one. The public health was exceptionally good.

SCOTLAND.

CARGEN.—Although the R was considerably above the average, and the number of days on which it fell was 19, the heaviest falls took place during the night, and on most other occasions there were only passing showers. The duration of sunshine was 47 hours above the average. The mean temp. was nearly 1° above the average; and the atmospheric conditions were highly favourable for vegetation. Harvest commenced before the close of the month; green crops (turnips, &c) have seldom presented a more promising appearance. T on 5th, 8th and 31st; L on 31st.

JEDBURGH.—Warm and genial throughout. Vegetation made great progress. The hay crop, though below the average, was got in well; turnips a very good crop; corn matured rapidly, and several fields were cut before the close of the month, which has only occurred once before within living memory.

ABERDEEN.—As a whole the month was dry and warm. Rainfall considerably below the average. T and L on 10th.

LOCHBROOM.—A great contrast to the preceding month; wet and cold alternately, with very little sunshine, but on the whole very favourable after the heat and drought of June. H on 24th.

CULLODEN.—Very windy on many days, drying up the R which fell at intervals; dry between 15th and 27th.

IRELAND.

BLACKROCK.—From 1st to 14th fine between misty showers; from 15th to 23rd very fine, and hot at times; thence fine to the end between some misty showers. Harvest began in the middle of the month, which is much earlier than usual. Rainfall to the end of July less than half the average of 22 years. Mean temp. (64°·0) 1°·5 above the average of 11 years.

DROMORE.—Rain, which was much wanted, brought on the crops well, though the hay crop was exceptionally light, and potatoes were very backward.

O'BRIENSBRIDGE.—The R was irregularly distributed in this locality. With a sufficient though moderate fall here and in the district beyond Killaloe, in other parts the amount recorded was very insufficient, with consequent loss in grass and root crops. Like the preceding two months, the weather was lovely, and without precedent for many years back.

DUBLIN.—Although not so dry or settled or sunny as the previous month, July was comparable with it in respect of warmth, the mean temp. (63°·7) being 3°·0 above the average. In the preceding 22 years, July was warmest in 1868, the mean temp. (63°·5) being almost identical with this month. Atmospheric pressure was lower than in June, and easterly air currents gave way completely to westerly. Up to the 31st only '66 in. of R fell, but that small quantity was distributed over as many as 12 days. On the 31st a TS occurred, accompanied by very heavy R and H; no other electrical disturbances were experienced in the city or its vicinity. Solar halos on 14th and 24th. High winds on 14 days; a gale on 27th. Temperature reached or exceeded 70° on 17 days. Mean humidity, 71; mean amount of cloud, 6·0; prevailing winds, S.W., W. and N.W.

EDENFEL.—Although the rainfall almost reached the average it did not interrupt the hay harvest, and proved of great benefit to green crops and vegetation generally. As to temperature, the month was a warm one without any of the "fierce heat" of June.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCLX.]

SEPTEMBER, 1887. [PRICE FOURPENCE,
or 5s. per ann. post free.

TO OUR READERS.

For the first time in our existence, that is to say for more than 20 years, we are puzzled by a plethora of matter beyond all precedent. We may as well enumerate some of the subjects calling for notice :—

The characteristics of one of the greatest droughts of the century.

The correspondence on definitions of droughts.

The thunderstorm of Aug. 17th, probably the most violent in London for thirty years.

An August frost.

Discussion in Parliament respecting the Meteorological Council.

Correspondence respecting the utility of Ben Nevis Observatory.

The British Association meeting.

Floods in Edinburgh.

Whirlwinds in Kent and Lancashire.

To treat all these fully would require 40 or 50 pages, we must therefore cut some of them short and postpone some for a month.

THE DROUGHT.

As regards the drought and the definitions thereof, we shall give a short article dealing with the total rainfall up to Sept. 1st, 1887, and, as regards the definition, Mr. Symons's paper read at Manchester, and reserve the many communications with which we have been favoured, for use in compiling a full account of the phenomena in *British Rainfall*, 1887, and we hope that this notice will not prevent any who think that they can help in the definition of What is a drought? doing so. We are by no means sure that our original proposals are of the right duration. Nobody has yet sufficiently investigated the matter, and very possibly the three kinds—Absolute, Partial, and Long—instead of starting with 14, 28, and 60 days respectively, should start with 20, 40, and 60. Absolute droughts of 14 days appear to be very common.

We have already devoted a considerable amount of space to The drought, and it cannot be thoroughly dealt with until the whole of

the returns are received at the end of the year. We purpose being very brief in our reference to it this month.

On page 85 (July number) 27 stations were selected from those usually published as being well distributed and having long records. In the present discussion we shall deal only with those stations.

Although July and August were decidedly dry, only three stations had *absolute* droughts, viz. Camden-square, 17 days; Bodmin, 18 days; and Orleton, 15 days; and none had a partial drought. As stated in Mr. Symons' letter to *The Times* (Aug 18th), there appears to be no definition of what may be called an engineering drought, *i.e.*, one seriously affecting waterworks—and the reading of the paper before section G of the British Association at Manchester (see p. 121) did not elicit any practical definition. We have therefore gone back to January—the first month of the dry series—and give in the following table the mean total rainfall from Jan. 1st to August 31st, 1870-79, the fall for the same period in 1887, the difference of 1887 from the average, expressed as a per centage, and the smallest previous fall in the period.

DRYNESS OF JANUARY—AUGUST, 1887.

Div.	STATION.	Mean 1870-79 Total fall Jan. to Aug.	1887.		Previous smallest fall. Jan. to Aug.			No. of cases of smaller falls.	Date of com- mence- ment of Obs.
			Total fall Jan. to Aug.	Per cent. of aver.	Year.	Amount	Per cent. of aver.		
I.	London, Camden Square..	in. 17.42	in. 11.38	65	1874	9.07	52	3	1858
III.	Hitchen	16.35	10.35	63	1870	8.85	54	1	1850
IV.	BurySt. Edmunds, Culford	16.27	10.34	64	1874	7.82	48	3	1859
„	Norwich, Cossey.....	16.40	13.14	80	1864	9.00	55	8	1858
V.	Bodmin.....	32.20	13.71	43	1864	18.28	57	None	1850
VI.	Tenbury, Orleton	21.30	12.51	59	1864	12.18	57	1	1831
VII.	Boston	15.84	7.50	47	1870	9.07	57	None	1867
VIII.	Manchester, Ardwick ...	23.03	10.90	47	1868	13.31	58	None	1854
IX.	Skipton, Arncliffe	37.08	22.27	60	1858	18.80	51	4	1853
„	Hull, Beverley Road.....	16.46	9.34	57	1864	9.71	59	None	1858
X.	Borrowdale, Seathwaite..	79.63	57.90	73	1855	48.71	61	2	1845
XI.	Haverfordwest	31.35	18.03	58	1864	19.36	62	None	1849
„	Llandudno	18.53	11.58	62	1885	11.34	60	1	1859
XII.	Cargen [Dumfries]	28.09	16.32	58	1880	18.41	66	None	1860
„	Jedburgh, Sunnyside.....	17.60	10.80	61	1870	9.61	55	1	1864
XIV.	Old Cumnock	24.65	22.19	90	1880	19.02	77	5	1870
XV.	Lochgilthead, Kilmory ...	35.86	30.08	84	1869	27.40	76	2	1863
XVI.	Loch Leven Sluice.....	23.30	15.70	67	1870	11.00	47	1	1842
„	Arbroath	18.50	13.27	72	1870	10.87	59	2	1844
XVII.	Braemar	22.52	12.20	54	1864	14.16	63	None	1857
XVIII.	Calluden	15.73	9.69	62	1870	7.88	50	1	1841
XX.	Cork, Blackrock.....	28.85	13.83	48	1868	17.49	61	None	1865
XXI.	Carlow, Browne's Hill ...	22.29	13.17	59	1870	15.59	70	None	1866
„	Dublin, Fitzwilliam Sq...	17.78	9.45	53	1870	10.43	59	None	1865
XXII.	Ballinasloe	24.02	14.90	62	1870	17.87	74	None	1868
XXIII.	Waringstown	21.40	15.30	71	1870	14.81	69	3	1862
„	Omagh, Edenfel	22.44	15.54	69	1870	16.73	75	None	1865

	1887.	Previous smallest fall.
Mean per centage of average, England	59·8	55·4
" " " Wales	60·0	61·0
" " " Scotland	68·5	61·5
" " " Ireland.....	60·3	68·0

In *British Rainfall*, 1881, p. 27. values are given for the *Extreme Limits of Fluctuation of Rainfall* in one year, three years, and seven years, and a rough calculation based on these gives as the approximate value for the driest eight months that may reasonably be expected 45 per cent. of the average fall. This value would seem to be rather too low, as it is reached only once in the table; Bodmin 43 per cent. in 1887, but there being five instances below 50 per cent. proves that it is not very far wrong as an extreme limit. And to look at the matter from another point we have—

	Mean period of observation.	Mean min. per centage of rainfall.
England	35·0 years	55·4
Wales	34·0 "	61·0
Scotland	32·9 "	61·5
Ireland	27·4 "	68·0

showing a marked decrease in the minimum rainfall, with an increase of period of observation, proving that the period under consideration is too short to give an absolute minimum.

These calculations may appear somewhat wide of the mark in considering the drought of 1887, but they give a valuable basis for calculation and, we believe, strongly support the hypothetical value of 45 per cent.

To return to 1887—the stations, of the 27 above tabulated, at which the drought was most severe, are—

Bodmin, Cornwall.....	43 per cent. of the average fall.
Boston, Lincoln.....	47 " " "
Manchester.....	47 " " "
Blackrock, Cork	48 " " "

In England out of 11 stations the drought is unprecedented at 6.

In Wales out of 2 stations the drought is unprecedented at 1.

In Scotland out of 8 stations the drought is unprecedented at 6.

And in Ireland out of 6 stations the drought is unprecedented at 5, but the duration of the observations is so much less that the comparison is unfair.

We may sum up by saying that the drought has been considerable over the whole of the British Isles, that Scotland has suffered least, and that in parts of England the deficiency of rain has been exceptional and has reached the extreme limit that may be expected.

METEOROLOGY IN PARLIAMENT.

A long and somewhat animated discussion occurred in Parliament on August 23rd, upon the vote of £23,900 for learned societies, &c. Many of the hon. members were puzzled as to the nature and titles of the various bodies referred to, and in the following report (based upon that in *The Times*) we have tried not only to be absolutely impartial, but to correct the many obvious errors, while reproducing as tersely as we can such arguments as were not based upon deficient information.

MR. BUCHANAN said that Scotchmen objected to the appropriation of the £4,000 placed at the disposal of the Royal Society for distribution for research, and thought that £3,000 might be left at their disposal and £1,000 sent to Edinburgh for disposal by the Royal Society of Edinburgh. He further said that out of the £15,300 voted to the Meteorological Council, Ben Nevis Observatory got nothing, except £100 a year in payment for observations. He proposed to reduce the vote by £1,000.

SIR E. BIRKBECK did not think that the Ben Nevis Observatory had satisfied the expectations raised with regard to it.

MR. MCLAREN did not think that the Meteorological Council dealt fairly with the Scotch observatories, and there was no Scotch member on that Council.

DR. CLARK, MR. M'LAGAN, and COL. NOLAN all urged payments to Scotland, but their statements were either so incorrect, or else so inaccurately reported, that it would only be misleading to reproduce them—*e.g.*, Mr. M'Lagan is reported to have said that "out of £23,000 only £300 was voted for Scotland." We believe that out of their £15,300 the Meteorological Council pay for the support, or part support, of two first order observatories and of a number of telegraph stations; they pay (we presume) Mr. Buchan, the Secretary of the Scot. Met. Soc., as he holds the office of inspector of stations in that country; and doubtless the members of the Council could add other items. Col. Nolan also is reported to have said, "It was all absorbed by England." Why, the Irish observatory at Valentia and the reports and inspection of that station alone must use up nearly £1,000 a year, and the coast is dotted round with stations maintained out of the very vote under discussion.

SIR J. LUBBOCK said that Mr. Buchanan complained of a vote of £2,500 to the Marine Biological Station, but seemed to have forgotten that £12,000 had been voted for the Scotch Fishery Board while there was no similar vote for England. It had been complained that out of the £15,300 nothing went to the Scottish Meteorological Society, but neither did anything go to the Royal Meteorological Society. As regarded the £4,000 distributed through the Royal Society he saw no objection to the addition of Scotch members to that committee, but he thought that it would be a mistake to divide the amount; he had served on the Committee and had never

considered for a moment whether the applicant was English, Scotch, or Irish.

MR. HUNTER said that the importance of the Ben Nevis Observatory had been testified to by Sir W. Thomson, the Royal Society, and the British Association, and the Government should support it as a national institution.

MR. JACKSON referred to the inutility of certain telegrams from Ben Nevis, but as from a letter in *The Times* from Mr. Omond, the superintendent of the Ben Nevis Observatory, there seems to have been some misunderstanding between the Ben Nevis and the Victoria-street establishments, we pass that by. He said that as far as the Government was concerned there was no desire to limit the number of Scotchmen either on the Meteorological Council or on the Government Grant Committee of the Royal Society.

MR. BRYCE pleaded for additional representation of Scotland.

MR. H. FOWLER thought that doubts being prevalent as to the wisdom of the expenditure a small Select Committee should be appointed to enquire into the matter.

DR. CLARK complained that out of 60 members of the Government Grant Committee only two were Scotch.

THE CHANCELLOR OF THE EXCHEQUER advised Mr. Buchanan not to press his motion to a division, as the Government were prepared to consider the subject during the recess.

The Committee divided—

For the reduction	...	...	...	45
Against ...	...	...	...	99
				—
Majority against	...	...	...	54

COL. NOLAN thought that the harvest warning telegrams issued by the Meteorological Council should be exhibited at the telegraph office in each market town.

MR. HANBURY thought that this ought to be done; at present the predictions were inaccessible to farmers.

MR. M. STEWART said that in Scotland the farmers had the warnings sent to them every morning at their own expense, and he thought that the same might be done in England and Ireland.

MR. M. J. KENNY did not think that the Meteorological Council deserved the name of a scientific body, and did not know that their predictions were of much use.

COL. WARING referred to the observations in connection with rainfall conducted by Mr. Symons, and said that the time had come when the Government should consider his claims, with a view to giving him some assistance in carrying on his work.

MR. AIRD said that for the large works in which he was engaged he had paid for a daily telegram of probable weather, finding it very useful he thought that the dissemination of the forecasts should be encouraged.

SIR G. CAMPBELL was of opinion that everything possible should be done if the forecasts were trustworthy, but he did not think that science had yet reached that point. (Hear, hear.)

Mr. PROVAND pointed out that the Post Office was by statute prohibited from disseminating news.

DR. CLARK wished to know how much was paid to the members of the Meteorological Council.

Mr. JACKSON said that £500 was paid to the Chairman and £100 each to the other five members, the Secretary apparently got £800, and £1,000 was devoted to special researches and experiments.

DR. CLARK said that if this vote appeared on the Estimates next year, he would move its reduction by the sum of £1,800.

The vote was then agreed to.

It is not perhaps for us to offer detailed comment on this discussion, but we may be permitted to express our opinion that it may be regarded as equally satisfactory to the meteorologist and to the tax-payer; for, apart from a little of the Home Rule line of argument, it seems to us to indicate a willingness to support hard and useful work, and on the other hand a determination to hunt out every doubtful payment. What more could we wish of our representatives?

THE BRITISH ASSOCIATION AT MANCHESTER.

We well remember the rejoicing wherewith the announcement was made in 1861 that the Manchester meeting had been attended by 3,138 persons, the largest number ever assembled; but this year Manchester has again eclipsed itself and all previous records, by the tremendous gathering of 3,823 members and associates. At so large a meeting the number of meteorologists was so great that we cannot spare space to give the list—among them we should find such leading men as Prof. Cleveland Abbé (of Washington, U.S.A.), Messrs. Abercromby, Archibald, Buchan, Glaisher, and a host of others—in fact, more than one-fourth of the Council of the Roy. Meteor. Society was present. We are, however, by no means sure that such large meetings are either as pleasant or as profitable to science as smaller ones. In such crowds it is impossible to find one's friends, and a list of nearly four thousand names (not in strict alphabetical arrangement) is too formidable a book to wade through, in order to see who are at the meeting and where they are staying. Hence many apparent incivilities, and many cases where if A, B, and C had known that D, E, and F were at the meeting, pleasure would have been given and scientific work advanced.

Grants to the total amount of £1,975 were made, but only £160 was voted for meteorology, viz., £150 for Ben Nevis, and £10 for researches on Solar Radiation.

The following is a list of the meteorological papers:—

Report of the Committee on Ben Nevis Meteorological Observatory.

Report of the Committee on the Chepstow Meteorological Observatory.

Report of the Committee on Daily Synoptic Charts of the Indian Ocean.

Report of the Committee on Solar Radiation.

PROFESSOR CLEVELAND ABBÉ.—*The General Bibliography of Meteorology.*

HON. R. ABERCROMBY.—*The Different Varieties of Thunderstorms and a Scheme for their Systematic Observation in Great Britain.*

PROFESSOR E. DOUGLAS ARCHIBALD.—*The Direction of the Upper Currents over the Equator, in connection with the Krakatoa Smoke-stream.*

H. N. DICKSON.—*On the Hygrometry of Ben Nevis.*

PROFESSOR E. HULL, F.R.S.—*On the Effect of Continental Lands in altering the Level of adjoining Oceans.*

DR. H. R. MILL.—*Contributions to Marine Meteorology.*

R. T. OMOND.—*On a Peculiarity of the Cyclonic Winds of Ben Nevis.*

ANGUS RANKIN.—*On the Thermic Wind-Rose at the Ben Nevis Observatory.*

H. C. RUSSELL, F.R.S.—*On some Variations in the Level of the Water in Lake George, New South Wales.*

G. J. SYMONS, F.R.S.—*What is a Drought?*

PROFESSOR L. WEBER.—*Observations of Atmospheric Electricity.*

THE BEN NEVIS OBSERVATORY.

Mr. A. Buchan read the report of the Committee appointed for the purpose of co-operating with the Scottish Meteorological Society in making meteorological observations on Ben Nevis. The observing work had been carried on during the past year with the same intelligence, enthusiasm, and completeness as in previous years. There had been many failures in the prognostications and storm warnings, and the cause of these was being investigated. The committee grounded their claim on the countenance and assistance of the British Association on the scientific work of the observatory. One was surprised to meet occasionally in the daily press and scientific literature of the day statements to the effect that Ben Nevis was expected of itself, and without the help of synchronous low-level observations, to frame warnings of coming storms, and that if this was not done the establishment did not deserve public support. It was unnecessary to say that the British Association had never withheld moral and material support to investigations, unless and until it was shown that the results could be turned to practical purposes. The Committee believed that the high expectations formed as to the practical value of the high-level observations in forecasting weather and storms had been more than realised, all criticisms to the contrary notwithstanding. It was necessary that for forecasting purposes the observations taken at the top of Ben Nevis should be combined with those made at the same instant at Fort William. It had been stated in the House of Commons that the practical results to be obtained from the Ben Nevis Observatory did not warrant the grant asked for from the Treasury. The Meteorological Council had yet to take the first step towards commencing an investigation into the utility of the Ben Nevis Observatory for forecasting purposes, and in the meantime the Meteorological Council had not published any decision regarding this important public question. On the other hand, the Council of the Scottish Meteorological Society were of opinion that the Ben Nevis observa-

tions were of the highest utility in the development of meteorology, and in framing forecasts of storms and weather for the British Islands.

The Chairman expressed the hope that the observatory at Ben Nevis would continue the work in which it had been engaged for some years with so much advantage.

THE CHEPSTOW METEOROLOGICAL OBSERVATORY.

The Committee appointed for the purpose of co-operating with Mr. E. J. Lowe in his project of establishing on a permanent and scientific basis, a meteorological observatory near Chepstow reported that they met at 22, Albemarle-street, on March 26th, and passed the following resolution :—

“As your Committee have heard no further results from the action referred to by Mr. Lowe in his letter quoted in their last report, and there thus appears to be an absence of local support, they see no prospect of the scheme ever being carried out. The fundamental idea presiding over the establishment of the observatory was that it should be one of permanence, and hence it is obvious that adequate endowment is essential. To provide this, and properly equip the observatory, several thousand pounds are needed ; but the Committee have no assurance that anything at all approaching the necessary amount has yet been subscribed, or even promised. As they have now been in existence for between three and four years with this negative result, they are of opinion that the Committee should now be dissolved.”

In consequence of this resolution the committee have not drawn the £20 voted at Birmingham, and they do not now request their reappointment.

SOLAR RADIATION.

Prof. A. Schuster presented the fourth report of the committee appointed for the purpose of considering the best methods of recording the direct intensity of solar radiation. The committee reported that they had made the following additions to the instrument described in the last report :—(1) We have had it swung like the ordinary actinometers with a motion in altitude and azimuth, and with two moderately delicate adjusting screws, one for azimuth and another for altitude adjustments. (2) We have had a thermometer centrally placed in the interior. The graduation of the stem is very delicate, and extends from 20° to 120° Fahr., the reading being taken from one of the sides. The bulb is of green flint, and the stem of colourless, glass. (3) We have also had a small plate of quartz cut and polished and mounted so as to cover the hole, and to be easily removed and replaced. The object of the plate is to prevent irregularities arising from irregular issue of heated air through the hole, entrance of cooler air blown in by wind, &c., and the choice of material was influenced by the wish to permit of frequent cleaning without risk of alteration by scratching. We ought to mention that as it would be difficult to procure the loan of a good heliostat, and expensive to make one, we resolved that in the preliminary experiments the adjustments to keep the sun's image on the hole should be made by the observer. Hence the necessity for the adjusting-screws already described. The committee suggest that they should be re-appointed.

THE GENERAL BIBLIOGRAPHY OF METEOROLOGY.

Prof. Cleveland Abbé described the steps which had been taken in the United States Signal Office in completion of the Meteorological Bibliography begun by himself and Mr. Symons, and subsequently strengthened by the splendid work of Dr. Hellmann and others, whereby finally about 52,000 books and pamphlets had been catalogued. He stated that the work was now practically complete and ready for publication, and awaited only the necessary funds for its printing to be undertaken. Mr. Buchan, Mr. Symons and others congratulated Prof. Abbé on the completion of this great labour, and a resolution expressing the hope that it would be printed as soon as possible was passed by the Section.

Subsequently a resolution was carried unanimously by the General Committee of the whole Association to the following effect:—"That the Council be requested to take such steps as to them shall seem expedient in order to communicate to the Signal Office the high importance attached by British Meteorologists to the Bibliography compiled by the Signal Office, and their hope that it may speedily be rendered accessible to all nations by being printed and circulated."

WHAT IS A DROUGHT?

By G. J. SYMONS, F.R.S.

Some years since, almost at the outset of my work in connection with rainfall, I was brought face to face with a hopeless confusion. People spoke of "Rainy days" and "Days with rain" and they compared the number of days at one place with that at another, and spoke of these relative values with great complacency. When, however, the subject was looked into, it became evident that the comparisons and conclusions were utterly useless, because what constituted a rainy day had never been defined; and therefore comparable data did not exist. Eventually a clear definition* was adopted and the difficulty vanished. We are now in want of another definition, and the object of this short paper is to state what has been proposed and adopted *ad interim* and to invite suggestions.

In *British Rainfall*, 1864, I dealt with the drought chiefly in the form of total monthly fall, *i.e.*, the deficiency in certain calendar months, and though the dates of beginning and ending of the two droughts of that year are given, there is no rigorous analysis.

The first systematic effort at a strictly uniform discussion of a drought was in *British Rainfall*, 1868, and as the introductory note to that article clearly states what were then and what still are the difficulties to be surmounted, I venture to reproduce it.

"One great hindrance to the progress of the science of meteorology has been the absence of specific rules and definitions. We had difficulty enough in deciding what was to be considered a day of rain; that has been surmounted, except that there are, of course, a few who will hold to their own opinions, however large may be the majority, and however strong the facts, against them. Having cleared up this and reduced sundry other vague matters to definite practice, the question arises, "What is a drought?" Is it a series of days without *any* rain, if so, how could engineers speak of droughts of 140 or 150 days? If the line is not to be drawn so tightly as to exclude even one shower, where

* Rainy day, or Day with rain, one upon which 0·01 inch of rain fell.

is it to be drawn—at falls of a tenth of an inch, or a quarter of an inch? All these rules are open to this difficulty—suppose a fall of 0·25 in. of rain in twenty-four hours is held to terminate a drought, are four separate daily falls of 0·20 in. to be included? If they are not, the limit must depend on a certain quantity in a certain longer period of time; yet the time must not be lengthened unduly, or we shall have such a case as 0·07 in. falling on, say six consecutive days; this would amount to 0·42 in., and on the last definition would terminate the drought; but we are sure that there are few reservoirs which would receive much benefit from, if they showed any trace of, these slight showers on the thirsty ground. It may occur to some that the flow of water into the reservoirs is the best guide to duration; but there are several objections thereto:—(1) Ordinary observers could not assist. (2) The duration assigned to the drought would depend considerably on the nature of the soil in the district, and the character of the rainfall. In drawing up the following tables, we have taken two or three consecutive days of rain, or one fall of half an inch, as terminating a period; and under the head of “exceptions” we have given all falls exceeding 0·10 in., and the aggregate of *all* amounts during the period.”

In *British Rainfall*, 1880, I adopted a classification which has been generally used up to the present time; it was as follows:—

Absolute droughts.—Periods of 14 or more consecutive days absolutely without rain.

Partial droughts.—Periods of 28 or more consecutive days in which the total rainfall did not exceed 0·25 inch.

It will be noticed that these definitions include the two elements of quantity of rain and of duration, and that neither opinion nor imagination can affect them. These points I regard as of the highest importance, for reasons too obvious to require enforcement.

These definitions have, however, no connection with or resemblance to that which engineers, who are familiar with water works construction, consider as a drought. And the object of this paper is to try and find a common ground whereby the records of the nearly three thousand observers of rainfall in the British Isles may be utilized in the form most useful to engineers.

During enquiries before Parliamentary committees as to the supply of water to towns I hear of droughts of 140, 160, 200, and even 240 days. It is quite certain that these are not “absolute” nor even “partial” droughts, according to the definition that we have laid down, because even in a dry place like London my own register for 30 years gives no “absolute” drought of more than 28 days, nor “partial” drought of more than 41 days. It is therefore evident that the drought of the engineer is something much less severe than even my “partial” drought.

I have already pointed out that as the change of rate of flow into reservoirs depends on the slope and character of the ground, it is not a satisfactory datum for comparison; and it is of course not available to the general public. Looking at the length of time ascribed to droughts by engineers, I am almost driven to conclude that with them “drought” is practically synonymous with “rainfall below the average,” but that no notice is taken of it unless its duration exceeds two months. But probably the real fact is that no definition has ever been given.

I should have thought that a fall of an inch of rain, or about fourteen million gallons per square mile, should be held to terminate a drought, but that does not seem the prevailing idea. Indeed, one of the most eminent water engineers

of the present, or of any, period has spoken repeatedly of droughts during which from 9 inches to 19 inches fell.

Suggestions on the subject having been invited by me in *The Times*, I have been favoured with several, but though very welcome as suggestions, I cannot see my way to recommending any of them, as they are mostly too vague or complicated; one would include the temperature, another the hygrometric state of the air; another (published in *The Times*) includes the relation of the actual to the average rainfall. There is something in that suggestion, but of course it should not be left in that crude form, but expressed as a per centage deficiency on the mean fall for the period.

I am anxious to obtain the advice of others, and think that the chief essentials are clearness and unmistakeableness.

Perhaps I ought not to refrain from offering a suggestion which might meet the requirements of engineers; at any rate, it will afford something to criticize.

Long droughts.—Periods of not less than 60 days with a total rainfall of less than 2.00 inches.

The droughts of the present year at Camden Square, London, according to the above definitions, have been—

Absolute Drought...	Feb. 3rd to 16th	14 days.
	April 6th to 20th	15 "
	June 9th to July 3rd	25 "
	July 29th to Aug. 15th	17 "
Partial Drought.....	June 4th to July 14th	41 "
Long Drought.....	Jan. 19th to March 30th.	71 "
	May 30th to Aug. 15th	78 "

ON THE HYGROMETRY OF BEN NEVIS.

By MR. H. N. DICKSON.

The author in this paper gave an account of observations which were undertaken for the purpose of testing the applicability at high-level stations, such as Ben Nevis Observatory, of existing tables and formulæ for calculating the dew-point and humidity from the readings of wet and dry bulb thermometers. The construction of the direct hygrometer used, that of Professor Chrystal, was described, and the action of the wet and dry bulbs under different meteorological conditions was examined in considerable detail; the results showing that for investigations of this kind a great range of humidity is necessary, the indications of the wet and dry bulbs being very uncertain when the difference between them is small. The reduction of the observations was performed in the first place by a graphic method, from which the following expression was deduced: $f' - f'' = (t - t') k$. f' being the vapour pressure at the temperature t' of the wet bulb, f'' that at the temperature of the dew-point, and t the air temperature. The truth of the above equation being assumed, the values of the quantity k were next found by direct calculation from the observations. The available observations—numbering in all about 300—made it possible to give fairly approximate values for each degree of temperature of the wet bulb from 13° to 45° F. A sudden large change took place at the freezing point, and a similar, though much smaller, discontinuity was shown to occur when the wet bulb stood between 39° and 40° F. Below 32° F. the quantity $1/k$ appeared steadily to increase from 26 to 61, while between 32° and 39° F. and from 40° F. upwards its values remained nearly constant at about 96 and 111 respectively.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEB., 1887.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London	54·1	5	22·6	17	45·2	33·1	34·9	86	97·8	16·6	·48	5	6·2
Malta.....	65·2	10	43·2	7, 23	60·1	48·5	47·1	84	123·8	36·0	1·30	11	3·9
<i>Cape of Good Hope</i> ...	98·4	3	51·5	12	83·2	58·9	...	68	...	...	·16	3	3·1
<i>Mauritius</i>	83·3	22	67·2	8	81·4	72·3	68·7	78	138·7	61·5	3·37	22	6·5
Calcutta.....	87·4	22a	47·6	12	80·9	57·1	54·4	63	146·4	35·4	·00	0	0·6
Bombay.....	91·3	18	55·9	9	82·5	66·7	62·3	66	141·9	41·9	·00	0	0·9
Ceylon, Colombo.....	94·2	19	66·8	1	88·5	71·3	66·3	66	145·8	56·0	2·20	7	3·2
<i>Melbourne</i>	99·6	9	46·7	20	78·4	58·9	55·1	66	147·9	38·0	2·67	8	6·0
<i>Adelaide</i>	101·7	9	53·3	5	85·4	63·1	51·0	44	158·1	44·7	·50	5	3·9
<i>Wellington</i>	78·5	17	46·5	22	71·1	56·8	55·8	76	145·0	41·0	1·43	9	3·5
<i>Auckland</i>	81·0	2, 3	59·0	9	77·3	62·4	65·3	85	147·0	46·0	3·07	7	6·2
<i>Falkland Isles</i>.....	...	...	37·3	24	...	43·2	46·2	81	126·8	30·2	2·24	16	5·8
Jamaica, Kingston.....	90·6	3	59·1	28	87·3	65·1	65·9	75	...	...	·11	...	...
Barbados.....	78·0	var.	66·0	13b	77·0	67·0	65·3	76	140·0	...	1·23	10	7·0
Toronto.....	45·1	8	— 8·4	13	29·6	13·2	19·6	83	...	—16·0	4·28	19	8·0
New Brunswick, Fredericton.....	42·9	27	—25·0	14	22·7	1·6	9·7	77	...	...	4·21	16	5·0
Manitoba, Winnipeg.....	24·3	17	—38·7	12	3·7	—20·3	—6·0	94	...	...	1·19	10	4·0
British Columbia, Victoria.....	48·0	27	6·0	2, 5	35·5	23·4	...	...	...	...	5·52	13	...

a And 25. b And 15, 21.

REMARKS, FEBRUARY, 1887.

MALTA.—Mean temp. 53°·4; mean hourly velocity of wind 8 miles. Sea temp. ranged between 58°·6 and 60°·2. TSS on 3 days; H on 2; squalls of R and H over the centre of the Island on 2nd. J. SCOLES.

Mauritius.—Rainfall 1·39 in., mean temp. of air 2°·0, and of dew point 1°·0 below the average; mean pressure ·031 in. above average; mean hourly velocity of wind (10·5 miles) 0·9 mile below average; extremes 26·1 miles on 4th and 1·6 miles on 18th; prevailing direction E. T on 3 days, L on 2. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 2°·2, of dew point 1°·9, rainfall ·69 in., and amount of cloud 0·7 above the average; mean pressure ·028 in. below the average; mean humidity average. Prevailing wind S., strong on 6 days. Hot, sultry, and very oppressive from 7th to 13th. L on evening of 24th, continuing on 25th, and culminating in a heavy TS on 26th with H and heavy R at 5 p.m.; T and L on 28th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure ·031 in., and rainfall ·18 in. below average; mean temp. and mean amount of cloud slightly above average. C. TODD.

Wellington.—Early part of month showery, with strong N.W. wind; from 9th to the close generally fine, with variable wind. Prevailing wind N.W.; mean temp. 1°·4 above, and rainfall 2·11 in. below the average. R. B. GORE.

AUCKLAND.—Heavy TSS on 8th, 9th, and 18th, remainder of the month very dry and warm; mean temp. and pressure slightly above, and rainfall slightly below the average. T. F. CHEESEMAN.

BARBADOS.—Pressure steady; mean temp. (71°·6) 1°·8 below, and rainfall considerably below the average. Prevailing wind N.E.; mean hourly velocity 15·2 miles; extremes 18·6 miles and 11·0 miles; 8 days were overcast. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
AUGUST, 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	2·62	XI.	Castle Malgwyn	1·73
„	Margate, Birchington...	2·31	„	Rhayader, Nantgwillt..	4·25
„	Littlehampton	1·88	„	Carno, Tybrith	3·97
„	Hailsham	2·88	„	Corwen, Rhug	3·00
„	Ryde, Thornbrough	1·86	„	Port Madoc	2·38
„	Alton, Ashdell.....	...	„	I. of Man, Douglas	1·06
III.	Oxford, Magdalen Col... ..	2·19	XII.	Stoneykirk, Ardwell Ho.	·69
„	Banbury, Bloxham	·76	„	New Galloway, Glenlee	3·64
„	Northampton	1·29	„	Melrose, Abbey Gate...	2·32
„	Cambridge, Beech Ho... ..	1·23	XIII.	N. Esk Res. [Penicuick]	4·05
„	Wisbech, Bank House..	2·30	XIV.	Ballantrae, Glendrisaig	2·61
IV.	Southend	2·45	„	Glasgow, Queen's Park.	2·71
„	Harlow, Sheering	1·55	XV.	Islay, Gruingart School..	3·82
„	Rendlesham Hall	1·38	XVI.	St. Andrews, Pilmour Cot	2·09
„	Diss	1·46	„	Balquhider, Stronvar..	4·63
„	Swaffham	2·40	„	Dunkeld, Inver Braan..	3·22
V.	Salisbury, Alderbury ...	1·26	„	Dalnaspidal H.R.S. ...	3·44
„	Warminster	3·01	XVII.	Keith H.R.S.	2·77
„	Calne, Compton Bassett	..	„	Forres H.R.S.	1·47
„	Ashburton, Holne Vic..	2·70	XVIII.	Strome Ferry H.R.S....	4·20
„	Holsworthy, Clawton...	1·73	„	Tain, Springfield	1·66
„	Hatherleigh, Winsford.	1·45	„	Loch Shiel, Glenaladale	5·19
„	Lynmouth, Glenthorne.	1·86	„	S. Uist, Ardkenneth ...	2·13
„	Probus, Lamellyn	1·67	„	Invergarry	2·40
„	Wincanton, Stowell Rec.	2·05	XIX.	Laing H.R.S. ....	...
„	Taunton, Lydeard Ho ...	1·31	„	Forsinard H.R.S.	2·65
„	Wells, Westbury.....	1·54	„	Watten H.R.S.	2·01
VI.	Bristol, Clifton	2·94	XX.	Dunmanway, Coolkelure	3·29
„	Ross	1·95	„	Ferroy, Gas Works ...	2·26
„	Wem, Clive Vicarage ...	2·74	„	Tralee, Castlemorris ...	...
„	Cheadle, The Heath Ho.	2·48	„	Tipperary, Henry Street	2·09
„	Worcester, Diglis Lock	1·25	„	Newcastle West	2·95
„	Coventry, Coundon	1·79	„	Miltown Malbay .....	...
VII.	Melton, Coston	·61	XXI.	Gorey, Courtown House	2·36
„	Ketton Hall [Stamford	·69	„	Navan, Balrath	1·78
„	Horncastle, Bucknall ...	2·75	„	Mullingar, Belvedere ...	1·94
„	Mansfield, St. John's St.	2·03	„	Athlone, Twyford	2·88
VIII.	Macclesfield, The Park.	1·26	„	Longford, Currygrane...	2·48
„	Walton-on-the-Hill.....	2·00	XXII.	Galway, Queen's Coll... ..	4·85
„	Lancaster, South Road.	2·19	„	Clifden, Kylemore	7·60
„	Broughton-in-Furness ..	1·49	„	Crossmolina, Enniscoe..	4·74
IX.	Wakefield, Stanley Vic.	1·23	„	Collooney, Markree Obs.	3·54
„	Ripon, Mickley	1·59	XXIII.	Rockcorry.....	2·52
„	Scarborough, West Bank	1·25	„	Warrenpoint	2·08
„	East Layton [Darlington]	1·86	„	Newtownards .....	...
„	Middleton, Mickleton ...	2·21	„	Belfast, New Barnsley .	3·38
X.	Haltwhistle, Unthank..	2·56	„	Cushendun	2·70
„	Shap, Copy Hill	1·69	„	Bushmills	2·43
XI.	Llanfrechfa Grange	2·61	„	Stewartstown	2·43
„	Llandovery	2·61	„	Buncrana	4·14

AUGUST, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Differ-ence from average 1870-9	Greatest Fall in 24 hours.		Days on which ≥ 0.1 or more fall.	Max.		Min.			
				inches.	in.		Dpth	Date.	Deg	Date	Deg	Date	On grass.	In shade.
I.	London (Camden Square) ...	3.15	+ .41	1.44	17	8	88.5	6	42.5	15	0	0
II.	Maidstone (Hunton Court)...	1.87	— .37	.58	16	11	...	...	...	...	...	...
III.	Strathfield Turgiss	1.86	— .56	.91	30	12	87.8	6	40.3	22	0	0
III.	Hitchin .....	.99	— 1.29	.33	30	8	80.0	8	44.0	14	0	...
IV.	Winslow (Addington)	1.01	— 1.94	.22	30	9	88.0	6	37.0	15	0	...
IV.	Bury St. Edmunds (Culford)	1.81	— .36	.58	30	11	82.0	8	34.0	22	0	...
V.	Norwich (Cossey)	2.95	+ .33	.51	19	12	...	...	...	...	...	...
V.	Weymouth (Langton Herring)	2.06	...	.88	30	10	77.0	7	48.0	15b	0	...
V.	Barnstaple	1.31	— 2.79	.36	30	9	86.0	7	47.5	3	0	...
VI.	Bodmin	2.26	+ 2.58	.64	28	11	76.0	6	46.0	15b	0	0
VI.	Stroud (Upfield)	1.60	— 1.57	.44	28	12	80.0	9, 24	46.0	2, 20	0	...
VI.	Church Stretton (Woolstaston)	2.34	— 1.74	.64	30	12	79.0	4, 6	41.5	14	0	0
VI.	Tenbury (Orleton)	1.88	— 1.84	.45	16a	10	84.2	8	34.2	15	0	1
VII.	Leicester	1.55	...	.32	18	10	86.3	6	39.8	15	0	1
VII.	Boston .....	.96	— 1.65	.27	18	10	92.0	6	38.0	15	0	...
VII.	Hesley Hall [Tickhill]	2.29	...	.73	30	10	84.0	6	37.0	14c	0	...
VIII.	Manchester (Ardwick)	1.12	— 2.80	.33	31	9	77.0	25	44.0	17	0	0
IX.	Wetherby (Ribston Hall) ..	2.07	— .56	.61	21	9	...	...	...	...	...	...
IX.	Skipton (Arncliffe)	3.03	— 2.77	.67	30	12	82.0	6	36.0	14	0	...
X.	Hull (Beverly Road)	1.72	— 1.01	.38	18	10	80.0	6	40.0	22	0	0
X.	North Shields	2.41	— .68	.95	18	12	78.5	6	38.5	14	0	0
X.	Borrowdale (Seathwaite) ..	4.75	— 6.29	1.28	31	17	...	...	...	...	...	...
XI.	Cardiff (Ely)	2.91	— 2.42	.73	28	10	...	...	...	...	...	...
XI.	Haverfordwest	2.28	— 2.69	.93	30	12	77.8	8	39.0	14	0	...
XI.	Plliflimmon (Cwmsymlog) ...	4.20	...	.77	30	12	...	...	...	...	...	...
XI.	Llandudno	1.78	— 1.41	.42	17	12	77.0	24	45.0	14d	0	0
XII.	Cargen [Dumfries]	2.14	— 2.13	.78	28	10	73.8	5	35.0	14	0	...
XII.	Jedburgh (Sunnyside)	1.70	— 1.67	.30	29	11	80.0	5	38.0	14	0	...
XIV.	Old Cumnock	3.47	— .67	.58	30	18	80.0	4	33.0	13	0	...
XV.	Lochgilthead (Kilmory)	5.48	+ .26	1.14	6	17	...	...	...	...	...	...
XV.	Oban (Craigvarren)	2.59	...	.75	6	19	71.0	4, 5	42.8	21	0	...
XV.	Mull (Quinish)	2.92	...	.78	29	21	...	...	...	...	...	...
XVI.	Loch Leven Sluices	3.60	— .48	1.00	7	11	...	...	...	...	...	...
XVI.	Arbroath	2.56	— .77	.81	6	10	74.0	8	43.0	14	0	0
XVII.	Braemar	2.13	— 2.30	.65	16	21	73.8	4	36.0	3	0	4
XVII.	Aberdeen	1.88	...	.41	6	18	73.0	23	42.0	2	0	...
XVIII.	Lochbroom	3.71	...	1.00	7	22	...	...	...	...	...	...
XVIII.	Culloden	1.28	— 1.72	...	...	...	76.0	26	41.0	22	0	0
XIX.	Dunrobin .....	...	...	...	...	...	...	...	...	...	...	...
XIX.	Kirkwall (Swanbister) .....	...	...	...	...	...	...	...	...	...	...	...
XX.	Cork (Blackrock)	2.12	— 1.71	.44	16	14	85.0	8	41.0	13	0	0
XX.	Dromore Castle	3.58	...	.93	25	16	75.0	2	41.0	13	0	...
XX.	Waterford (Brook Lodge) ...	2.68	...	.50	26	12	83.0	8	38.0	16	0	...
XX.	O'Briensbridge (Ross)	2.75	...	.62	26	15	78.0	6	44.0	18	0	0
XXI.	Carlow (Browne's Hill)	3.21	— .52	.96	16	13	...	...	...	...	...	...
XXI.	Dublin (Fitz William Square)	1.52	— 1.66	.35	17	16	78.9	8	42.3	14	0	0
XXII.	Ballinasloe	2.49	— 1.54	.40	28	17	73.0	5	38.0	14d	0	...
XXIII.	Waringstown	2.41	— 1.03	.70	30	11	80.0	3, 25	35.0	13e	0	...
XXIII.	Londonderry (Creggan Res.) ..	5.13	...	.90	16	21	...	...	...	...	...	...
XXIII.	Omagh (Edenfel)	4.45	+ .80	1.35	6	16	73.0	5	39.0	20	0	...

a And 30. b And 21. c And 22. d And 15. e And 20.

+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON AUGUST, 1887.

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

ENGLAND.

STRATHFIELD TURGISS.—During the first half of the month the drought remained unbroken in this neighbourhood, and vegetation of all kinds suffered in consequence, the leaves on many of the trees drooping and withering. Moles died by hundreds, unable to penetrate the iron-bound earth. Towards the close a considerable fall in temperature occurred, with white frosts and local showers. TSS at 8.30 a.m. and at 2.30 p.m. on 17th, a man was killed at Riseley by L. Very heavy R (.91 in.) on 30th.

ADDINGTON.—Another month of very fine, warm, dry weather, the want of R showing itself very decidedly by the dried up pastures and the drooping appearance of many trees and shrubs. We had none of the heavy rains which some districts were favoured with, particularly on the 17th, when there was heavy R two miles E. of us, we had very little. At the close the drought seemed quite broken up. T on 17th; fog on 28th; high wind and distant T on 31st.

CULFORD.—The early part of the month was very hot and dry. R fell on 12th, and the closing days were wet and stormy. TSS on 18th and 29th.

LANGTON HERRING.—Most favourable weather for gathering in the harvest, though root crops suffered much from the drought. Mean temp. at 9 a.m. $0^{\circ} \cdot 3$ above the average. Distant T on 17th, 20th, and 31st, but no storm. The heavy rainfalls of 26th and 30th were preceded by thick fogs on 25th and 29th. The year of Jubilee will here be remembered as the year of the long drought. From February 4th to August 25th inclusive (203 days), only 6.18 in. of R fell; From February 4th to August 18th (196 days), only 5.90 in., or a little less than .03 in. per diem for six months and a half.

BODMIN.—Mean temp. $61^{\circ} \cdot 6$. The drought affected our streams more than I ever witnessed before

STROUD.—A very fine dry month; vegetation much burnt up till the close. On the 17th a great quantity of R fell all round us at different intervals, just missing this village (Pakenhill) and Randwich to the N. of us. Very heavy R fell at Stroud, one mile from here, at noon, and a severe TS was seen from the hills in the Severn valley from 5 a.m. to 7 p.m. on 17th. T and L on 31st.

WOOLSTASTON.—The drought continued till the middle of the month. The harvest was unusually early, and secured in good condition, though deficient in quantity. Mean temp. $59^{\circ} \cdot 7$.

ORLETON.—Another warm and dry month, with a large amount of sunshine. No R fell during the first 11 days, and it was afterwards light and partial till the 26th. The pastures were all burning up at the middle of the month, but after R fell they rapidly recovered. The max. temp. was generally high and steady, but the min. was low, so that the mean temp. for the month was very little above the average of 26 years. Pressure was high and steady till the end of the month, when it became unsettled. L and T all night on 16th, with R at intervals; distant T on 17th and 28th. Frost on the morning of the 15th; fogs on 22nd and 23rd. The R for the eight months was about seven and a half inches below the average of 50 years, or only two-thirds of the average.

LEICESTER.—The first half of the month was hot and dry; in the second half came T and L, with some heavy and refreshing showers, which very much altered the appearance of the country.

WALES.

HAVERFORDWEST.—The fine, dry, warm weather lasted, with scarcely a break, up to the 24th, and no important change occurred until the 26th, when the weather became suddenly very stormy, with R; the next day was sultry, with R and L at night, and similar weather prevailed, with R and L at night, until the 30th, on which date, at 2 p.m., .39 in. of R fell in 20 minutes, and at 3 a.m. of the 31st, .54 in. fell in about 15 minutes. The month ended wet and

very stormy. Thundery weather prevailed from 7th to 12th, with close, sultry air; much cooler weather followed, until again on 15th and 16th temp. increased with much L at night; fine mackerel skies were observed on 18th and 19th. Grain crops were good; turnips small and much injured by the protracted drought. Temp. at or above 70° on ten days. The air was very dry throughout. The summer may now be said to be over. Taken as a whole, I do not remember one during the last 40 years in this locality to equal it for persistent high temperature, bright sunshine, and dryness.

SCOTLAND.

CARGEN.—Northerly winds prevailed from 1st to 20th and the night temperature of that period was unusually low. On the night of 13th min. in shade fell to 35° , and in only two Augusts during the last 28 years has it fallen so low. In many places in the higher parts of the country the potatoes were injured and the garden flowers destroyed. The temp. of the last ten days was above the average. The great bulk of the crops in the lower part of the country were got in before the close. Mean temp. $1^{\circ}8$ below the average; sunshine 33 hours above the average. T and L on 17th, 18th, and 27th; T on 6th.

JEDBURGH.—A remarkably fine August. The cereals rapidly ripened and, except in high lying districts, were mostly secured in fine order. Harvest was fully a month earlier than last year and crops are nearly an average. Potatoes were in splendid condition. With the dry, warm weather vegetation matured greatly, and the leaves on lime and beech trees began to change colour by the 14th. T and L on 17th and 27th.

CUMNOCK.—Potatoes, dahlias, &c., were injured by frost in several places on the morning of the 14th.

ABERDEEN.—Fine and dry; suitable for harvest operations. R about 1.30 in. below the average.

LOCHBROOM.—A beautiful month, with just the proper quantity of R and sunshine to fill and ripen the corn and make hill and dale most luxuriant. Potatoes and other crops are excellent. Very loud peals of T were heard on 29th.

CULLODEN.—A month of fine, sunny weather; frequent heavy R with T from 28th to 31st, though with very little L.

IRELAND.

BLACKROCK.—Generally very fine between slight showers. R 1.26 in. below the average of 22 years; mean temp. ($61^{\circ}3$) 2° below the average of 11 years. Falling fire-balls or shooting stars of considerable size and brilliancy were seen distinctly in N.W. on the night of 10th. Distant L on 26th; lunar rainbow on 30th, at 9 p.m. The R for the eight months was only slightly more than half the average of 22 years.

WATERFORD.—Mean temp. $59^{\circ}5$; total R since January 1st 14.50 in., considerably less than for the same period in any year since 1860. T and L on 17th and 27th.

O'BRIENSBRIDGE.—The long drought ended on 23rd; two inches of R in the last week greatly improved grass and green crops. T and L on 15th and 16th.

DUBLIN.—The change towards less settled weather, noticed in July, continued through August, which proved to be rather cool, very breezy and showery. At first, indeed, conditions were settled and the weather was dry and warm, but after the 11th R fell in larger or smaller quantities on 14 days, and high winds from opposite quarters—chiefly N. or S.—prevailed. The last few days were unsettled, showers and local TSS being reported from all districts. The close of the month witnessed the termination of the protracted drought, for which the spring and summer of 1887 will long be memorable.

EDENFEL.—Notwithstanding the heavy R of 1.35 in. on 6th, the weather till the 24th was generally fine and summerlike. The last week, however, was squally and unsettled, with heavy drenching showers, in one of which, on 30th, .15 in. of R fell in eight minutes, and an unusually early harvest was much imperilled by persistent wet. At 9 p.m. on 31st, the most distinct lunar rainbow I have ever seen spanned the northern heavens.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCLXI.]

OCTOBER, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

THE CLIMATE OF THE BRITISH EMPIRE DURING 1886.

WE this month publish our fifth annual table of the climate of the British Empire, giving a summary of the daily observations at sixteen stations distributed over the whole of the globe.

We believe that many of our readers, if they would give a few minutes' thought to the subject, would more fully realize the interest and value of these tables. They give, to a great extent, a record of the weather of the world for a whole year. They contain the results of more than 100,000 readings made by scientific men, many of them under circumstances of extreme discomfort if not difficulty.

How many of those who read these lines can appreciate a shade temperature of $112^{\circ}\cdot4$, or of $-44^{\circ}\cdot6$ ($76^{\circ}\cdot6$ below zero), or an average shade maximum for a whole month of $-5^{\circ}\cdot0$ ($37^{\circ}\cdot0$ below zero)—a month in which the temperature never rose within 8° of the freezing point? Is it a wonder that in such months the hygrometrical values are sometimes curious? Let our observers think of the difficulty they often have with their wet bulbs, even with our slight frosts.

Although we have published only five annual abstracts, we can lengthen the period to twelve years by referring to the tables which were previously published in *The Colonies*, thus obtaining such a basis for comparison as is, we believe, nowhere else to be found.

In the summary, we select the extreme values recorded for 16 of the chief meteorological elements, and, as would naturally be expected, the greater number of these unenviable distinctions are monopolized by two or three stations. Nine stations appear in the list—Adelaide and Winnipeg exhibit four extremes each (Winnipeg would have five but that there is no grass minimum thermometer there), Barbados exhibits two extremes, and the other six stations one each.

Adelaide has always exhibited the highest maximum in shade, but this year it "beats record" with $112^{\circ}\cdot4$, the highest reading in any of the summaries; this station, as might be expected, had also the highest maximum in sun and the lowest humidity, but both these values have been exceeded in other years. It has also the smallest rainfall ($14\cdot42$ in), and the drought of the past summer in England

will give us a feeble idea of how the people of Adelaide must rejoice in a shower.

Winnipeg claims our attention next with a gruesome minimum in shade of $-44^{\circ}6$; a range of shade temperature of $147^{\circ}6$; a mean daily range of $24^{\circ}7$; and a mean daily temperature of $33^{\circ}2$, $1^{\circ}2$ above freezing point for the average temperature of the whole year summer and winter! Withal the temperature is variable, but it may be a consolation for it to run up $87^{\circ}6$ degrees (more than the range in London in the year) in four days; especially when we consider that it ran up from $-41^{\circ}6$.

As a contrast, Barbados appears comfortable with a range of $21^{\circ}0$ in the year, and a mean temperature of $76^{\circ}7$.

The other extremes do not call for special comment. Colombo must be uncomfortable with a mean temperature of $81^{\circ}0$, and the rainfall of Bombay, $99\cdot74$ in. ($79\cdot24$ in. in two months), must seem heavy to anyone but a dweller in the wettest part of the Lake district. Malta commends itself for its clear skies.

London appears for the first time in the table of extremes with the greatest relative humidity.

It is curious to note that the highest shade temp. (at Adelaide) and the lowest (at Winnipeg) were recorded within a week, and that at Bombay the extreme range occurred within six weeks from February 3rd to March 14th.

SUMMARY.

Highest temperature in shade : $112^{\circ}4$ at Adelaide, on January 4th.

Lowest temperature in shade : $-44^{\circ}6$ at Winnipeg, on January 9th.

Greatest range in year : $147^{\circ}6$ at Winnipeg.

Least range in year : $21^{\circ}0$ at Barbados.

Greatest mean daily range : $24^{\circ}7$ at Winnipeg.

Least mean daily range : $9^{\circ}5$ at Barbados.

Highest mean daily temperature : $81^{\circ}0$ at Colombo, Ceylon.

Lowest mean daily temperature : $33^{\circ}2$ at Winnipeg.

Driest station : Adelaide, mean humidity 56.

Dampest station : London, mean humidity 80.

Highest temperature in sun : $174^{\circ}5$ at Adelaide.

Lowest temperature on grass : $-27^{\circ}0$ at Toronto.

Greatest rainfall : $99\cdot74$ inches at Bombay.

Least rainfall : $14\cdot42$ inches at Adelaide.

Most cloudy station : Auckland, average amount 6·3.

Least cloudy station : Malta, average amount 3·8.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1886.

STATIONS.	ABSOLUTE.				AVERAGE.					ABSOLUTE.		TOTAL RAIN.		AVE- RAGE.
	Maximum.		Minimum.		Max.	Min.	Mean.	Dew Point.	Height.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.										
<i>Those in Italics are South of the Equator.</i>														
England, London	88·4	August 30	19·4	February 10	57·1	42·4	49·8	42·7	80	133·4	8·3	27·01	176	5·9
Malta	94·4	July 26	40·2	March 12	71·5	58·6	65·1	56·1	76	149·0	35·5	23·69	89	3·8
<i>Mauritius</i>	88·4	February 1, 11	57·7	August 14	79·5	68·7	74·1	63·5	72	143·6	48·2	29·74	194	5·5
Calcutta	103·5	April 14, 20	46·7	February 6	86·8	71·0	78·9	70·1	78	167·0	35·2	65·20	128	4·8
Bombay	95·7	March 14	58·1	February 3	85·4	74·8	80·1	71·6	76	150·6	45·9	99·74	110	4·3
Ceylon, Colombo.	94·8	March 14	67·0	February 4	86·7	75·3	81·0	72·2	74	153·0	56·2	87·01	169	5·8
<i>Melbourne</i>	104·1	February 19	28·1	July 8	66·5	48·4	57·5	47·0	71	150·9	20·8	24·00	128	6·0
<i>Adelaide</i>	112·4	January 4	35·6	June 26	72·5	53·0	62·8	46·2	56	174·5	27·5	14·42	141	4·6
<i>Wellington</i>	79·0	January 25	32·0	July 27, Aug 28	60·5	48·4	54·5	47·8	79	150·0	27·0	54·47	165	4·3
<i>Auckland</i>	82·0	January 22	36·0	August 28	65·4	52·9	59·1	50·7	74	153·0	28·0	32·64	165	6·3
Jamaica, Kingston	96·4	October 1	62·2	January 26	89·1	71·0	80·1	70·6	79	...	...	67·80	...	5·3
*Barbados	87·0	September 22	66·0	March 31	81·4	71·9	76·7	70·9	78	147·0	...	88·29	200	6·0
Toronto	89·5	July 6	-22·8	February 5	51·7	35·1	43·4	38·0	77	...	-27·0	35·07	166	6·1
Fredericton	89·3	July 6	-24·0	January 13	50·3	29·9	40·1	35·0	74	...	...	38·53	158	5·5
Winnipeg	103·0	August 24	-44·6	January 9	45·5	20·8	33·2	28·2	78	...	...	14·64	118	4·9
Victoria	85·0	July 18	17·0	January 21	56·7	41·4	49·1	...	...	...	...	27·59	130	...

* The humidity at this station for January, 1886, was 76, not 60 as printed.

THE THUNDERSTORMS OF AUGUST 16TH AND 17TH, 1887.

As mentioned in our last issue, the thunderstorm which occurred over the Metropolis on the evening of August 17th was one of exceptional intensity, and the most severe for several years.

At Camden Square thunder was first heard about 5.30 p.m., and a storm appeared to be brewing in the N. Lightning was seen about 6.30; heavy rain commenced about 6.50, and till 8 p.m. the storm continued with unusual violence; it then gradually passed off to southward, the lightning being still frequent, and the rain steady till 9 p.m.

The statements as to the direction from which the storm arrived and in which it passed off are very contradictory, though all agree that it travelled slowly, and the times given for the commencement and termination agree very closely for the whole of London. An observer at Highgate states that it commenced at 6 p.m. in the N. and travelled southward; and one at Brixton (8 miles almost due S.) states that it commenced at 6 p.m. in the S.E. and travelled N.W. All agree that it lasted with unusual violence from about 6.45 to 8.45 p.m.

Fourteen authenticated cases of injury have been reported, and two or three cases which appear to be unfounded.

A man crossing Carlton Bridge, Harrow Road, was struck and killed on the spot, and a man passing along Clifton Road, Maida Vale, was killed as he emerged from under a tree; a friend a few paces in front of him is said to have had his face lacerated. It was also reported that a man sheltering under a tree in Portsdown Road, Maida Vale, was rendered insensible and died shortly afterwards, but as his name did not transpire and no details of the inquest appeared, the report was either altogether unfounded or the man was not seriously injured. The three places mentioned are all within an area of one square mile.

A servant at the Lyric Club, Bond Street, was rendered insensible.

Christ Church, Endell Street, was struck twice; first between 7.30 and 8. when a stone about 10 ft. from the top of the steeple, weighing 1 cwt, was thrown down, with smaller fragments; this fortunately created such consternation that the officiating clergyman at once dismissed the congregation, for later on the lightning struck the roof, making a large hole and igniting the woodwork; it was, however, extinguished by the heavy rain.

A few minutes after 7 the tower of St. John's Church, Walham Green, was struck, some of the brickwork of the N.W. pinnacle being displaced and thrown over to the southern side of the church.

Holy Trinity Church, Tulse Hill, was said to have been struck, but the report was not confirmed.

At St. Paul's Road, Canonbury, the lightning struck a house, throwing down the chimney stack, and making a large hole in the roof and another in the ceiling of the top room. A very similar acci-

dent occurred in Vidal Road, Brixton, the roof and top ceiling being pierced.

A serious fire occurred at a workshop in Gill's Yard, Hampstead Road, which is believed to have been caused by lightning, and an erection at Lord's Tennis Ground was also fired.

A tavern at Leverton Street, Kentish Town, was struck, a cement ornament was broken, the plaister was damaged in various places, and bell wires and pipes were fused. Very similar damage was done at another tavern in Lismore Circus, Gospel Oak, and the stonework of a tower at some schools in Wilkin Street, Kentish Town, was broken. Lightning also passed down the chimney of a house in the Strand and loosened the fire grate.

All these 14 cases of injury occurred west of a line running N. and S. through St. Paul's Cathedral; only one (Vidal Road, Brixton,) is south of the Thames, and ten are within a radius of two miles from the centre of Regent's Park; it is therefore evident that the storm was most severe over the N.W. of London.

The amount of rain was great over the western half of the Metropolis, but in most directions decreased very rapidly, the fall at Hackney, within a mile of one of the houses struck, being only .27 in. The following are the values for several of the Metropolitan and Suburban Stations :—

Station.	in.	Station.	in.
Wimbledon	2.08	Brixton.....	.97
Regents Park	1.92	Spring Gardens ..	.92
Teddington	1.43	Old Street, City .....	.85
Camden Square	1.42	Hampstead .....	.65
Isleworth.....	1.25	West Norwood .....	.50
Holland House	1.17	Highgate .....	.35

At Camden Square, rain commenced at 6.50 p.m. and ceased at 9.15 p.m.

In 1 hour from	7 p.m. to	8 p.m.	1.24 in. fell.
„ 30 min. „	7	7.30	.45 „ „
„ 30 „ „	7.30	8	.79 „ „
„ 22 „ „	7.42	8.4	.66 „ „
„ 10 „ „	7.45	7.55	.50 „ „

Considerable inconvenience was caused by flooding. About 7.15 a sewer between Baker Street and Portland Road, on the Metropolitan Railway, burst, and the line was flooded, traffic being stopped, from 7.30 to 11.30 p.m., the water rose at Baker-street within an inch of the level of the platform. The line belonging to the Midland and Great Northern Railways where it passes under the Metropolitan at Farringdon Street was also blocked for several hours.

Richmond Station was flooded, as is usual during heavy rains, but the trains were able to pass through. In Brixton Road the water accumulated so that the trams stopped running between 7 and 8 p.m., reports stating that at the station the road was covered with from 12 to 18 inches of water. At Wandsworth and Battersea large numbers of basements were flooded.

Thunderstorms were general over England on the afternoon and night of Tuesday, August the 16th, and in the early morning of the 17th, and in some places occurred during the day and night of the 17th; it is therefore difficult to say on which day some of the following accidents occurred, but the great majority were during the afternoon and night of the 16th-17th.

At Birmingham, two men in a hut built against the chimney of a brick-kiln were killed. The shaft, which is 120 feet high, had no lightning conductor and was practically uninjured, only three small pieces of brick being forced out at distances of about 20 feet apart.

At Rotherham a tree under which two colliers were sheltering was struck, one man being killed and the other rendered insensible. A policeman at Tinsley near Sheffield was also injured.

A man was killed by lightning at Risely, in Bedfordshire.

At Gornal, near Sedgely, a man was killed as he entered an out-house; a tree and buildings also were damaged.

Near Hinckley, two horses were killed in a field at Barwell and one at Some. One was killed at Willenhall, near Wolverhampton, and near Nuneaton several trees were struck, and a horse was killed at Griff and another at Falleshill. At Dorking also a horse was killed. Two cows were killed at Auchenrodden in Dumfriesshire, and a haystack was burnt at Annanbank.

At Leeds, a chimney-stack was thrown down and a woman was injured by the falling bricks. At Moor Park, Rickmansworth, an oak was struck and four sheep were killed.

At Chichester, the bell turret of the police-station was partly thrown down and the roof of a coach factory was damaged. Houses were struck at Brimington, near Chesterfield (2), Monmouth (1), Dudley (1), Mutley, near Plymouth (1), and a stack was fired at Rudgwick, near Horsham, Sussex; near Colchester some farm buildings were burnt, believed to have been fired by lightning.

On the afternoon of the 17th, a little before the storm in London, a house at Oxford was struck and the roof fired, and some of the streets were flooded by the heavy rain. At Kingston-on-Thames, also, a shop was struck and set on fire.

Heavy hailstorms were reported from several districts as accompanying the thunderstorms, but none of such exceptional violence as to break glass.

The rain which accompanied the storms, though generally heavy, was, as a rule, not remarkable, the following list giving all the falls exceeding one inch reported from the 250 stations whose records we have received:—

TUESDAY, AUGUST 16TH.

Hoar Cross, Burton, Staffordshire..... 1·19 in.

WEDNESDAY, AUGUST 17TH.

Hythe, Kent 1·05 in.

Magdalen College, Oxford 1·09 „

Southend, Essex 1·13 „

North Esk Reservoir, Edinburghshire..... 1·40 „

Average relation of duration of rain to total time, by day, 0·055, or
 " " " " " " about $\frac{1}{19}$ th.
 " " " " " " by night, 0·049.
 " " " " " " or about $\frac{1}{25}$ th.

(That is to say, on the average there is about $1\frac{1}{4}$ hours of rain out of the 24 hours, and as we see above that rain on the average fell on only 188 days, it follows that the average duration on the days on which any rain fell was about two hours and a half.)

The average duration of a shower was 21 minutes.

The longest continuous fall was 10 hours, on Jan. 16th, 1887.

The longest interval without rain was 26 days—Sept. 11th to Oct. 6th, 1865 ; there were also other instances—1 of 25 days, 1 of 20, 2 of 16, and 3 of 15 consecutive dry days.

The largest number of consecutive wet days was 18—Oct. 3rd to 20th, 1867.

There are many other interesting details in the paper, but the above sufficiently illustrate its nature.

THREE WHIRLWINDS.

WEAK.

HAMPSTEAD, Aug. 14th, 1887.—At about 1·15 p.m. I saw a perfect little whirlwind. As shown by the dust it raised, it was about 9 ft. in diameter at the bottom and rather more higher up ; the dust went up about 30 feet, and some pieces of paper about 50 ft. Wind N.W. and very slight ; the whirlwind moved nearly S.E., but perhaps not quite in a straight line, and at about four or five miles an hour. It appeared to rotate against the sun.—*H. Sharpe.*

STRONGER.

ASH, KENT, Aug. 15th, 1887.—Some tradesmen on the road between Canterbury and Sandwich, saw, for a few minutes, a whirlwind of some violence. Heaps of dust, grit, and stones were whirled round at a furious pace, and sheaves of corn were lifted up in the air.—*Sussex Express.*

STRONGEST.

BURNAGE, MANCHESTER, Sept. 6th, 1887.—About 5.45 p.m., during a strong S.W. wind and rain, a whirlwind passed along a track about a mile long and from 50 to 100 yards wide. Hay stacks were carried away and several roofs were damaged. Probably the strongest evidence of force was the breaking of an ash tree where the trunk was 7 inches in diameter, and the transport of the whole top, (about 16 ft. long), 150 feet—over the roofs of some cottages and over the church, which, however, it did not quite clear as it struck the roof and then, rising a little, carried away the stone cross on the eastern gable of the nave ; it then went over the roof of the schools, and fell point downwards in the school-yard beyond.

THE BRITISH ASSOCIATION AT MANCHESTER.

(Concluded from page 123.)

ON THE EFFECT OF CONTINENTAL LANDS IN ALTERING THE LEVEL OF THE ADJOINING OCEANS.

BY PROFESSOR EDWARD HULL, LL.D., F.R.S.

The effect of the attraction of continental land upon the oceanic waters adjoining, seems to have been very much overlooked by British physical geographers. That some slight effect arises in the direction of elevating the surface of the ocean in proximity to the coast is generally admitted, but the amount of rise is considered to be small, perhaps insignificant. The prevalence of these views was attributed by the author to the widespread influence of Lyell's hypothesis of the uniformity of the ocean-surface all over the globe.

The author's attention had been called to the subject by the perusal of the works of the German geographers Suess* and Fischer,† especially the latter; and he had received great assistance in his investigations from Professor G. G. Stokes, Pres. R.S., and from the Rev. Maxwell H. Close, F.G.S., which assistance he gratefully acknowledged.

In attempting to determine the relative levels of the ocean surface along the margins of continents as compared with those of mid-oceanic islands, the German authors above quoted had based their results on observations of the length of the second's pendulum. Many years ago (1849) Stokes had shown that the force of gravity must be greater in such islands than on continental stations,‡ and Airy had corroborated this conclusion by showing that it corresponded with actual observations on the length of the second's pendulum at stations all over the globe.§ The formula of Suess and Fischer based on these was to the effect that the difference in the level of the ocean between two such stations was found in *mètres* by multiplying the difference in the number of daily oscillations in the second's pendulum by 122. This in the case of the stations of California (or Mexico?) in lat. 21° 30' and of the Sandwich Islands would amount to 4,520 feet; a very startling result if correct.

The author proceeded to discuss the effect of continental lands, showing that this was in the first instance divisible under two principal heads: The effect (1) of the unsubmerged, and (2) of the submerged masses. In the former case, where the mass rose above the surface, one component of the attraction acted in a more or less vertical direction; in the second case all in a lateral direction, but both had the effect of elevating the surface of the ocean. The horizontal distance to which the vertical effect extended owing to the curvature of the earth's surface was then considered; and it was shown that, where continental lands rise from a deep ocean, the effect of the lateral attraction far exceeds that of the vertical attraction of the unsubmerged mass. Professor Stokes had furnished the author with a hypothetical case, in which the elevation of the ocean was estimated to reach 400 feet above the mean geodetic surface of the earth.

For the purposes of illustration three cases were selected, viz. :—

- (1) The table-land of Mexico, between lats. 18° and 26° N.
- (2) The table-land of Bolivia, ,, 19° and 26° S.
- (3) The Andes of Chile, ,, 26° and 35° S.

* Suess, *Das Antlitz der Erde* (1887).

† Fischer, *Untersuchungen über die Gestalt der Erde* (1886).

‡ Stokes, *Cambridge Philosophical Transactions*, vol. viii, pp. 672-695.

§ Airy, "On the Figure of the Earth," *Encyclop. Metropolitana*.

The mean elevations, distances from the ocean, and extent having been determined, the mean density of the crust being taken at 2.6 for emergent, and 1.6 for submerged lands, the results of the attraction of the mountain masses in each case were as follows :—

(1) Mexico, 230 feet ; (2) Bolivia, 301 feet ; (3) Chile, 63 feet ; the elevations being calculated above a mean geodetic surface.

To the above results, due to the gravitation-potential of the elevated masses, were to be added those due to the following factors :—

- (a) The marginal plain or emergent tract on either side of the mountain mass.
- (b) The high lands both to the north and south of the special sections above dealt with.
- (c) And lastly, and most important, the submerged continental mass.

To provide for the sphericity of the earth deductions of various amounts, according to circumstances, were made from the numbers obtained from the formula which Mr. Close had arrived at by a double process, and which is given at length in the paper itself.

Combining these results with those given above, we obtain as the whole rise of the ocean surface as follows :—

(1) Mexico, 780 feet ; (2) Bolivia, 2,159 feet ; (3) Chile, 1,582 feet.

In all the above cases the coast was taken as descending to a depth of 15,000 feet at a gradient of about $\frac{1}{44}$ to $\frac{1}{60}$, the comparatively low results in the case of Chile being due to the narrowness of the mountain range, 30 miles in mean breadth, as compared with 300 miles in the case of Bolivia.

The above results, which are probably rather under than over estimates, fall considerably short of those to be drawn from Suess and Fischer's formula, but are probably much in excess of the views held by British physical geographers generally ; and the conclusion was drawn, that if the same processes of reasoning and calculation were applied to all parts of the world, it would be found that the ocean waters were piled up to a greater or less extent all along our continental coasts, producing very important alterations in the terrestrial configuration as compared with an imaginary ellipsoidal, or geodetic, surface, to which all these changes of level must necessarily be referred.

ON THE DIFFERENT KINDS OF THUNDERSTORMS, AND ON A SCHEME FOR THEIR SYSTEMATIC OBSERVATION IN GREAT BRITAIN.

BY HON. RALPH ABERCROMBY, F.R.MET.SOC.

There are at least three well defined types of thunderstorms in Great Britain.

1. Squall thunderstorms, or those associated with simple squalls. These are usually formed on the sides of primary cyclones and move nearly in the direction of the surface wind.

2. Secondary thunderstorms, so called because they are developed in secondary cyclones. Nothing is known of their motion, but they are not associated with much wind of any kind and often advance in opposition to the surface wind.

3. Line thunderstorms, so called because they take the form of long narrow strips of rain and thunder moving nearly broadside on across the country.

Such a storm might stretch north and south for 200 miles, and yet be but 5 or 10 miles wide, while the whole system might travel towards the east at a rate of 40 miles an hour. These storms are often formed where isobars totally fail to show any signs of disturbance, though they (the storms) are sometimes found along the troughs of cyclones and V-shaped depressions. In all cases these storms are preceded by a very violent squall.

A scheme for the systematic observation of thunderstorms in England has been elaborated, which it is hoped will be in operation next year. The primary object is to try and discover the nature of the aerial, circulation, or eddying, which is undoubtedly the origin of all kinds of thunderstorms.

THE DIRECTION OF THE UPPER CURRENTS OVER THE EQUATOR IN CONNECTION WITH THE KRAKATOA SMOKE-STREAM.

BY PROF. E. DOUGLAS ARCHIBALD.

The author said that from observations in Africa and America, supplemented by a comparison of the logs of vessels, it was pretty clear that the vapours ejected at the recent eruption passed from east to west round the earth for at least two revolutions, travelling at a rate varying from 65 to 80 miles an hour. The height of the stream above the Equator was about 120,000 ft., its width after the first revolution covering a region extending 12 deg. north and south from the latitude of Krakatoa (6 deg. south). After the second revolution this had increased to 24 deg. in each direction.

Sir William Thomson, in the discussion which followed, said that the motions of the atmosphere and of the luminiferous ether at great altitudes occupied his thoughts day and night.

The President reminded his hearers of the extreme purity of the sky at the time of the glows caused by the eruption, and said he had observed the new moon one night when it was only 22 hours old.

Mr. G. J. Symons, in reply to an enquiry, said that every effort was being made to secure the publication of the Report of the Krakatoa Committee of the Royal Society, in November next.

ON SOME VARIATIONS IN THE LEVEL OF THE WATER IN LAKE GEORGE, NEW SOUTH WALES.

BY H. C. RUSSELL, F.R.S.

This was a description of records obtained by a self-recording gauge at the south end of Lake George, about 100 miles from Sydney, New South Wales. The phenomena—known on the Swiss lakes as *Seiches*—are there reproduced, but at present no complete explanation is forthcoming; the amplitude of the waves is about 4 inches, and their period about 2 hours 11 minutes.

OBSERVATIONS OF ATMOSPHERIC ELECTRICITY.

BY PROF. L. WEBER.

This was a short paper giving an account of experiments made with a kite flown from the summit of the Schneekoppe.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1887.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days	Cloud.
	Temp.	Date.	Temp.	Date.									
England, London	57·5	27	22·4	14	45·8	32·2	34·1	85	100·4	17·4	1·65	12	6·5
Malta.....	73·7	16	46·2	6	64·5	53·2	51·1	81	128·3	38·1	·29	4	5·3
<i>Cape of Good Hope</i> ...	101·3	24	44·3	27	81·2	56·2	...	73	...	...	·26	4	4·6
<i>Mauritius</i>	83·6	4	68·4	21	81·7	73·0	70·4	82	135·5	60·8	12·76	26	6·5
Calcutta.....	95·4	24	63·7	27	89·6	70·7	67·8	70	152·5	56·5	3·25	5	1·9
Bombay.....	88·6	18	69·0	8	84·6	72·4	69·6	74	143·8	57·1	·00	0	1·1
Ceylon, Colombo ...	91·2	30	68·6	7	88·2	73·0	69·4	68	147·5	62·0	1·66	5	2·8
<i>Melbourne</i>	93·0	6	42·0	28	76·1	55·6	53·0	66	142·0	33·0	·78	7	4·6
<i>Adelaide</i>	99·8	6	48·4	27	80·3	57·7	50·1	51	150·1	35·4	·32	7	3·6
<i>Wellington</i>	75·0	4, 12	45·0	29	69·0	54·8	55·0	79	140·0	40·0	1·90	12	3·7
<i>Auckland</i>	78·5	25	50·0	29	74·3	60·1	63·8	89	143·0	40·0	·80	7	6·4
<i>Falkland Isles</i>.....	...	...	33·4	18	...	40·6	45·3	85	119·2	27·2	1·82	18	6·1
Jamaica, Kingston.....	90·1	30	58·3	12	86·8	64·3	64·9	73	...	...	·43	...	...
Barbados.....	81·0	15	66·0	3, 4 ^a	78·0	68·0	66·6	75	146·0	...	1·41	9	5·0
Toronto.....	44·9	2	4·0	5	31·9	17·6	19·8	76	...	— 1·0	1·51	15	6·1
New Brunswick, } Fredricton	47·2	15	— 19·5	4	33·3	15·3	21·0	74	...	...	4·48	18	5·9
Manitoba, Winnipeg } British Columbia, } Victoria.....	43·0	11	— 36·5	4	23·5	— 3·5	12·0	84	...	...	·93	8	5·0
	59·0	22	24·0	4	49·4	38·9	...	...	...	...	5·36	15	...

^a And 8.

REMARKS, MARCH, 1887.

MALTA.—Mean temp. 57°·7 ; mean hourly velocity of wind 11·4 miles. Sea temp. rose from 59°·0 to 62°·0 J. COLES.

Mauritius.—Rainfall 5·31 in., and mean temp. of dew point 0°·7 above the average ; mean temp. of air 1°·0 below the average ; mean hourly velocity of wind 9·8 miles ; extremes 20·9 miles on 9th and 0·0 mile on 21st ; prevailing direction E. by N. L on 7 days, T on 6 days. C. MELDRUM, F.R.S.

COLOMBO.—TSS on 5 days, L on 22nd, T on 23rd. F. C. H. CLARKE, LT.-COL. RA.

Melbourne.—Mean temp. of air 1°·3, and of dew point 0°·8, above the average ; rainfall 1·39 in., mean amount of cloud 1·0, mean humidity 2, and mean pressure slightly below the average ; Prevailing winds S., S.E., and W. ; strong on 4 days. Heavy dew on 7 days, H on 1, TSS on 2 days, T or L on 5 other days. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·5, rainfall ·83 in., and pressure slightly below the average. Weather generally seasonable. C. TODD.

Wellington.—Showery during the first part and towards the end ; fine during the middle, with light showers at intervals. Altogether fine weather, with little B for the time of year. Prevailing wind N.W., strong on 8 days ; rainfall ·92 in. and mean temp. slightly below the average. Fog on 4 days ; very slight earthquake on 15th. R. B. GORE.

AUCKLAND.—With the exception of a few slight showers, fine, hot, and dry throughout, with light variable winds. Mean temp. 2° above the average ; pressure much above the average ; rainfall not one-third of the average. T. F. CHEESEMAN.

KINGSTON.—Rainfall 1·04 in. below the average. MAXWELL HALL.

BARBADOS.—Mean temp. (72°·3) 1°·2 below average ; rainfall considerably below average. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
SEPTEMBER, 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	2·95	XI.	Castle Malgwyn	3·40
„	Margate, Birchington...	3·18	„	Rhayader, Nantgwillt...	4·71
„	Littlehampton	2·93	„	Carno, Tybrith	4·62
„	Hailsham	4·14	„	Corwen, Rhug	3·44
„	Ryde, Thornbrough	4·11	„	Port Madoc	5·14
„	Alton, Ashdell.....	3·06	„	I. of Man, Douglas	3·17
III.	Oxford, Magdalen Col...	2·10	XII.	Stoneykirk, Ardwell Ho.	3·95
„	Banbury, Bloxham	2·10	„	New Galloway, Glenlee	5·70
„	Northampton	1·65	„	Melrose, Abbey Gate...	5·03
„	Cambridge, Beech Ho...	2·01	XIII.	N. Esk Res. [Penicuick]	5·70
„	Wisbech, Bank House..	2·16	XIV.	Ballantrae, Glendrishaig	3·59
IV.	Southend	2·11	„	Glasgow, Queen's Park.	3·53
„	Harlow, Sheering	3·07	XV.	Islay, Gruinart School..	4·99
„	Rendlesham Hall	2·24	XVI.	St. Andrews, Pilmour Cot	4·39
„	Diss	2·37	„	Balquhiddier, Stronvar..	5·10
„	Swaffham	2·57	„	Dunkeld, Inver Braan..	3·76
V.	Salisbury, Alderbury...	2·23	„	Dalnaspical H.R.S.	4·64
„	Warminster	2·39	XVII.	Keith H.R.S.	4·28
„	Ashburton, Holne Vic..	4·75	„	Forres H.R.S.	4·49
„	Holsworthy, Clawton...	...	XVIII.	Strome Ferry H.R.S....	3·89
„	Hatherleigh, Winsford.	...	„	Tain, Springfield.....	...
„	Lynmouth, Glenthorne ..	6·23	„	Loch Shiel, Glenaladale	5·23
„	Probus, Lamellyn	4·02	„	S. Uist. Ardkenneth ...	2·94
„	Wincanton, Stowell Rec.	2·39	„	Invergarry	3·78
„	Taunton, Lydeard Ho...	3·09	XIX.	Laig H.R.S.	1·40
„	Wells, Westbury.....	3·03	„	Forsinard H.R.S.	3·50
VI.	Bristol, Clifton	3·42	„	Watten H.R.S.	2·96
„	Ross	2·50	XX.	Dunmanway, Coolkelure	3·48
„	Wem, Clive Vicarage ...	2·09	„	Fermoy, Gas Works ...	2·44
„	Cheadle, The Heath Ho...	3·22	„	Tipperary, Henry Street	2·52
„	Worcester, Diglis Lock	1·40	„	Newcastle West .....	...
„	Coventry, Coundon	1·74	„	Miltown Malbay.....	6·25
VII.	Melton, Coston	2·50	XXI.	Gorey, Courtown House	2·50
„	Ketton Hall [Stamford	1·59	„	Navan, Balrath	1·40
„	Horncastle, Bucknall ...	2·26	„	Mullingar, Belvedere ...	2·87
„	Mansfield, St. John's St.	2·33	„	Athlone, Twyford	3·34
VIII.	Macclesfield, The Park	3·55	„	Longford, Currygrane...	2·13
„	Walton-on-the-Hill.....	3·82	XXII.	Galway, Queen's Coll...	*6·97
„	Lancaster, South Road.	4·22	„	Clifden, Kylemore	5·32
„	Broughton-in-Furness ..	4·39	„	Crossmolina, Enniscoe..	5·69
IX.	Wakefield, Stanley Vic.	2·22	„	Collooney, Markree Obs.	5·34
„	Ripon, Mickley	3·77	XXIII.	Rockcorry	2·18
„	Scarborough, West Bank	3·22	„	Warrenpoint	1·99
„	East Layton [Darlington]	3·11	„	Newtownards .....	...
„	Middleton, Mickleton ..	4·03	„	Belfast, New Barnsley .	4·82
X.	Haltwhistle, Unthank..	5·08	„	Cushendun	6·48
„	Shap, Copy Hill	5·19	„	Bushmills	4·28
XI.	Llanfrehfa Grange	2·83	„	Stewartstown	3·87
„	Llandovery	3·76	„	Buncrana	4·41

* On Sept. 1st 4·93 in. of R fell, much damage by floods.

SEPTEMBER, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which "01 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Max.		Min.		On grass	In shade.		
				Dpth	Date.			Deg	Date			Deg	Date.
		inches	inches.	in.			Deg	Date	Deg	Date.			
I.	London (Camden Square) ...	1·81	— ·70	·35	16	19	69·5	6	34·3	29	0	2	
II.	Maidstone (Hunton Court)...	2·69	+ ·38	·85	3	13	...	...	...	...	...	...
III.	Strathfield Turgiss	1·98	— ·32	·48	1	19	68·2	5	32·5	30	0	4	
III.	Hitchin	2·60	+ ·12	·52	1	19	66·0	4,6	36·0	28	0	4	
IV.	Winslow (Addington)	2·62	+ ·14	·42	6	16	69·0	6	30·0	29	3	4	
IV.	Bury St. Edmunds (Culford)	2·40	— ·38	·38	4	21	69·0	1	28·0	28	2	...	
V.	Norwich (Cossey).....	2·45	— ·63	·48	13	19	...	...	...	...	...	...
V.	Weymouth(LangtonHerring)	2·73	...	1·02	16	16	68·0	6	38·0	29	0	...	
"	Barnstaple.....	4·78	+ ·50	1·20	1	18	69·0	1	39·0	25	0	...	
"	Bodmin	5·11	— ·13	1·72	1	16	68·0	1	36·0	29	0	1	
VI.	Stroud (Upfield)	2·89	— ·36	·65	16	15	69·0	3	34·0	28	0	...	
"	ChurchStretton(Woolstaston)	2·35	— 1·12	·56	3	18	64·0	4,5	38·0	29	0	1	
"	Tenbury (Orleton)	1·60	— 1·75	·36	1	14	67·8	6	29·7	29	3	4	
VII.	Leicester	2·59	...	·38	4	16	69·0	3	32·0	29	1	8	
"	Boston	1·47	— 1·14	·35	16	15	71·0	4	30·0	29	1	...	
"	Hesley Hall (Tickhill).....	1·52	...	·25	14	17	67·0	3	30·0	28	1	...	
VIII.	Manchester (Ardwick).....	4·59	+ ·82	·77	14	17	65·0	3	36·0	28	0	...	
IX.	Wetherby (Ribston Hall) ...	3·11	+ ·03	·76	7	12	...	...	...	...	...	...
"	Skipton (Arncliffe)	7·61	+ 2·03	1·38	1	18	...	...	...	...	0	...
"	Hull (Beverly Road)	2·41	— ·34	·32	6	23	...	...	38·0	25	0	0
X.	North Shields	5·06	+ 2·74	1·60	6	21	69·0	1	32·0	28	1	1	
X.	Borrowdale (Seathwaite).....	15·58	+ 2·36	2·15	9	22	...	...	...	...	...	...
XI.	Cardiff (Ely).....	...	...	...	...	...	...	...	...	...	...	...
"	Haverfordwest	3·41	— 1·64	1·01	1	19	66·8	5	34·0	28	0	3	
"	Plinlimmon (Cwmsymlog) ...	7·24	...	1·05	4	17	...	...	...	...	...	...
"	Llandudno	2·27	— 1·48	·48	28	18	65·0	3	38·5	29	0	...	
XII.	Cargen [Dumfries]	4·53	+ ·12	1·01	5	18	65·4	20	30·8	28	1	...	
"	Jedburgh (Sunnyside).....	4·87	+ 2·23	·69	6	20	62·0	3	30·0	28	1	...	
XIV.	Old Cumnock	4·75	+ ·26	·64	3	18	68·0	1	31·0	12	1	...	
XV.	Lochgilphead (Kilmory).....	4·83	— ·93	·65	9	18	...	...	...	...	...	...
"	Oban (Craigvarren)	3·91	...	·77	8	19	66·0	4	41·8	13	0	...	
"	Mull (Quinish)	3·81	...	1·16	7	15	...	...	...	...	...	...
XVI.	Loch Leven Sluices	3·20	— ·03	·50	2	16	...	...	...	...	...	...
"	Arbroath	2·89	— ·18	·74	28	10	67·0	1	34·0	28	0	...	
XVII.	Braemar	2·89	— 1·05	·76	1	19	65·2	2	28·0	28	1	8	
"	Aberdeen	3·39	...	1·20	1	18	67·0	3	30·0	27	1	...	
XVIII.	Lochbroom	4·48	...	1·00	2,9	20	...	...	...	...	...	...
"	Culloden	3·36	+ ·46	...	...	...	65·0	9	33·0	28	0	3
XIX.	Dunrobin	2·08	...	·62	2	12	64·0	1	34·5	28	0	...	
"	Kirkwall (Swanbister).....	...	...	...	...	...	...	...	...	...	...	...
XX.	Cork (Blackrock).....	2·52	— 1·63	1·22	1	12	72·0	9	38·0	27	0	...	
"	Dromore Castle	4·30	...	1·86	1	14	70·0	19	38·0	28	0	...	
"	Waterford (Brook Lodge) ...	1·72	...	·46	1	11	66·0	4,5a	37·0	8, 28	0	...	
"	O'Briensbridge (Ross)	2·49	...	·53	4	17	71·0	2	33·0	29	0	...	
XXI.	Carlow (Browne's Hill)	2·07	— 1·19	·32	1,6	18	...	...	...	...	...	...
"	Dublin (FitzWilliam Square)	1·51	— ·90	·48	1	16	67·4	9	37·9	29	0	2	
XXII.	Ballinasloe	2·99	— ·97	1·23	1	14	63·0	3	34·0	19c	0	...	
XXIII.	Waringstown	2·72	— ·63	·72	1	18	70·0	1,3b	35·0	18d	0	2	
"	Londonderry (Creggan Res.)..	4·73	...	1·03	1	19	...	...	...	...	...	...
"	Omagh (Edenfel)	3·34	— ·70	·93	1	18	65·0	1	36·0	20	0	...	

a And 9, 11. b And 4. c And 29. d And 23, 27.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON SEPTEMBER, 1887.

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

ENGLAND.

STRATHFIELD TURGISS.—The first part of the month was remarkable for a succession of strong S. W. gales, accompanied by heavy R, with floods in some of the valleys; the latter part was characterized by fine autumnal weather. The land was still very dry at the close, and more R would be acceptable in our wheat growing districts.

ADDINGTON.—The month was unsettled throughout. It began with a very heavy gale, doing much damage to the apple crop; on the 8th there was enough frost to blacken tender plants, and frost again on 25th, 28th, and 29th. Fog on 20th. Pressure very low on 2nd, and high on 19th.

CULFORD.—The recent rains have very much improved the crops, and apples and pears are ripening earlier than usual; nights cold, with frost.

LANGTON HERRING.—Rainfall 17 in. below the average; mean temp. at 9 a.m. ($55^{\circ}0$) $3^{\circ}1$ below the average of 15 years, and with the exception of 1882 ($54^{\circ}7$) the lowest for September in that period. Mean min. ($46^{\circ}1$), lower than in any of the last 15 Septembers, and as much as $5^{\circ}6$ below the average. Mean max. $2^{\circ}2$ below the average. A great storm on the night of the 1st caused great damage to fruit trees. The total rainfall for the nine months of the year is 8.11 in. below the average of 12 years.

BODMIN.—The heavy rains were most welcome, but the streams and wells had not permanently increased at the close. Mean temp. 52° .

STROUD.—S. W. gale all night on 1st; T and one flash of L at noon on 27th; frost on 28th, touching vegetable marrows.

WOOLSTASTON.—A pleasant genial month, with R nearly every day in the first fortnight. Mean temp. 52° . Strong gale on the night of the 1st.

ORLETON.—A very fine and pleasant month, but cold. A great wind occurred on 1st and 2nd. From that time to the close a steady low temp. prevailed with northerly wind, though there was a large amount of sunshine. The mean temp. was 3° below the average of 26 years, during which period it was only once a little lower, in 1877. The last week was very cold. Fog on 5 days; distant T on 27th and 29th.

HULL.—An unsettled month; gloomy for September; T on 27th.

NORTH SHIELDS.—1.60 in. of R fell in 9 hours from 9 p.m. on 5th to 6 a.m. on 6th, and on 16th .18 in. fell in about five minutes. Two TSS occurred on 27th, and T was heard on 4th, 16th and 28th; L was seen on 12th; H fell on 11th, 13th and 16th.

WALES.

HAVERFORDWEST.—On the whole a fine, pleasant, cool month, with much bright sunshine. In the first week large quantities of R fell, and wet weather continued till the 16th, R falling principally at night. Fine, bright, cool weather prevailed from 17th to 25th. The last week was again wet, R falling at night. Prevailing winds S.W., N.N.W., and N.E. Very stormy on 4th and 5th; slight TS on 6th. Potato crop splendid; grain of all kinds very good.

SCOTLAND.

CARGEN.—Almost the whole of the R fell during the first half of the month; the latter half was very dry. Mean temp. $2^{\circ}7$ below the average.

JEDBURGH.—With the exception of September, 1872, the wettest September during 23 years, with a rainfall exceeding the total of the preceding three months. Crops were, on the whole, secured in good order; potatoes were good and free from disease. The fall of the leaf earlier than for many years past.

BRAEMAR.—A fine month; crops all secured in capital condition.

ABERDEEN.—Rainfall slightly above the average. T on five days; L seen on three nights; aurora on 23rd; H and sleet on 29th.

LOCHBROOM.—An average month as to amount of R and number of wet days, but on the whole fine, though rather wet for the ingathering of the crops, which were good; much corn remained out at the close in this district. Potatoes and turnips were excellent.

CULLODEN.—The month generally was favourable for harvest work. The rainfall was considerable during the first part, but from 15th to 30th fair weather prevailed, favourable for harvesting.

IRELAND.

BLACKROCK.—Showery to the 11th, then fine "second summer" weather to the 25th with no R, except a shower of 0·02 in., for 14 days. Mean temp. 54°·6. The rainfall from January 1st is 14·98 in. below the average of 22 years for the same period.

DROMORE.—Fine, with no storms. The ground was so dry that it soaked up nearly all the R. Potatoes were very good, and grass was growing plentifully at the close.

WATERFORD.—Rainfall two inches below the average of 28 years. During the nine months 16·22 in. of R fell, the next driest year being 1864, when 19·91 in. fell in the same period.

O'BRIENSBRIDGE.—A most favourable month for all harvest operations. A considerable fall of temperature occurred towards the close with a touch of frost on one night. The total rainfall for the nine months was 17·46 in., an unprecedentedly small amount in this district, where records have been kept for 40 years.

DUBLIN.—Opening with very unsettled, squally, and showery weather, September, nevertheless, proved a favourable month. It was no doubt very cool, but from the 11th to the 25th conditions were usually anti-cyclonic, and the weather was quiet and dry. The mean temp. (54°·0) was decidedly below the average (56°·0). In the preceding 22 years, September was coldest in 1866 and in 1882 (53°·0), and warmest in 1865 (61°·4). On the night of the 28th, a TS of exceptional violence raged along the coast of the counties of Dublin and Wicklow. Solar halos appeared on 28th. High winds were noted on 8 days, but attained the force of a gale on only two occasions, the 1st and 5th. Fog on 3rd, 21st, 23rd and 24th. Temperature did not reach 70° in the screen on any day, while it fell below 40° on two days. Mean humidity 85; mean amount of cloud 5·1; prevailing winds N.W., W., and N. The rainfall for the nine months was only 54·4 per cent. of the average of 20 years.

BLACK RAIN.

To the Editor of the Meteorological Magazine.

SIR,—Referring to Mr. Morgan's letter in the August number of the *Meteorological Magazine*, I may remark that I live in a coal district and very near a railway, so am visited somewhat abundantly with smoke. I have noticed that after a long drought, if a heavy shower falls, the gravel beneath the trees in the avenue shows considerably blacker than elsewhere. I attribute this to the circumstance that during the drought the soot settles on the ground and where not protected by the trees gets washed off by the first shower.

Again I notice that around the stems of the trees (which are not very old) the grass shows more luxuriance than that farther off. This I suppose to be caused by the rain running down the stems and carrying with it the soot that has settled on the leaves and twigs, and thus manuring the ground for a small space.—Yours truly,

HENRY MUIRHEAD.

Cambuslang.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCLXII.]

NOVEMBER, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

THE CLIMATE OF TONQUIN.

(Translated from *Ciel et Terre.*)

FROM May to September Tonquin is a truly tropical country, hot among the hottest, and very rainy. May and June are the most distressing, the sun is in the zenith, and the heavy rains have not come to cool the air. (In June, 1885, the temperature was $98^{\circ}\cdot5$ by day and from 95° to 97° at night.)

All through the summer physical exertion is impossible, and intellectual labour difficult. One is drowsy, overcome by the damp heat, deluged with perspiration, which there is no evaporation to relieve; the punkah is a necessity, and repose can only be obtained after repeated cold ablutions. One must not think of going out except in the early morning hours, or from 5 to 7 p.m.

The cataracts of water which fall during the burning nights of July scarcely freshen the atmosphere. During the hottest season, the difference between day and night is rarely more than 7° . "At Nam-dinh," says Dr. A. Lejeune, "during July, 1884, it was between 91° and 93° at 11 p.m. each day."

During the first fortnight of August it was still very hot (max. $92^{\circ}\cdot3$, min. $76^{\circ}\cdot1$). Towards the end of that month the mornings are fresh and the nights bearable.

During September a cyclone usually marks the end of the hot season, the mornings then become about 2° cooler; no great difference, but still very acceptable to those who have borne the summer.

In October, northerly and north-westerly winds produce true autumnal weather, the temperature becomes a tonic, a brilliant sun adorns an azure sky, while the mountains become deep violet; intellect, which has been drowsy during five months, awakens, and work can be resumed with pleasure.

Winter begins with November; one can hunt, ride on horseback, and make long excursions; the nights are fresh, the temperature falls to 61° , while brilliant sunshine prevails. The rains are over, and this is a dry month, with only a few fine rains or mists floating half-way up the mountains.

The early part of December is similar, but towards the end the sky is more often overcast, rain is more frequent, the temperature may fall to 50°, and fires in the rooms are welcome.

January is the coldest month of the year, fires are general, temperature is variable, and woollen clothing is necessary.

February is characterized by constant and penetrating mists, fires are needed to dry oneself and the wet streams down the walls. Boots or other articles of leather are covered with mould in a single day.

March is variable, but warmer, with an overcast sky, and exertion becomes irksome.

April is very damp, and the heat increases so that by the 25th the S.W. wind is fully established, and the burning tropical monotony again prevails.

To sum up, a European will find in Tonquin :—

Five good months—	November to the end of March.
Five bad	„ May to the end of September.
Two passable	„ April and October.

IS TERRESTRIAL MAGNETISM CONCERNED IN ATMOSPHERIC MOVEMENTS ? *

From the "Electrical World" (New York), August 27th, 1887.

BY M. A. VEEDER.

THE present paper is the result of an attempt to collate certain facts observed in reference to auroras, thunder-storms and solar conditions. Each day a drawing representing the condition of the sun has been made, and upon the same page information in regard to the phenomena in question occurring on that day has been recorded as soon as received. The writer has pursued this or similar methods for several years. It would be impossible within brief limits to give any adequate synopsis of the mass of information thus secured. It is not therefore the purpose of the paper to discuss the subject fully, or to answer all or even the more important questions that will naturally suggest themselves, but rather to suggest methods of study that will be found to be fruitful.

As the result of the extended series of observations described, it has been found in general that whenever groups of faculæ with or without dark spots are appearing by rotation, or are bursting forth upon the earthward side of the sun, there is an immediate increase in thunder-storms in the lower latitudes, and probably of auroras in the higher latitudes. If, however, the aurora becomes visible nearer the equator, at such times there is an immediate, though perhaps temporary, decrease in thunder-storms, as though the aurora had taken their place. In short, the aurora and thunder-storms appear to have a common origin, and in certain localities at least a reciprocal relation to each other. Instances have been

* Read before the American Association for the Advancement of Science, New York, August, 1887.

noted also in which an aurora in the United States has been coincident with unusual electrical storms in Europe, and *vice versa*.

The relation between the various phenomena is such that if an increase of thunder-storms or auroras is noted, faculæ coming into view by rotation or bursting forth elsewhere upon the sun may be looked for with confidence. On the other hand, the appearance upon the sun of bright faculæ betokens an immediate increase in the electrical phenomena attending the storms which may be prevailing at the time anywhere on the face of the earth, unless an aurora should intervene, as has already been noted.

In general, the disturbed solar and terrestrial conditions increase or diminish in like ratio. The curious fact has been noted, however, that a single disturbance occupying the sun's disc alone, seems to have a more marked effect than a succession of such disturbances, as though variability of tension, rather than the maintenance of high tension, were most concerned in the production of the phenomena in question. Aside from this, and as a rule, however, there is an evident proportion between the extent of the disturbances on the sun and those on the earth. Neither auroras nor thunder-storms become universal, but are distributed in accordance with laws which it is not proposed to discuss at present. The point is that, under known limitations and in definite localities, there is an increase in these phenomena whenever the solar conditions are favorable, and no such increase has been noted at any other time.

As is the case with auroras and thunder-storms, the disturbances of earth currents known as magnetic storms are subject to limitations and do not prevail with equal intensity at any one time over the entire surface of the globe.

It is evident from these considerations that the phenomena in question can be adequately studied by securing information in reference to them from localities that are favorably situated only. To attempt the study of auroras and their attendant magnetic phenomena within the tropics, and of thunder-storms within the polar regions, would, for example, lead for the most part to negative results. Moreover, the various conditions that have been described are not always equally well defined in localities that are most favorably situated. Frequently the problem that presents itself is extremely complex. In the middle latitudes and during a single season it is not difficult, nevertheless, to find numerous instances that are so strongly marked that the most ordinary sources of information are sufficient to corroborate very fully the statements that have been made. It was much easier to do this with fulness and accuracy when the Signal Service authorities were making a more complete report of thunder-storms than is published in the *Monthly Weather Review* at present.

The forces manifest in thunder-storms and auroras being of the character and having the origin that has been described, the question arises as to whether these forces are concerned also in the production

of the movements of the atmosphere with which they are associated.

In the case of thunder-storms it is difficult to determine whether the electrical forces are simply superadded to ordinary storms or whether they are really concerned in the movements of the atmosphere, which are, as a rule, in progress at such times. It will be better to consider the case of auroras first, the conditions of the problem being much simpler.

By comparing the record of different years it becomes apparent that certain atmospheric movements increase or diminish in direct proportion to the number of auroras and their associated phenomena. Thus, during the spring and summer of 1886 there was a recurrence of brilliant and widespread auroras at intervals closely approximating the time of the rotation of the sun on his axis. Telescopic observation also revealed the fact that one side of the sun was much more disturbed than the other. Thus the conditions for these observations were well-nigh perfect. In close relation with the successive auroras and disturbed solar conditions then existing, there were powerful surgings to and fro of the atmosphere, as is shown most readily by the sudden and extreme changes of temperature. Thus "The Ice Saint's Festival" in May, 1886, was made the subject of articles in *Nature* and other publications because of the period of cold from the 12th to the 15th of the month, following severe storms in the United States and Europe. On June 6th again there was frost along the northern border of the United States. On July 9th there was a flurry of snow in Poquosue township, Virginia. On August 3rd there were snows and frosts in Central New York and in New England, and on August 31st there were severe frosts in the Upper Mississippi Valley. At each date mentioned there had been a brilliant aurora a few days preceding and a period of characteristic storms. The record for a similar period in 1887 presents a very marked contrast. During this year there has been no such recurrence of auroras as there was in 1886. Solar disturbances have not been wanting, but they have been less active and more uniformly distributed on all sides of the sun. Coincidentally the movements of cyclones and anti-cyclones have been less energetic, and the temperature has remained very steady as compared with 1886. Indeed, the season has been remarkable for persistent elevation of temperature over extensive areas in the United States and Europe. If the heating up of local areas, either continental or oceanic, were the proximate cause of the atmospheric movements in question, they ought certainly to have been more energetic in 1887 than in 1886, which has not been the case. There has not been entire calm, but such atmospheric perturbations as have occurred, although less violent and less extensive, have been associated with solar and terrestrial conditions similar to those which were so well defined in 1886.

It is probable, to say the least, that the variations in terrestrial magnetism which accompany auroras, and perhaps, likewise, the

related electrical phenomena which accompany thunder-storms, are in some way concerned in the larger movements of the atmosphere which cause sudden and extreme oscillations of temperature over wide areas. In winter the same relations may be traced, although not so clearly as in summer; "blizzards," as they are called, taking the place of thunder-storms. At any season the continuity of these movements appears to be broken up by a succession of impulses of the character indicated, the influence of a single well defined solar disturbance being more clearly traceable than that of a succession of such disturbances.

In short, auroras, thunder-storms and the solar conditions described, bear such relations to each other, and to storms having a steep temperature gradient, that it seems probable that the associated magnetic and electrical forces may in some way be concerned in the production of the atmospheric movements in question. If, after the facts have been sufficiently collated, it shall be found that the conclusions here suggested are justified, they may perhaps become available for purposes of weather prediction, or perhaps may be the means of showing why such predictions in certain instances are almost sure to fail. During 1886 there was, as has been shown, a periodicity of characteristic storms, continuing for several months, while during 1887 for a similar period the conditions were much more vague and ill-defined. In the one case, weather prediction might perhaps have been possible so far as the general character of the storms liable to occur was concerned, while in the other case there was no possibility of even this.

Something will have been gained, however, if the precise reason why the prediction of thunder-storms must, as a rule, fail, shall have been ascertained.

REVIEWS.

Weather Charts and Storm Warnings. By ROBERT H. SCOTT, M.A., F.R.S., Secretary to the Meteorological Council. With numerous illustrations; 3rd edition; revised and enlarged. London: Longmans, 1887. Sm. 8vo., viii-229 pages.

It has always seemed to us that editors are wrong in their general practice of not giving more than scant notice to any editions of a book except the first. When an edition differs from its predecessor chiefly in the date on the title page, the general practice is undoubtedly correct and wise; but when an author has largely revised, perhaps nearly re-written, his book, it is very hard that because it retains its old title it is to pass unnoticed.

To judge from the space devoted to barometric diagrams and weather charts in the newspapers of the present day, there must be tens of thousands of persons interested in the subject. So much the better for Mr. Scott and his publishers, for evidently no one else is in so good a position as he is for treating on *Weather Charts and Storm*

Warnings. The work commences by explaining what information is collected, and then proceeds to show how it is utilized. Here, however, we come upon a sentence, concerning which we must say a few words as we entirely disagree with it. The author is pointing out that the returns received by the office are, as regards time, not nearly frequent enough; *with that we heartily agree*, but then he goes on to say:—

“Our own Meteorological Office, however, can only afford one at 8 a.m. from most of our stations, and at best we only get additional reports at 2 p.m. and at 6 p.m. from a limited number of places.”

We are sure that Mr. Scott does not so intend it, but to us this reads as a distinct libel upon John Bull. Here are the facts, from the *Report of the Meteorological Council* up to March, 1886—“Parliamentary Vote, £15,300”; Expended upon “Weather Information and Forecasts, £4,587 5s. 0d.” John Bull pays handsomely. The Meteorological Council spend more than two-thirds of the grant upon other objects, and then we are told that the office “can only afford, &c.” The words should be, The Meteorological Council are willing, however, to pay for only, &c.

The middle of a short notice like this is not the place to pronounce any opinion upon the merits or otherwise of the Forecasts issued by the office, and we do not do so, but we may point out that in the table on p. 167 something approaching to injustice to the office, or at any rate remarkable self-abnegation, is shown. It is a matter of calculation, and therefore we must reprint the table. The author has been discussing the proportion of successes scored by the official forecasters, and says:—

“The forecasts have been issued and checked regularly since the beginning of the year 1879, and the following are the figures of the summary for the entire period of seven years, under the same headings as those just given:—

Years.	Complete success.	Partial success.	Partial failure.	Total failure.	Total success.
1879	28	47	20	5	75
1880	35	40	16	9	75
1	34	44	16	6	78
2	44	35	13	8	79
3	48	33	11	8	81
4	51	31	11	7	82
1885	51	32	11	6	83

It will be seen that here the “total success” in the last column is the sum of the per centages of “complete success” and “partial success,” *e.g.*, in 1879—

Complete Success	28
Partial Success	47
	—
Total Success.....	75

We think that a fairer plan would be to allow only half the value to the "*partial successes*," then we should have for the same year, 1879,—

Complete Success	28
Partial Success	$\frac{47}{2} = 23\frac{1}{2}$
—	
Total Success	$51\frac{1}{2}$

And a similar plan should be adopted with respect to the failures. The following table shows the result:—

	Total success.	Partial success. Partial failure.	Total failure.	T.S. T.F.
1879	$51\frac{1}{2}$	$33\frac{1}{2}$	15	3.4
1880	55	28	17	3.2
1	56	30	14	4.0
2	$61\frac{1}{2}$	24	$14\frac{1}{2}$	4.2
3	$64\frac{1}{2}$	22	$13\frac{1}{2}$	4.8
4	$66\frac{1}{2}$	21	$12\frac{1}{2}$	5.3
1885	67	$21\frac{1}{2}$	$11\frac{1}{2}$	5.8

This shows that, according to their own figures, the forecasts in 1879 and 1880 were not very valuable ; but it shows far more plainly than the other table how much they have improved ; in the one their successes are represented as having improved from 75 to 83, or by one-tenth, whereas really they have improved from $51\frac{1}{2}$ to 67, or by nearly one-third. The most striking result is that given by the last column, in which the total success of each year is divided by the total failure, and (except for 1880) this shows an almost regular improvement in each successive year ; the successes used to be about three times as numerous as the failures ; they are now, according to the data given, nearly six times as numerous. In fact, if the Meteorological Council have been regarding the progress of their forecasters according to the table we have quoted, they may thank us for re-working it and putting the matter in a form so much more complimentary to the office.

The chapter devoted to "The Weekly Weather Report" deals with the ill-understood question of cumulative temperature and would have been greatly improved by half-a-dozen values being worked out as examples.

As regards accuracy, the work is wonderfully near perfection ; the best proof of which is that the only errors we have noticed are that Dr. Meldrum is twice mentioned as Mr. Meldrum, and that the reference on p. 129 should be to p. 236 not to p. 351. Of how many books of 238 pages could as much be said ?

Ueber die Jährliche Periode der Richtung des Windes. Von. Prof. DR. F. AUGUSTIN. 2 parts. (Aus den Sitzungsber. d. k. böhm. Gesells. d. Wissenschaften). Prag 1886-87. 8vo. 22 + 34 pp. and 1 plate.

EVEN if we for a moment ignore entirely the *thought* which the author has bestowed upon the observations collected in these two

pamphlets, it is still our duty and our pleasure to thank him for the *labour* which he has expended in epitomising thousands on thousands of years of observations upon the direction of the wind. Like all his countrymen he is most careful to give the authority for every statement, and though he begins with a general statement of indebtedness to Buchan, Coffin, Dove, Hann, Mohn, Supan, and Wojekov, he speedily brings in Kaemtz, Schouw, Ragona, Stelling, Blanford, Köppen, Hellmann, and many others. This string of names sufficiently indicates the authenticity of the data, and the mass of materials with which the author has dealt.

Dr. Augustin points first to the Monsoons as direct proof of the dependence of periodic winds on the change of the sun's declination, and then sets to work to see to what extent similar indications of influence can be traced in higher latitudes. As a specimen of the compactness of the whole of the two papers we reprint in *fac simile* the data for a British station, Milbrook in the Isle of Jersey.

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
	Milbrook 49° 12' N. 2° 7' W. 4 J.							
W.	5	12	7	12	19	21	16	8
F.	6	20	13	8	14	{19	14	7
S.	5	19	6	4	11	20	24	10
H.	3	17	10	8	16	23	15	8

This does not need much explanation, except, perhaps, that 4 J after the longitude means 4 Jahre, *i.e.*, mean of four years' observations, and W., F., S., H. stand respectively for winter, spring, summer, and autumn. The heavy type shows in which of the four seasons each wind is most frequent—for instance, the N., N.E., and E. all have their max. in the spring (as most of us know to our cost.)

There are 40 or 50 such tables for *selected* stations in all parts of the world, *e.g.*, Australia and Algeria, Siam and New Orleans. Then the author goes more closely into details, and gives the values for each *month* as well as each season, and there are 50 of them, besides other tables, scattered through the papers.

Dr. Augustin, from the consideration of this immense mass of data, arrives, among others, at the conclusions: (1) that the E. and N. coasts of both hemispheres have a seasonal influence deflecting the winds towards the right, and the W. and S. coasts one drawing towards the left; (2) that the wind in summer has a tendency to back from E. through N. to W., and in winter the reverse. We may very possibly be wrong, but the impression left upon our mind is that the evidence is not so accordant as one would have wished, though considering the ridiculous position of many anemometers and observatories it is perhaps all that could have been expected. One other subject may be mentioned. The apparent variation in prevalent wind direction largely depends on the trajectory of depression centres. We may have overlooked remarks upon this subject—at any rate, we

have not seen them—and so we seem to feel that the papers would have been all the better for the fusion with the excellent statistical meteorology of a little cyclonic. Be that as it may, Dr. Augustin has done a good piece of work ; we shall be glad to see some Englishman turn out something equally solid.

STORMS OCT. 29TH TO NOV. 3RD.

To the Editor of the Meteorological Magazine.

SIR,—I send you a few notes on the storms of the past week. There were great fluctuations of barometric pressure. The bar. (corrected to 32° and M.S.L.), fell from 29·751 in. at 10.45 a.m. on October 29th to 28·900 in. at 1.50 a.m. on the 30th, rose (very rapidly till 4 a.m.) to 29·590 in. at 7 p.m., fell to 29·540 in. at 4 a.m. on the 31st, rose to 29·768 in. at 6 p.m., fell rapidly to 29·040 in. at 8.40 a.m. on November 1st, rose to 29·305 in. at 4.45 p.m. on the 2nd, and fell to its lowest point, 28·740 in., at 11 p.m. on the 3rd. The greatest hourly ranges were : in falling, 0·126 in. from 11 to 12 p.m. October 29th ; and rising, 0·160 in. 2 to 3 a.m. October 30th.

The wind backed from W., at 7 a.m. 29th, to E.S.E. at 8 p.m., and blew stiffly between E.S.E. and S.S.E. till midnight, it then veered to a moderate breeze from S. at 1 a.m. on 30th ; rose to a strong N.N.W. gale from 1.45 to 2.15 a.m., was squally (from a moderate to strong breeze) from W.N.W. to W.S.W. from 5 a.m. 30th, to 4 p.m. 31st ; backed to a light S.S.W. breeze at 6 p.m., rose to a strong S.S.W. gale in a squall at 11.50 p.m., fell to a moderate breeze at midnight on the 31st ; rose to a heavy southerly gale from 6 to 9 a.m. November 1st, attaining the force of a storm (11) in the squalls, which did much damage to trees and roofs. The sea and tide were very high at this time, and did much injury to the Torquay New Pier. The wind then lulled and veered to S.W. at 10 a.m., and varied between moderate to light S.W. to W. breezes till 7 p.m. on 2nd, when it backed to S.S.W. ; it increased to a S. gale from 10 to 11 p.m., and blew a whole gale from 11.37 p.m. to 0.15 a.m. on the 3rd, veering to S.S.W. at midnight on the 2nd ; at 1 a.m. on the 3rd it lulled to a strong S.W. breeze, but rose to a gale at times during the rest of the day. The max. hourly velocities registered by the anemometer (at 41 ft. above ground, and rather sheltered from S. and N. to W.) were 49 miles (from S.) from 7 to 8 a.m. November 1st, and 42 miles (from S.) from 11 to 12 p.m. on the 2nd.

R fell from 4.50 p.m. October 29th (heavily from 7.50 to 11.22 p.m.) to 2.30 a.m., and showers from 9.20 a.m. to 5.35 p.m. 30th, and from 8 a.m. 31st, to 2.30 a.m. November 1st, then R (mostly heavy) from 3 to 8.25 a.m., showers to 4.55 p.m. (with H at 1.30 p.m.) 1st, and up to 5.10 p.m. 2nd, and R from 8.45 p.m. 2nd, to 0.35 a.m. 3rd, and showers from 1 a.m. to 11.10 p.m. (with

H at 7.30 a.m. and 5.2 p.m.) The heaviest R falls in this period were 1.25 in. on October 29th, 0.79 in. on October 31st, and 0.53 in. on November 2nd.

The temp. varied from a min. of $39^{\circ}5$ on October 30th, to a max. of $54^{\circ}6$ on November 2nd.

L was seen on the evening of the 3rd.

I am, yours truly,

EDWIN E. GLYDE.

Kirkham, Babbacombe, Torquay, Nov. 7th, 1887.

CHILL OCTOBER.

To the Editor of the Meteorological Magazine.

SIR,—I learn from the *Bath Chronicle* of November 3rd that the last month was the coldest October known in Bath for more than 20 years, or as long as meteorological observations have been taken at the Literary and Scientific Institution.

The point reached on Wednesday, the 26th, $24^{\circ}6$ F., was lower than any temperature previously recorded for that month, and the mean temperature, $45^{\circ}8$ F., was below that of any October during the same period.

I am, Sir, yours faithfully,

J. BYRON, F.R.MET.SOC.

15, Bennett Street, Bath, Nov. 5th.

The following table shows that at Camden Square, October, 1887, was the coldest for 29 years; the mean temperature at 9 a.m. and the absolute minimum being the lowest recorded for the month, and the absolute maximum the lowest with two exceptions.—ED.

OCTOBER.		
Mean temp., 9 a.m., 1859-87		$50^{\circ}1$
„ „ 9 a.m., 1887		$44^{\circ}7$
	Difference	$-5^{\circ}4$
Minimum temp., 1887.....		$25^{\circ}4$
Lowest previously recorded		$26^{\circ}2$ in 1873.
Maximum temp., 1887		$63^{\circ}6$
Lowest previously recorded	}	$60^{\circ}9$ in 1885.
		$63^{\circ}4$ in 1881.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1887.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days	
	Temp.	Date.	Temp.	Date.									
England, London	68·2	19	26·2	17	55·1	36·4	39·2	83	113·4	21·8	1·41	10	0·10
Malta.....	72·7	22	45·0	2	65·6	52·7	52·0	79	133·9	38·9	1·17	9	4·5
<i>Cape of Good Hope</i> ...	87·9	4	40·0	30	73·7	51·0	...	81	...	...	2·13	5	4·0
<i>Mauritius</i>	81·3	5	63·9	25	79·1	69·7	66·2	77	133·6	54·4	2·91	17	5·0
Calcutta.....	102·0	21 ^a	68·2	9	93·1	74·1	70·8	60	155·6	60·4	·89	3	1·7
Bombay.....	93·5	14	73·5	1	87·4	76·6	73·5	76	146·7	62·7	·02	1	1·4
Ceylon, Colombo	91·7	2	68·8	28	87·5	75·0	72·3	78	148·0	65·5	23·80	24	6·5
<i>Melbourne</i>	90·6	2	41·3	30	68·2	51·2	51·5	76	139·0	36·3	4·84	13	5·3
<i>Adelaide</i>	94·5	2	47·1	16	73·2	55·5	48·5	56	143·6	35·7	2·08	6	4·4
<i>Wellington</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Auckland</i>	73·0	1	48·0	27	69·3	56·9	56·6	80	131·0	35·0	1·98	12	6·0
<i>Falkland Isles</i>.....	...	...	31·8	14	...	36·4	40·7	90	108·0	25·8	2·23	21	6·7
Jamaica, Kingston.....	90·8	21	65·6	5	87·3	68·5	69·4	74	...	...	1·84	...	...
Barbados	82·0	27	67·0	6	80·0	70·0	66·0	70	148·0	...	·58	6	7·0
Toronto	71·1	10	20·0	5	48·4	30·5	30·6	70	...	10·8	1·61	11	6·3
New Brunswick, } Fredericton	63·7	10	— 2·0	1	45·3	25·5	24·7	60	...	...	3·61	11	5·0
Manitoba, Winnipeg } British Columbia, } Victoria	74·8	30	— 9·0	4	47·1	23·6	29·0	69	...	...	1·14	10	5·1
	59·0	5	29·0	3	53·0	39·3	...	...	...	...	·76	11	...

^a And 22.

REMARKS, APRIL, 1887.

MALTA.—Mean temp. 58°·2; mean hourly velocity of wind 10·2 miles. Sea temp. rose from 60°·0 to 63°·5. TSS on 14th and 22nd; H on 9th. J. SCOLES.

Mauritius.—Mean pressure 30·046 in., ·037 in. above average. Mean temp. of air 1°·9, of dew point 1°·8, and rainfall 2·10 in. below their respective averages. Mean hourly velocity of wind 10·1 miles; extremes 29·3 miles on 20th, and 0·0 mile on 23rd and 24th; prevailing direction E.S.E. No T or L. Fine sky-glow after sunset almost every evening after 8th. C. MELDRUM, F.R.S.

COLOMBO.—TSS on 19 days, T on one other day. L on 4 other days. F. C. H. CLARKE, LT.-COL. R.A.

Melbourne.—Mean temp. of air 0°·8, of dew point 2°·0, mean pressure 0·100 in., rainfall 2·61 in. and humidity 3 above their respective averages; mean amount of cloud 0·6 below the average. Prevailing wind W.; strong breezes on 3 days. TSS on 2nd and 9th; L on 1st; heavy dew on 12 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Rainfall ·49 in., and mean pressure ·068 in., above the average; mean temp. about the average. C. TODD.

AUCKLAND.—A fine warm month, with rainfall not half the average, and pressure unusually high. T. F. CHEESEMAN.

KINGSTON.—Rainfall ·65 in. above the average. MAXWELL HALL.

BARBADOS.—Pressure steady. Mean temp. (74°·2) 2°·0, and rainfall greatly below the average. Mean hourly velocity of wind 11·8 miles; one mile above the average. Two days were clouded. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
OCTOBER, 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	2·02	XI.	Castle Malgwyn	2·82
„	Margate, Birchington...	1·95	„	Rhayader, Nantgwillt..	3·11
„	Littlehampton	1·02	„	Carno, Tybrith	3·07
„	Hailsham	1·64	„	Corwen, Rbug	3·97
„	Ryde, Thornbrough	1·28	„	Port Madoc	4·80
„	Alton, Ashdell	1·55	„	I. of Man, Douglas	2·82
III.	Oxford, Magdalen Col...	1·96	XII.	Stoneykirk, Ardwell Ho.	1·94
„	Banbury, Bloxham	2·02	„	New Galloway, Glenlee	1·97
„	Northampton	1·68	„	Melrose, Abbey Gate...	1·41
„	Cambridge, Beech Ho...	1·47	XIII.	N. Esk Res. [Penicuik]	2·55
„	Wisbech, Bank House..	2·02	XIV.	Ballantrae, Glendrisaig	1·89
IV.	Southend	1·13	„	Glasgow, Queen's Park.	1·57
„	Harlow, Sheering	1·66	XV.	Islay, Gruinart School..	2·37
„	Rendlesham Hall	2·57	XVI.	St. Andrews, Pilmour Cot	1·04
„	Diss	2·93	„	Balquhider, Stronvar..	3·62
„	Swaffham	3·45	„	Dunkeld, Inver Braan..	·69
V.	Salisbury, Alderbury ...	1·33	„	Dalnaspidal H.R.S. ...	3·73
„	Warminster	2·26	XVII.	Keith H.R.S.	3·76
„	Ashburton, Holne Vic..	4·64	„	Forres H.R.S.	3·14
„	Holsworthy, Clawton...	...	XVIII.	Strome Ferry H.R.S....	5·84
„	Hatherleigh, Winsford.	4·31	„	Tain, Springfield .....	...
„	Lynmouth, Glenthorne.	4·17	„	Loch Shiel, Glenaladale	9·62
„	Probus, Lamellyn	4·58	„	S. Uist. Ardkenneth ...	2·08
„	Wincanton, Stowell Rec.	2·52	„	Invergarry	5·26
„	Taunton, Lydeard Ho ...	3·62	XIX.	Lairg H.R.S.	3·03
„	Wells, Westbury	2·96	„	Forsinard H.R.S.	3·44
VI.	Bristol, Clifton	2·48	„	Watten H.R.S.	2·49
„	Ross	2·28	XX.	Dunmanway, Coolkelure	4·76
„	Wem, Clive Vicarage ...	3·26	„	Fermoy, Gas Works ...	2·58
„	Cheadle, The Heath Ho.	2·16	„	Tipperary, Henry Street	2·26
„	Worcester, Diglis Lock	2·31	„	Newcastle West	1·33
„	Coventry, Coundon	2·05	„	Miltown Malbay	3·97
VII.	Melton, Coston	2·13	XXI.	Gorey, Courtown House	1·58
„	Ketton Hall [Stamford	2·11	„	Navan, Balrath	1·15
„	Horncastle, Bucknall ...	2·20	„	Mullingar, Belvedere ...	2·75
„	Mansfield, St. John's St.	1·91	„	Athlone, Twyford	2·46
VIII.	Macclesfield, The Park.	2·27	„	Longford, Currygrane...	1·78
„	Walton-on-the-Hill	2·75	XXII.	Galway, Queen's Coll..	3·49
„	Lancaster, South Road.	2·38	„	Clifden, Kylemore	5·39
„	Broughton-in-Furness ..	5·49	„	Crossmolina, Enniscoe..	4·36
IX.	Wakefield, Stanley Vic.	1·89	„	Collooney, Markree Obs.	2·47
„	Ripon, Mickley	3·36	XXIII.	Rockcory	1·62
„	Scarborough, West Bank	3·16	„	Warrenpoint	2·16
„	East Layton [Darlington]	1·77	„	Newtownards .....	...
„	Middleton, Mickleton ..	1·21	„	Belfast, New Barnsley..	2·29
X.	Haltwhistle, Unthank..	2·24	„	Cushendun	1·83
„	Shap, Copy Hill	2·10	„	Bushmills	2·62
XI.	Llanfrechfa Grange	3·18	„	Stewartstown	1·48
„	Llandovery	2·91	„	Buncrana	3·54

OCTOBER, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which $\frac{1}{10}$ or more fell.	Max.		Min.			
				Dpth	Date.		Deg.	Date	Deg.	Date.		
		inches.	inches.	in.		Deg.	Date	Deg.	Date.	In shade.	On grass.	
I.	London (Camden Square) ...	1.24	- 1.46	.61	29	9	63.6	8	25.4	26	7	15
II.	Maidstone (Hunton Court)...	1.67	- .79	.67	29	10	...	...	...	...	...	...
III.	Strathfield Turgiss	1.49	- 1.25	.74	29	12	62.2	8	19.6	26	10	16
IV.	Hitchin	1.58	- .60	.69	29	13	58.0	8	24.0	25	13	...
V.	Winslow (Addington)	1.45	- 1.17	.82	29	11	62.0	28	21.0	22d	11	16
VI.	Bury St. Edmunds (Culford)	2.59	+ .42	.75	29	15	62.0	8	24.0	21e	16	...
VII.	Norwich (Cossey)	3.37	+ 1.04	.73	10	16	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	2.97	...	.98	29	11	60.0	2, 4a	29.0	25	4	...
IX.	Barnstaple	4.39	- 1.06	1.39	29	15	61.0	3	32.0	16	1	...
X.	Bodmin	4.76	- 1.51	1.35	29	15	57.0	1, 2	48.0	4	2	9
XI.	Stroud (Upfield)	2.61	- .40	1.20	29	9	58.0	29	26.0	25	7	...
XII.	Church Stretton (Woolstaston)	2.79	- 1.81	.69	9	15	57.5	4	28.0	26	4	15
XIII.	Tenbury (Orleton)	1.92	- 1.32	.84	29	12	60.3	17	17.2	26	13	14
XIV.	Leicester	1.94	...	.94	29	14	60.0	4	23.6	22	7	21
XV.	Boston	1.74	- .29	.92	29	12	59.0	7	21.0	22d	10	...
XVI.	Hesley Hall [Tickhill]	1.75	...	.61	8	13	58.0	4	26.0	23	6	...
XVII.	Manchester (Ardwick)	1.93	- 2.50	.46	8	13	55.0	2, 3	27.0	23	9	...
XVIII.	Wetherby (Ribston Hall) ...	1.94	- 1.42	.68	9	8	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	2.57	- 4.69	.46	8	14	61.0	4	23.0	26	10	...
XX.	Hull (Beverley Road)	3.29	+ .69	.81	8	15	60.0	8	28.0	26	5	8
XXI.	North Shields	3.23	+ .72	.86	14	14	61.5	3	27.5	26	5	7
XXII.	Borrowdale (Seathwaite)	7.89	- 8.66	2.02	26	15	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	3.01	- 2.22	1.14	29	11	...	...	...	...	...	...
XXIV.	Haverfordwest	4.39	- 2.06	1.21	27	17	58.7	3	26.0	26	3	12
XXV.	Plinlimmon (Cwmsymlog) ...	4.73	...	1.07	8	15	...	...	...	...	...	...
XXVI.	Llandudno	2.55	- 2.04	.84	9	14	59.1	4	31.8	26	1	...
XXVII.	Cargen [Dumfries]	1.64	- 4.07	.36	28	10	60.6	1	23.6	12	10	...
XXVIII.	Jedburgh (Sunnyside)	1.42	- 1.25	.34	9	8	58.0	3, 4b	25.0	16	8	...
XXIX.	Old Cunnock	2.03	- 3.13	.47	30	11	59.0	1, 2	21.0	11	...	...
XXX.	Lochgilphead (Kilmory)	3.11	- 5.21	.78	31	15	...	...	...	...	...	...
XXXI.	Oban (Craigvarren)	3.76	...	1.09	26	19	57.0	3	30.0	12	2	...
XXXII.	Mull (Quinish)	4.97	...	1.34	31	20	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	1.90	- 2.41	.60	27	6	...	...	...	...	...	...
XXXIV.	Arbroath .....	.91	- 1.96	.36	9	7	61.0	3	30.0	12	5	...
XXXV.	Braemar	2.28	- 2.20	.56	12	16	58.7	4	26.0	16	11	24
XXXVI.	Aberdeen	2.73	...	.55	9	16	62.0	6	30.0	22e	4	...
XXXVII.	Lochbroom	4.42	...	.73	6	22	...	...	...	...	...	...
XXXVIII.	Culloden	2.34	+ .55	...	...	...	58.0	3, 4	30.0	12	1	16
XXXIX.	Dunrobin .....	...	...	...	...	...	...	...	...	...	...	...
XL.	Kirkwall (Swanbister)	4.52	...	1.66	6	27	53.9	4, 18	30.0	24	...	...
XLI.	Cork (Blackrock)	2.69	- 2.05	1.38	31	8	66.0	7	26.0	24	3	...
XLII.	Dromore Castle	4.28	...	1.55	26	8	70.0	3	25.0	24	...	...
XLIII.	Waterford (Brook Lodge) ...	1.74	...	.74	31	7	63.0	1	27.0	25	2	...
XLIV.	O'Briensbridge (Ross)	2.23	...	.97	26	9	57.0	24	24.0	25	...	...
XLV.	Carlow (Browne's Hill)	1.91	- 2.20	.71	31	9	...	...	...	...	...	...
XLVI.	Dublin (Fitz William Square)	1.40	- 2.02	.63	31	11	59.7	27	33.4	11	0	12
XLVII.	Ballinasloe	2.88	- 1.55	.77	31	11	56.0	1, 3c	28.0	26	9	...
XLVIII.	Waringstown	1.97	- 1.64	.39	26	13	60.0	7	27.0	25	6	13
XLIX.	Londonderry (Creggan Res.) ..	3.06	...	.48	11	22	...	...	...	...	...	...
L.	Omagh (Edenfel)	2.34	- 1.98	.38	11	16	57.0	1	28.0	...	...	...

a And 8. b And 20. c And 7. d And 26. e And 25.

+ Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON OCTOBER, 1887.

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.—The commencement of the month was dry, and fine dry weather prevailed in the middle of the month with severe frosts and local fogs at night. The soil was very dry, and the streams were so low that millers were unable to work their mills full time. Gale on 29th.

ADDINGTON.—A very cold October, with sharp night frosts. A shade min. of 21° (which occurred twice) is a very rare occurrence. It was also very dry until the 29th, when heavy R fell. The ground was still very hard and dry at the close. From 2nd to 6th inclusive there was no sunshine. Fog on 9th and 18th. Aurora on 22nd. Ice half-an-inch thick on the lake on 26th.

CULFORD.—The month was very cold and winterly, with very high winds. S on 11th and 24th.

LANGTON HERRING.—On the whole a very fine month. Colder than any previous October for 15 years, the mean temp. being $4^{\circ}3$ below the average. The max. temp. (60°) was as low as any max. for October during 15 years, and the min. temp. (29°) is the lowest, with one exception (28° in 1881), during that period. On the night of the 29th a great storm occurred, with sudden fall of pressure. L on 10th, 11th, and 12th. Solar halos on 23rd and 29th.

BODMIN.—A very genial month, except at its termination. A heavy, but brief, S.W. gale on 30th.

WOOLSTASTON.—A severe spell of cold weather, lasting a week, set in on the 9th, on which and the two following days S fell heavily on the Shropshire hills. It became very cold again on the 24th, and the month closed with a tremendous gale on the night of the 31st. Mean temp. $44^{\circ}4$. A flock of wild geese passed over on the 9th.

ORLETON.—The rainfall till the 26th was very small, with much sunshine by day and frequent severe frosts at night, the temperature being generally very low. On the morning of the 26th the temperature fell to $17^{\circ}2$, which is the lowest registered here in October. The remainder of the month was unsettled and rainy. The mean temp. was $5^{\circ}6$ below the average of 26 years, and lower than that of October in any year except 1880. On the morning of the 10th the Cleve Hills, and other high hills, were covered with S. Pressure was generally very high and steady. The land continued very dry, and springs were very low at the close. L on 11th; fog on 5th, 6th, 18th, and 22nd.

BOSTON.—Very sharp frosts occurred on the 22nd and 26th, the canal being frozen over. S on 24th and 26th.

HULL.—A fine month on the whole. S on 11th, 23rd, and 25th.

WALES.

HAVERFORDWEST.—The first five days were fine and autumnal in character. Broken stormy weather followed from 6th to 14th, with much R, H, and L and a heavy fall of S on the whole of the Precelly range and the land about Wiston, which is about 400 feet above mean sea level. Fine autumnal, but cold, weather then prevailed for the next seven days, during which the pressure was high with N. and N.E. wind. The last seven days were stormy at times, cold and showery with, on some days, rather low temperature, and much R near the close. On the whole it was a very fine month, the R falling principally at night, and colder than usual. A terrific gale sprang up after midnight on the 31st, pressure at 8 a.m. on November 1st being $28\cdot811$ in. corrected.

SCOTLAND.

CARGEN.—A very cold month. The mean temp. ($44^{\circ}7$) being the lowest for October in 27 years, with the exception of October 1885 ($44^{\circ}0$). Pressure, until the last few days, was unusually high. N. and E. winds prevailed on 18 days, R $3\cdot07$ in. below the average of 27 years.

JEDBURGH.—Remarkably dry with a great deal of frost, which caused the fall of the leaf to be early and quick. Potatoes were lifted in good order, and free from all disease, and the cereal crops were all got in in good order.

OBAN.—The early part of the month was very fair, with a sudden change to extreme cold on the 8th, when S fell upon the hills at least four weeks earlier than usual. This lasted a week, and nearly all the autumn flowers were destroyed. Very disturbed weather prevailed after the 22nd. N. winds prevailed, and the mean humidity (72) was particularly low. Fine lunar rain-bows were seen in N.W. at 8 to 9 p.m. on the 24th.

QUINISH.—Very fine until the 25th, thereafter very wet and stormy. Very heavy R (1·34 in.) on the 31st, with severe S gale at night.

ABERDEEN.—Rainfall somewhat below the average; sleet and S on several occasions.

LOCHBROOM.—With the exception of the first five days, which were beautiful, the weather was wild and wintry in the extreme. From the 9th to the 14th it was like the middle of winter, with S and sleet in the glens and severe frost, S and H on the heights. Thence to the end it was a mixture of all kinds of weather, with very few fine days. On the whole a very stormy month, more like February than the last month of autumn. Gale on 19th.

CULLODEN.—From the 10th to the 30th, with the exception of the 20th, the weather was fine. The frost on the nights of the 16th and 19th destroyed many tender flowering plants.

SWANBISTER.—Showery, but, on the whole, good for harvesting operations, being cold and windy. S on hills on 11th, 14th, and 15th. Fog on hills on 27th, 30th and 31st. H on 8th, 10th, 11th, and 14th.

IRELAND.

BLACKROCK.—Generally very fine and often bright, without R, except two showers, till the 22nd, thence frequent cold showers to the end. Mean temp. $47^{\circ}\cdot 5$. Rainfall 1·34 in. below the average of 22 years. The rainfall of the year to October 31st (19·04 in.) is 16·32 in. below the average of 22 years, the fall having been deficient in every month.

WATERFORD.—But for the heavy rains after the 25th, the month would have been remarkable for its dryness. Mean temp. $46^{\circ}\cdot 5$. H on 30th, S.W. gale on 31st. A few swallows seen on the 18th.

O'BRIENSBIDGE.—The finest possible weather up to the 26th, gave every facility for concluding harvest operations, and for the gathering in of an exceptionally good potatoe crop. The last six days were wild and squally; stormy on 29th and 30th, with some T and L and very low pressure.

DUBLIN.—For the most part and until towards the close a quiet, dull, cold month, with high pressure and scanty rainfall. There was a broken period from the 7th to the 12th. On the morning of the latter day the first S of the season fell. After the 25th the weather again fell into an unsettled, showery state, and on the night of the 31st a deep depression, advancing from the southwestward, brought a violent southerly gale and much R. The mean temp. ($47^{\circ}\cdot 3$) was decidedly below the average ($50^{\circ}\cdot 0$). In the preceding 22 years October was coldest in 1880 ($45^{\circ}\cdot 4$) and in 1885 ($45^{\circ}\cdot 5$). Solar halos on 20th and 29th. High winds on 7 days, attaining the force of a gale on 26th, 30th, and 31st. L on 10th; H on 9th; S on 12th. Shade temperature did not reach 60° on any day, while it fell below 40° on 12 days. The atmosphere was not once foggy. Mean humidity 82; mean amount of cloud 6·6; prevailing winds N., N.W., W., and S.W.

WARINGSTOWN.—A very fine month; autumn tints were gorgeous; the potato crop was unprecedentedly large, and there was no disease.

EDENFEL.—With the exception of a few days in the second week, and again at the end of the month, the weather throughout was fine and settled, and, although the wind was northerly on 18 days, mild, with little or no frost. Swallows did not finally leave till the 16th, more than a fortnight later than my previous latest record.

AN AIR BATH.

[From an article on the *Mammoth Cave of Kentucky*, in "*Longman's Magazine*."]

ANOTHER very interesting feature to me was the behaviour of the cool air which welled up out of the mouth of the cave. It simulated exactly a fountain of water. It rose up to a certain level, or until it filled the depression immediately about the mouth of the cave, and then, flowing over at the lowest point, ran down the hill towards Green River, along a little watercourse, exactly as if it had been a liquid. I amused myself by wading down into it as into a fountain. The air above was muggy and hot, the thermometer standing at about eighty-six degrees, and this cooler air of the cave, which was at a temperature of about fifty-two degrees, was separated (in the little pool or lakelet which is formed) from the hotter air above it by a perfectly horizontal line. As I stepped down into it I could feel it close over my feet; then it was at my knees, then I was immersed to my hips, then to my waist, then I stood neck-deep in it, my body almost chilled while my face and head were bathed by a sultry, oppressive air. Where the two bodies of air came into contact, a slight film of vapour was formed by condensation; I could wade in till I could look under this as under a ceiling. It was as level and as well defined as a sheet of ice on a pond. A few moments' immersion into this aerial fountain made one turn to the warmer air again. At the depression in the rim of the basin one had but to put his hand down to feel the cold air flowing over like water. Fifty yards below, you could still wade into it as into a creek, and at a hundred yards it was still quickly perceptible, but broader and higher; it had begun to lose some of its coldness and to mingle with the general air. All the plants growing on the margin of the watercourse were in motion, as well as the leaves on the low branches of the trees near by. Gradually this cool current was dissipated and lost in the warmth of the day.—JOHN BURROUGHS.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCLXIII.]

DECEMBER, 1887.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

A BOLIDE EXPLODED OVER CENTRAL ENGLAND.

SOME of the Metropolitan newspapers on November 22nd, and many of the Provincial ones on following days, contained accounts of what nearly all of them described as an earthquake shock. Among the earliest notes which we received was the one from our excellent observer at Addington (Mr. Mathison), which will be found further on.

Our attention was immediately fixed upon the loudness of the sound, and we at once plotted on a map such records as we had obtained. These showed that at western stations, *e.g.*, in Oxford and Buckingham, the reporters spoke chiefly of noise; and at the eastern ones, Hertford and Cambridge, chiefly of earth tremor. These two facts made us suspect that, instead of an earth tremor, we had to deal with the far more exceptional phenomenon of a large meteor or bolide bursting in the atmosphere.

We, therefore, applied for a copy of each of a considerable number of local newspapers, and from them extracted a large amount of useful information. While this was in process, we heard from Mr. Fordham that he was collecting information as to the slight shock of earthquake, for the Hertfordshire Natural History Society, and in replying to him, we pointed out that after all it might have been an explosive meteor.

This turns out to have been the case, as the following interesting letter shows:—

To the Editor of the Meteorological Magazine.

SIR,—It seems most probable that the loud report, heard over so wide an area, about 8.20 a.m., on November 20th, and associated with a supposed earth tremor, was due to the explosion in the air of a large meteor.

In general, the theory of a meteoric explosion accords well with the experience of those who were in a good position for observing the effect of the concussion of the air, which was in this district so marked a feature of the supposed earthquake; but, until yesterday, I had not obtained any positive evidence suggestive of such an occur-

rence. Yesterday, however, I received a letter from Hertford, stating that a "falling star" was seen there on November 20th, at 8.20 a.m., It is described as a "brilliantly luminous body travelling across the sky from N.E. to W.," and it is stated that a portion of the meteor was seen to fall from the main body. No report was heard at Hertford. I have received no other information as to this meteor being seen; but it is possible that the foggy state of the atmosphere may have prevented its being generally observed.

As I have undertaken to collect information, with a view to drawing up a report upon the supposed earthquake, for the Herts Natural History Society, I shall be exceedingly obliged to any of your readers who may be able to help me, if they will send me any notes of observations they may have made.—Yours faithfully,

H. GEORGE FORDHAM.

Odsey Grange, Royston, December 5th, 1887.

This by no means lessens the interest of the phenomenon. We now know approximately for what we have to seek, and all the information already collected has to be examined by the light of the meteor—or rather in relation to that theory. It would be quite rash to even conjecture what must have been its size and weight; but a meteor of which the explosion was heard at Lambourn, near Swindon, Wilts, and at Newmarket, in the east of Cambridgeshire, or 84 miles from S.W. to N.E., and over a belt from N.W. to S.E. of about 30 miles—certainly over an area of 2,000 square miles—must surely have been a formidable missile. Happily, its fragments appear not to have hurt anyone; and, therefore, all that remains to be done is to be thankful for that, and to try to find some of the pieces. The morning was so foggy and misty, that it is quite possible that the observer at Hertford is the only person who saw the meteor; if he can fix the position in which he saw it explode that will be very useful. Our own impression is that it was in the neighbourhood of Thame, but we have no evidence beyond that which we append to this article. Our selection of Thame depends on (1) our high opinion of Mr. Mathison's qualities as an observer; he says, "on the horizon, about S.S.W. from where I stood;" Thame is between S. and S.S.W. from Addington: (2) the strong sense of fear indicated in the reports from Thame and its vicinity.

We have arranged the records in each county from south to north, the counties themselves are also in somewhat the same order, viz., Berks, Oxford, Bucks, Northampton, Hertford, Bedford, Essex, Huntingdon and Cambridge.

BERKS.

READING.—"L.B.," writing from Reading, says:—"At 8.18 on Sunday morning last, I heard a sound like a heavy explosion, or a big gun, very distant, followed as I fancied by a slight rumbling. I mentioned the circumstance to several persons during the day. It would be interesting to know whether anyone in Reading or the

neighbourhood had the same experience, which seems to correspond with accounts given in the *Daily News* and *Morning Post* of a slight shock of earthquake heard and felt in various counties at that same time."

MAIDENHEAD.—Loud noise heard at Bisham, 4 miles N.N.W. of here.

LAMBORNE.—This is in the extreme West of the county; we reprint *verbatim* :—

THE RECENT EARTHQUAKE.

To the Editor of the Reading Mercury.

SIR,—In the *Mercury* of last week, I notice an account of the shock of earthquake which was felt in Berkshire and other counties, on Sunday, the 20th.

I was out at my sheep-fold that morning, and I distinctly heard what I took to be the report of a large cannon. It was as if it came from the north-west. My carter also heard the sound, and he asked me if it was thunder. I thought no more of it until I saw the account in your paper. I pulled out my watch at the time; it was just 8.20 a.m.—I am, Sir, yours truly,

DAVID ALBURY.

Upper Lamborne, Swindon, Nov. 29th.

WANTAGE.—It was supposed that the Abingdon gas works had blown up; a terrific explosion was heard; doors, windows, and even slates rattled here, and also at Wootton, Marsham and Shippon, all in the vicinity of Abingdon. At Shippon, a man rushed out of doors, thinking that the house was falling.

ABINGDON.—"C. L.," writing to the *Morning Post*, says :—"The shock of earthquake described in your issue of this morning as having been felt in Cambridgeshire and adjoining counties on Sunday morning was also distinctly felt at Abingdon. I was in church at the time (8.20 a.m.), when there came a loud report as of an explosion, and all the members of the congregation, who were kneeling at the moment, looked up startled, expecting to see some catastrophe in the church, but all was quiet there. The prevailing idea then was that a dynamite explosion in or near London must have taken place."

OXFORDSHIRE.

DRAYTON, near [ABINGDON].—Very loud explosion, windows shaken.

To the Editor of the Meteorological Magazine.

SIR,—I don't know whether you have any communication from this vicinity respecting a very loud report, which I heard on Sunday morning, the 20th, at 8.20 a.m.; and which, to my judgment, seemed due to a thunder-clap, though it sounded very like a big cannon shot, or an explosion; the sound seemed to come from a S.E. direction, that quarter being full of foggy cloud at the time.

I mention it because people in this neighbourhood have connected it with certain earth shakings, which, I must say, I did not experi-

ence (I was out of doors at the time); and there is a paragraph in the *Oxford Times* this last week, headed, "A supposed earthquake shock"—in connection with the loud report alluded to.

Yours very truly,

JAMES C. ROSS.

Baldon Vicarage, Oxford, Nov. 28th, 1887.

TETSWORTH, $2\frac{1}{2}$ miles S.W. of THAME.—Loud explosion.

THAME.—At a farmhouse near here the occupants rushed out, as they thought that a chimney stack was falling. Another observer says: A very unusual sound, like the rumbling of a distant explosion.

OXFORD.—Many inhabitants were startled shortly after eight o'clock on Sunday morning by a rumbling sound like that of a distant explosion. Some persons appear not to have experienced anything unusual, but others state that doors and windows were made to rattle, and a noise was heard resembling the passing of a heavy vehicle. Reports have been received from villages in the neighbourhood to the same effect.

OXFORD.—A correspondent writes:—"I heard an extraordinary explosion in my house in North Oxford. It seemed rather to come from above than below the earth, similar to a clap of far-off thunder, or a distant sound of a moving train. I am inclined to attribute it to some atmospherical disturbance."

BICESTER.—A singular phenomenon, which appears to have been a shock of earthquake, was observed here, and in several of the surrounding villages, on Sunday morning, at about twenty minutes past eight. The effect is variously described as resembling a distant explosion and as somewhat like a clap of thunder. Happening as it did, when anticipation was being directed to what might be taking place in London, some conjectured that a terrible dynamite explosion had taken place in London, whilst an extensively prevailing report on Monday attributed the noise to an explosion, which was said to have taken place in connection with the gas works at Baron Rothschild's seat at Lodge Hill.

BUCKINGHAMSHIRE.

PRINCES RISBOROUGH.—Sunday's earthquake was distinctly felt by many persons in the town and neighbourhood. It mostly seems to have been noticed as a somewhat peculiar thunder, though one person felt the vibration as if it proceeded from the direction of Watlington along the Chiltern Hills, and in quite a contrary direction to that which would have been expected had the centre of the seismic disturbance been in Beds or Cambs as has been generally reported. In one house in the town the occupier was dressing upstairs, and the other inmates called up to ask why he was making such a noise. At Saunderton a flock of sheep was observed to be very frightened.

WENDOVER.—At Butler's Cross a cow could hardly be got to proceed further. In the main, however, people seem to feel a sort of regret that they did not notice it.

At SHABBINGTON, LONG CRENDON, TOWERSEY and CHEARSLEY, all near THAME, or between it and AYLESBURY, the explosion was loud.

BRILL.—Sound heard.

AYLESBURY.—An explosive sound, which those who heard it freely attributed to an earthquake visitation, was heard here as nearly as possible at 8.15 a.m. It was not, however, audible to all the population, many of whom at that hour on a Sunday morning are yet in their slumbers; and it was not loud enough to arouse them. Even many who were wide awake had no knowledge of it; but to those who did hear it, and especially persons who happened to be out of doors at the time, the sound was very distinctive and even startling. Most persons in Aylesbury who testify to the occurrence compare the report to that of a clap of thunder, without the customary rolling sound, and as a rule we have heard it described as apparently overhead, which seems inconsistent with the earthquake theory; the wide extent of the phenomenon and its all but simultaneousness throughout a large area is, however, puzzling. Probably the sound was much louder in some places than in others.

AYLESBURY.—The report was noticed at Long Marston, Berton, and many other places near here.

DAGNALL.—The noise was distinctly heard in this extreme S.E. of the county; about 6 miles N.E. of TRING.

FENNY STRATFORD.—At Linslade, 4 miles S.E. from here, a rumbling noise was heard, and windows rattled.

WINSLOW.—

To the Editor of the Meteorological Magazine.

SIR,—Last Sunday morning, the 20th, when standing in the kitchen garden, shortly after eight o'clock, perhaps a quarter past, I was startled by what seemed to be the loud report of a big gun away to the south-west, and the sound reverberating along the hills in an easterly direction. The report was sharp, loud, and of short duration. I did not think it thunder, but fancied it was an explosion of some sort; being in the direction of Bicester, I thought of the gas works there. Many people about here heard the sound, and I see by the papers, the same thing was heard in many different places and wide apart, so thunder it could not be. Some fancied the sound was up in the air above head, my impression was that it was near the horizon, and about S.S.W. from where I stood; perhaps you will have received communications that will throw some light on the subject.—I am, Sir, yours obediently,

JOHN MATHISON.

Addington, Nov. 26th, 1887.

P.S.—I find that different persons have different ideas as to the direction of the sound. To me it was decidedly S.S.W., some say just the opposite quarter. It puzzles me that the sound could be heard at points so far apart as Bicester and Brackley; each is ten or twelve miles W. from here; and it was also heard at Bow Brickhill, as many miles in the opposite direction.

BUCKINGHAM.—In Buckingham the explosion—for such it is described by those who heard it—was very loud ; indeed, in many instances persons were much frightened, and the daily papers on Monday were eagerly sought, it being believed that what was heard was the report of a serious dynamite explosion in the metropolis. In the surrounding villages, too, considerable consternation was caused by the explosion. Some attribute it to thunder, and others to earthquake, whilst there are those who believe it to have been caused by meteoric influences. One person says it was a sharp distinct report as of cannon, and yet somewhat differing from the report of cannon.

NORTHAMPTONSHIRE.

BRACKLEY.—On Sunday morning a sound like the report of a cannon was heard here between 8 and 9 a.m. It appears, however, that a similar sound was heard throughout this district, at Buckingham on the one side, and also in the neighbourhood of Bicester. Various conjectures are rife as to the origin of the sound, which is attributed in some quarters to an earthquake, while others are of opinion that it was caused by an explosion. If the first account be the correct one, there appears to be no testimony as to any vibration or shock accompanying the sound.

HERTFORDSHIRE.

TRING.—The shock was distinctly felt at Aldbury, 3 miles N.E. of here. Mr. Grange's shepherd boy, who was in charge of a flock, was so startled that he bolted home, and the sheep were equally startled, though they did not resort to a stampede.

HITCHIN.—The shock was noticed at Hitchin soon after eight o'clock as the milkmen were going their rounds, and several of the men bear testimony to underground rumblings. On the high ground near Offley a sound as of low thunder was heard, accompanied by a vibration of the ground, and after an interval other distinct vibrations without any rumbling noise.

To the Editor of the Meteorological Magazine.

SIR,—I dare say you will have seen in the *Daily News* that a slight shock of earthquake was experienced here on Sunday last at 8.30 a.m. In this immediate neighbourhood it was thought that an explosion had taken place, but within a few miles I fancy the characteristics were more marked. Five miles to the S.W. the sheep and cattle seem to have been quite panic-stricken ; six miles to the N.E. the window panes rattled quite in accordance with the usual descriptions of slight earthquakes. However, can it be in any way accountable for the extraordinary depression of the barometer, which was unaccompanied by rain or wind, and which was so unusual that everybody was predicting a very deep snow ? I dare say from your different stations you will hear plenty of details.—Yours truly,
W. LUCAS.

Hitchin, Nov. 22nd, 1887.

BALDOCK.—At Baldock it was thought that the Gas Works had blown up, as windows were shaken and beds were felt to move.

ROYSTON.—About 20 minutes past eight o'clock on Sunday morning, the inhabitants in many parts of the district around Royston were startled by an unusual noise and vibration as of a violent explosion. Owing to the time at which it occurred, and its very brief duration, there was not a favourable opportunity for careful observation of its effects, but from many similar reports from villages, many miles apart, all agreeing with those of persons who noticed it in Royston, as to the time and general effect, there appears to be no way of accounting for the phenomenon, excepting on the hypothesis of its being a slight shock of earthquake. The places affected by it lie almost in a line across from Bedfordshire over the junction of the two counties of Cambs and Herts into Essex, the shock being especially felt about the Chishills and Heydon, as well as in Royston, and other places upon, or at the foot of, the chalk hills.

BEDFORDSHIRE.

DUNSTABLE.—Shortly after eight on Sunday morning, a most uncomfortable, and, to many, alarming noise, accompanied by a shaking sensation, was heard and felt by various persons in and around Dunstable. Many persons thought, at first, it must be very distant thunder, but when the rattling of doors and windows followed, together with the clinking of plates and other crockeryware standing upon shelves, this idea was at once abandoned, and it was the almost unanimous opinion that an alarming explosion had occurred somewhere in the district. However, nothing at present seems to corroborate this view. In the villages of Whipsnade, $2\frac{1}{2}$ miles S.W., and Studham, 4 miles S.W., the noise was very distinctly heard, but the shaking sensation appears to have been most felt at Whipsnade in this district.

LEIGHTON BUZZARD.—A curious sensation was felt by many persons. By some it is described as a rumbling noise, accompanied by a clattering of the window frames and loose articles in the houses. To others it seemed more like the vibration accompanying an explosion; but it is the general idea that it was not caused by thunder. By some persons it was thought to be a slight shock of earthquake.

WOBURN.—Rumbling noise heard.

AMPTHILL.—Noise heard and vibration felt, supposed to be due to a distant explosion. At Westoning, 3 miles S., Flitwick, 2 miles S., and Flitton, 2 miles S.E., the shaking was so very distinct, that almost a panic, for a time, seemed to seize several of the people, who knew not how to account for it, nor what to make of it. Its character may be correctly judged of, when it is stated that here, also, the bulk of the people inclined to the belief that what they had heard and felt was the effect of an explosion somewhere or other. The affair has caused a good deal of talk in the neighbourhood. At Silsoe, 3 miles

E.S.E., doors and windows rattled. It was also felt at Clophill, 4 miles E. At Lidlington, 3 miles W.N.W., a loud noise, apparently caused by an explosion, was heard; it was generally supposed to be due to the explosion of a boiler in the neighbourhood of Brackley. [We do not know what can have led to this place being named, it is not a large one, and is 26 miles due W. of Lidlington. —ED. *M.M.*]

STOTFOLD, 3 miles N.W. of Baldock.—The shock was distinctly felt here, and it was thought that an explosion at the Arlesey Brickfields [which are W. of Stotfold—ED. *M.M.*] had taken place.

BIGGLESWADE.—At 8.20 a.m., many persons heard a noise like a distant explosion, doors and windows were shaken; persons in fields felt earth tremor. The explosion was also heard and felt at Southill, which is 3 miles S.W., and at Warden, which is about 2 miles W.

SANDY.—The shock was heard and felt here, and also at Potton, which is 3 miles E.

BEDFORD.—The shock was felt in the villages of Cardington, 3 miles S.E., and Harrowden, 2 miles S.

RISLEY.—This is in the N. of the county, about 6 miles S.W. of Kimbolton, and is the limit towards the N.N.W. from which we have any record; the shock is said to have been felt here.

ESSEX.

SAFFRON WALDEN.—At Saffron Walden, about a quarter past eight in the morning, a rumbling noise, as of distant thunder or the discharge of artillery, was heard in the town, and also in the neighbourhood of Wenden 2 miles S.W., and Arkesden 4 miles S.W. The vibration was felt by persons in bed. The shock was also felt at Heydon, which is about 7 miles W.N.W.

HUNTINGDON.

ST. NEOTS.—The shock of earthquake on Sunday morning was felt in this neighbourhood by many persons. Mr. Clark (coachman to Mr. C. P. Rowley, of Priory Park), who was crossing the fields leading from St. Neots to Priory Hill, thought that the sound and the accompanying vibration of the earth must have been caused by a large explosion of dynamite. Some men in the employ of Mr. Isaac Hall, of Eynesbury, thought that the sound was caused by thunder, but were somewhat startled by the peculiar sensation experienced by the shaking of the earth simultaneously with the noise they had heard. The matter was freely discussed by several people a long time before it was known there had been a shock of earthquake.

CAMBRIDGE.

CAMBRIDGE.—At Gamlingay 10 miles W., a distinct shock was felt, and people were so alarmed that they rushed out of doors. Several buildings were shaken, but the wave appears to have been very partial, as in some parts of the village nothing was noticed. Many persons heard a heavy report at the time, as if a tremendous

explosion had taken place in some distant part of the country. The shock was felt in Cambridge, and also at Wimpole, 8 miles W.S.W., and at Bourne, 8 miles W.

NEWMARKET.—Shock felt here. [This is at present the most easterly and north-easterly record. — ED. *Met. Mag.*]

It is rather singular, but purely a coincidence, that the only parallel case recorded for the British Isles by the late Dr. Flight, in his *Chapter in the History of Meteorites*, occurred in very nearly the same district between 200 and 300 years since. The following is the account:—

1628, *April 9th., about 6 p.m.*—CHALOWS AND BARKING, NEAR WANTAGE, BERKSHIRE.

Mr. Webb directs attention to a letter, preserved in Wallington's *Historical Notices*, I. 13, which was written in 1628, "by Mr. John Hoskins, dwelling at Wantage, to his son-in-law, Mr. Dawson, a gunsmith, dwelling in the Minories without Aldgate," relating to the fall of meteorites. Describing the explosion, Hoskins says: "It began as followeth:—First, as it were, one piece of ordnance went off alone. Then, after that, a little distance, two more; and then they went as thick as ever I heard a volley of shot in all my life; and after that, as if it were the sound of a drum. . . . Yet this was not all; but, as it is reported, there fell divers stones, but two is certain in our knowledge. The one fell at Chalows, half-a-mile off (from Wantage), and the other at Barking, five miles off. Your mother was at the place where one of them fell knee deep, till it came to the very rock, and when it came at the hard rock it broke, and being weighed, all the pieces together, they weighed six-and-twenty pound. The other that was taken up at the other place (Barking) weighed half a tod, 14 pound."

HOW OUR READERS CAN HELP.

We require

- (1.) Any information as to intensity or direction of the sound which any one can give us.
- (2.) Any information as to any person by whom the shooting star or meteor was seen.
- (3.) Any fragments which may have fallen. Those which fell on grass or ploughed land would probably make an approximately circular hole from 4 to 8 inches across, and from 6 to 12 inches deep.

Until we can hear of other persons who saw the meteor burst, it is impossible to say where the fragments are most likely to be found, but at present we consider the most likely locality to be near Thame, perhaps between it and Abingdon.

Intelligence can be sent either to Mr. Fordham or to us, at 62, Camden Square, N.W.

R E V I E W .

Weather: a Popular Exposition of the Nature of Weather Changes from Day to Day. By the HON. RALPH ABERCROMBY, F.R.Met.Soc., &c.
London: Kegan Paul, Trench & Co., 1887. 8vo. xix. 472 pp.

THE publication of a book as one of the International Scientific Series is *per se* a compliment to the author, and an indication of its nature. The directors of a series which started with Tyndall's "Forms of Water," rapidly followed by Herbert Spencer's "Study of Sociology," "Huxley's Crayfish" and many other works of equal importance, are not likely to include any work that is not solid and good.

"Weather" possesses both these qualities—if anything it has perhaps a trifle too much of the former, but we are so delighted to get a work upon Meteorology which reverses the usual order of things—one in which we have thoughts, instead of tables—that we do not mind setting to work to master it. Of course theoretically every reviewer knows far more about the subject of the book which he reviews than does the man who wrote it. That is the ideal reviewer; we know few such geniuses, and we make no such claim.

Mr. Abercromby is, moreover, perhaps the most competent person in the world for the task he has undertaken, because he combines in an unusual degree the character of student and of traveller. Directly it occurs to him that some point can only be examined at some other part of the globe, he makes arrangements for starting, be it round the tropics to study the upper currents, or to Sweden to discuss cloud forms with Hildebrandsson, or to Teneriffe to examine the distribution of atmospheric electricity. The power, and the will, to do this are not given to all, and it is not to be wondered at that he who does it, stores up experience of the greatest value.

The first part of the book deals with the simpler branches of synoptic meteorology, especially in relation to, and illustration of, old fashioned weather proverbs, and treats fully of cloud forms, but while giving full directions for observing the motion of clouds, the author says nothing of any pattern of cloud mirror. If he thinks them good, why did he ignore them; if bad, why not point out their faults?

The second and much larger part deals fully and more minutely with synoptic meteorology, cyclones, V shaped depressions, thunderstorms, tornadoes, diurnal and annual changes, and weather types. It closes with two chapters on forecasting, the first by a solitary meteorologist cut off from all communication by post or telegraph, and compelled to rely upon his own instruments and upon the appearance of the sky; the second by the head of a meteorological office surrounded by observers all communicating by telegraph—in fact, a spider in the centre of a web hundreds of miles in diameter, and along the threads of which the faintest breath of wind is

instantly transmitted to the officer on duty. No meteorologist has, however, yet been in so good a position, the telegrams may travel with lightning speed, but the lines are blocked with quotations of stocks, political speeches, racing news, love messages, &c., and therefore, even were his observers always on the watch, much delay would be inevitable, and no sooner does a heavy gale come than it breaks his web by carrying away telegraph posts.

Mr. Abercromby calls in to the aid of the central office what he terms "meteograms"—we do not remember having seen this word before, and we do not like it—we have no fondness for long words, and "meteorology" always worries us by its length—but we should have preferred one more letter in this latest addition to our vocabulary, meteorgrams: If all is to be sacrificed to brevity, why not cut it down to metgrams. This, however, is a digression, the fact which we were going to point out is, that our imaginary spider can seldom if ever utilize these meteograms—(1) because central offices are usually in the heart of cities, where accurate observations can rarely be made; (2) because "meteograms," such as the author reproduces on p. 152, cannot be obtained until at least one or two days after the storm is over. An instrument could be designed which would do it. Van Rysselberg's is very near it, but in this country, at any rate, the money all goes in harmonic analysers, and apparatus to give mean values true to hundredths of a Fahrenheit degree, instead of in efforts to improve our storm warnings.

We have noticed very few errors. Buy Ballot, Gulberg and Hildebrandson appear too frequently for the printer to be held wholly responsible, and it is the first time that we have heard of Stonyhurst, *near Manchester*, but these are evidently trifles. Of errors or misstatements as to facts we have not seen one, and the very numerous charts and diagrams are good—we cannot, however, say so much for the tornado-cloud on p. 269—we doubt if it is admired by either author, engraver or publisher.

Talking of tornadoes, we regret that Mr. Abercromby has not referred to the disruptive force generated within buildings by the low pressure centre passing over them. Of true tornadoes in foreign countries we have no personal experience, but in this country more damage is often done by the sudden expansion of confined air than by the motion of translation of the whole meteor.

In the Preface the author says that "it has not been considered necessary to give references to all the original authorities in a popular work." We agree with that, but if this be a popular book it is certainly a high level popular one—one requiring careful thought in order to transfer all the writer's ideas to the reader's mind—and it is one that no weather student can be without; that being so, we think that a dozen or two of additional references would have been useful, *e.g.*, from p. 237, a reference to Mr. Abercromby's own paper in the *Quar. Jour. Met. Soc.*, Vol. ii., p. 450.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1887.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days	
	Temp. °	Date.	Temp. °	Date.									
England, London	71·2	8	32·8	1	59·8	43·4	43·3	79	118·8	24·9	inches 1·45	21	0·10 7·2
Malta.....	91·9	31	52·0	12	75·7	59·4	55·9	69	144·6	46·2	·17	4	3·0
<i>Cape of Good Hope</i> ...	88·9	16	34·9	28	71·0	49·2	...	87	...	...	4·01	9	5·9
<i>Mauritius</i>	79·0	1a	62·6	8	77·0	66·9	64·8	80	130·4	52·3	4·68	15	5·3
Calcutta	98·9	18	65·0	3	92·7	77·6	76·0	69	158·5	63·9	5·17	11	5·0
Bombay.....	91·4	8	77·8	7	90·0	80·7	74·5	71	149·0	74·0	·09	4	3·9
Ceylon, Colombo	89·0	10	73·3	24	86·6	77·5	72·1	76	145·0	69·5	14·14	21	7·5
<i>Melbourne</i>	66·0	1	36·8	20	58·3	47·0	47·6	84	120·0	29·9	1·98	15	7·9
<i>Adelaide</i>	67·9	3	40·4	19	62·2	49·7	48·2	75	129·0	33·4	4·09	22	7·1
<i>Wellington</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Auckland</i>	71·5	2	42·5	30	63·0	51·5	50·0	77	127·0	31·0	5·30	22	6·8
<i>Falkland Isles</i>.....	...	...	30·7	4	...	35·9	38·9	91	98·3	25·2	2·18	21	7·0
Jamaica, Kingston.....	90·5	31	66·5	4	88·2	71·1	70·7	72	...	...	4·33	...	...
Barbados	84·0	21b	68·0	1	82·0	72·0	70·7	78	146·0	...	5·75	19	7·0
Toronto	78·3	20	39·2	14	68·8	47·8	47·8	68	...	32·8	·81	9	5·5
New Brunswick, Fredericton	84·7	10	33·0	2	64·4	40·6	41·6	62	...	...	1·65	10	5·7
Manitoba, Winnipeg ...	90·6	11	29·0	16	68·7	42·3	45·0	65	...	...	3·01	13	5·4
British Columbia, Victoria	80·0	29	30·0	12	62·4	41·4	...	...	...	...	1·32	10	...

a And 17, 20. b And 22.

REMARKS, MAY, 1887.

MALTA.—Mean temp. 66°·2. Sea temp. ranged from 62°·5 to 72° 6 J. SCOLLS.

Mauritius.—Mean temp. of air 1°·3, of dew point 0°·6, and rainfall 1·8 in. below average; mean pressure 30·085 in., slightly above average; mean hourly velocity of wind 7·2 miles, 3·2 miles below average; extremes 23·7 miles on 23rd, and 1·6 miles on 2nd and 3rd; prevailing direction E.S.E. T and L on 1st and 17th, and T on 2nd.

C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·7, and rainfall 1·0 in. below average; mean temp. of dew point 1°·6, humidity 6, amount of cloud 1·4, and pressure 30·075 in. above average. Prevailing winds N. and W.; strong on six days. Hoar frost on 20th. Dense fog on five days; heavy dew on five days.

R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure 30·195 in., 0·68 in. above the average of 30 years. Mean temp. 1·5 below average. Rainfall an inch above average.

C. TODD.

AUCKLAND.—A wet and disagreeable month, with unusually low pressure. Mean temp. close to the average. Rainfall 1·30 in. above the average.

T. F. CHEESEMAN.

KINGSTON.—Rainfall 1·49 in. below average. On the 2nd, a H storm occurred in Kingston about 1 p.m., the stones varying from the size of a pea to that of a pigeon's egg. The max. temperature of the day (88°·1) occurred a little before the storm, which reduced the temperature to 71°.

MAXWELL HALL.

BARBADOS.—Pressure steady. Mean temp. 76°, same as 30 years' average. Rainfall above average. Mean hourly velocity of wind 10·3 miles, same as 14 years' average. L on 21st. TS on 22nd. Three days were overcast.

R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
NOVEMBER, 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	5·89	XI.	Castle Malgwyn	3·59
„	Margate, Birchington...	4·21	„	Rhayader, Nantgwillt..	4·85
„	Littlehampton	4·77	„	Carno, Tybrith	3·68
„	Hailsham	5·31	„	Corwen, Rhug	2·46
„	Ryde, Thornbrough	3·94	„	Port Madoc	4·07
„	Alton, Ashdell.....	5·06	„	I. of Man, Douglas	3·94
III.	Oxford, Magdalen Col... 1·85	1·85	XII.	Stoneykirk, ArdwellHo.	1·78
„	Banbury, Bloxham	2·39	„	New Galloway, Glenlee	4·91
„	Northampton	1·85	„	Melrose, Abbey Gate...	3·64
„	Cambridge, Beech Ho... 1·83	1·83	XIII.	N. Esk Res. [Penicuik]	5·75
„	Wisbech, Bank House.. 1·65	1·65	XIV.	Ballantrae, Glendrisaig	3·14
IV.	Southend	3·00	„	Glasgow, Queen's Park.	2·55
„	Harlow, Sheering	3·36	XV.	Islay, Gruinart School..	2·86
„	Rendlesham Hall	3·78	XVI.	St. Andrews, PilmourCot	2·97
„	Diss	2·07	„	Balquhider, Stronvar..	6·57
„	Swaffham	2·34	„	Dunkeld, Inver Braan..	2·42
V.	Salisbury, Alderbury ... 3·66	3·66	„	Dalnaspidal H.R.S. ...	5·79
„	Warminster	3·93	XVII.	Keith H.R.S.	3·01
„	Ashburton, Holne Vic.. 6·54	6·54	„	Forres H.R.S.	2·50
„	Holsworthy, Clawton... ..	...	XVIII.	Strome Ferry H.R.S....	3·58
„	Hatherleigh, Winsford. ...	...	„	Tain, Springfield.....	...
„	Lynmouth, Glenthorne. 6·09	6·09	„	Loch Shiel, Glenaladale	8·63
„	Probus, Lamellyn	4·59	„	S. Uist. Ardkenneth ...	...
„	Wincanton, StowellRec. 3·19	3·19	„	Invergarry	5·24
„	Taunton, Lydeard Ho ... 3·76	3·76	XIX.	Lairg H.R.S.	2·14
„	Wells, Westbury.....	3·11	„	Forsinard H.R.S.	3·61
VI.	Bristol, Clifton	2·77	„	Watten H.R.S.	1·98
„	Ross	3·00	XX.	Dunmanway, Coolkelure	4·48
„	Wem, Clive Vicarage ... 1·38	1·38	„	Fermoy, Gas Works ...	2·35
„	Cheadle, The Heath Ho. 1·33	1·33	„	Tipperary, Henry Street	2·25
„	Worcester, Diglis Lock 2·45	2·45	„	Newcastle West .....	...
„	Coventry, Coundon 1·82	1·82	„	Milton Malbay	3·59
VII.	Melton, Coston	1·77	XXI.	Gorey, Courtown House	3·80
„	Ketton Hall [Stamford] 2·26	2·26	„	Navan, Balrath	3·97
„	Horncastle, Bucknall ... 1·83	1·83	„	Mullingar, Belvedere...	3·91
„	Mansfield, St. John's St. 2·39	2·39	„	Athlone, Twyford	3·09
VIII.	Macclesfield, The Park. ...	...	„	Longford, Currygrane...	3·30
„	Walton-on-the-Hill..... 1·67	1·67	XXII.	Galway, Queen's Coll... 4·54	
„	Lancaster, South Road. 2·11	2·11	„	Clifden, Kylemore	6·22
„	Broughton-in-Furness .. 3·30	3·30	„	Crossmolina, Enniscoe.. 5·37	
IX.	Wakefield, Stanley Vic. 1·33	1·33	„	Collooney, Markree Obs. 4·34	
„	Ripon, Mickley	2·70	XXIII.	Rockcorry.....	2·41
„	Scarborough, West Bank 2·63	2·63	„	Warrenpoint	2·80
„	EastLayton[Darlington] 3·67	3·67	„	Newtownards .....	...
„	Middleton, Mickleton.. 3·75	3·75	„	Belfast, New Barnsley.. 3·02	
X.	Haltwhistle, Unthank.. 3·89	3·89	„	Cushendun	2·77
„	Shap, Copy Hill	3·78	„	Bushmills	3·24
XI.	Llanfrechfa Grange 4·21	4·21	„	Stewartstown	2·45
„	Llandoverly	4·95	„	Buncrana	4·35

NOVEMBER, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Night below 32°.		
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which .01 or more fell.	Max.		Min.			In shade	On grass.
				Dpth	Date.		Deg.	Date	Deg.	Date.			
		inches	inches.	in.									
I.	London (Camden Square) ...	3.40	+ .96	.60	3	18	55.4	4	22.1	17	8	14	
II.	Maidstone (Hunton Court) ...	4.73	+ 1.83	.87	2	18	...	...	...	...	...	...
III.	Strathfield Turgiss ...	3.78	+ 1.03	.64	19	19	55.1	4	18.8	16	12	20	
IV.	Hitchin ...	2.94	+ .33	.55	3	16	52.0	3	21.0	16	13	...	
V.	Winslow (Addington) ...	2.51	+ .01	.73	9	21	54.0	4,6	16.0	17	12	19	
VI.	Bury St. Edmunds (Culford) ...	2.38	- .45	.40	2	17	52.0	4,5	19.0	16	10	...	
VII.	Norwich (Cossey) ...	2.31	- 1.00	.32	9	17	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring) ...	3.72	...	.62	18	22	53.0	2,4b	26.0	16	6	...
IX.	Barnstaple ...	3.56	- .59	.90	3	14	55.0	7	...	...	...	...
X.	Bodmin ...	4.68	- .64	1.23	21	24	51.0	26	27.0	16	3	10	
XI.	Stroud (Upfield) ...	2.88	- .06	.52	5	15	55.0	1	23.0	15d	12	...	
XII.	Church Stretton (Woolstaston) ...	2.82	- .62	.49	1	18	52.5	2	24.0	18	11	16	
XIII.	Tenbury (Orleton) ...	2.61	- .25	.47	3	18	54.0	2,5	16.0	17	13	18	
XIV.	Leicester ...	1.73	...	.32	5	20	55.8	6	22.5	16	9	19
XV.	Boston ...	1.52	- .85	.30	5	13	58.0	6	23.0	16j	10	...	
XVI.	Hesley Hall [Tickhill] ...	1.55	...	.29	3	17	55.0	6	23.0	16e	10	...
XVII.	Manchester (Ardwick) ...	1.10	- 1.87	.20	2,5	11	53.0	4	25.0	16f	10	...	
XVIII.	Wetherby (Ribston Hall) ...	1.78	- .98	.38	6	12	...	...	...	...	...	...
XIX.	Skipton (Arncliffe) ...	4.58	- 1.17	.65	5	19	52.0	6	23.0	23	13	...	
XX.	Hull (Beverley Road) ...	...	...	...	...	...	...	...	...	...	...	...
XXI.	North Shields ...	2.57	- .88	.45	14	21	55.0	26	24.5	16	9	11	
XXII.	Borrowdale (Seathwaite) ...	8.62	- 3.20	2.85	26	18	...	...	...	...	...	...
XXIII.	Cardiff (Ely) ...	3.89	- .31	.82	3	16	...	...	...	...	...	...
XXIV.	Haverfordwest ...	4.88	- .46	.74	2	18	52.5	1,2	22.0	15g	11	16	
XXV.	Plinlimmon (Cwmsymlog) ...	3.52	...	.57	5	11	...	...	...	...	...	...
XXVI.	Llandudno ...	2.28	- 1.63	.36	2	16	53.5	26	29.0	24	...	...
XXVII.	Cargen [Dumfries] ...	3.81	- .10	.89	1	14	51.2	8	21.0	24	13	...	
XXVIII.	Jedburgh (Sunnyside) ...	2.91	- .10	.61	7	18	56.0	26	17.0	16	9	...	
XXIX.	Old Cumnock ...	3.94	+ .47	.97	27	15	50.0	5,26	20.0	14	...	...
XXX.	Lochgilphhead (Kilmory) ...	4.34	- 1.02	1.63	25	16	...	...	...	...	...	...
XXXI.	Oban (Craigvarren) ...	4.81	...	1.15	25	17	52.3	9,26	27.2	15	7	...	
XXXII.	Mull (Quinish) ...	5.00	...	.76	25	18	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices ...	4.60	+ 1.05	1.00	7,8	14	...	...	...	...	...	...
XXXIV.	Arbroath ...	2.55	- .60	1.04	6	9	51.0	1	28.0	15	7	...	
XXXV.	Braemar ...	5.29	+ 1.52	1.80	1	20	50.6	26	19.0	15	17	23	
XXXVI.	Aberdeen ...	2.54	...	.60	7	22	55.0	26	27.0	15	9	...
XXXVII.	Lochbroom ...	4.42	...	1.19	25	18	...	...	...	...	...	...
XXXVIII.	Culloden ...	1.83	- .87	...	...	...	50.0	3,25	22.0	15	5	23
XXXIX.	Dunrobin ...	1.67	...	.37	25	12	57.8	16	28.8	29	11	...
XL.	Kirkwall (Swanbister) ...	...	...	...	...	...	...	...	...	...	...	...
XLI.	Cork (Blackrock) ...	2.52	- 2.09	.54	21	17	53.0	1,2	22.0	15	10	...	
XLII.	Dromore Castle ...	3.62	...	.44	3	18	56.0	26	22.0	11	...	...
XLIII.	Waterford (Brook Lodge) ...	2.79	...	.55	5	17	53.0	1,4	23.0	16	9	...
XLIV.	O'Briensbridge (Ross) ...	2.82	...	.51	5	18	51.0	5,30	24.0	24	10	...
XLV.	Carlow (Browne's Hill) ...	3.20	+ .28	.45	5a	20	...	...	...	...	...	...
XLVI.	Dublin (Fitz William Square) ...	3.01	+ .73	.87	5	18	55.4	26	28.0	24	4	16	
XLVII.	Ballinasloe ...	3.12	+ .12	.75	5	21	48.0	26	20.0	16b	12	...	
XLVIII.	Waringstown ...	2.25	- .46	.40	2	19	55.0	5	24.0	19	13	20	
XLIX.	Londonderry (Creggan Res.) ...	3.01	...	.72	6	18	...	...	...	...	...	...
L.	Omagh (Edenfel) ...	2.78	- .27	.90	1	15	50.0	4.5c	25.0	15i	12	20	

a And 20. b And 5, 6. c And 3, 9, 26. d And 16. e And 18. f And 17. g And 16, 23. h And 24. i And 19, 23. j And 17, 18.

+ Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON NOVEMBER, 1887.

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.—The month opened with a change to higher temperature which brought gales and showery weather over this district. The close of the month was remarkable only for its wintry character, its dense fogs, severe frosts and heavy rainfall. Fine lunar rainbow at 8.15 p.m. on 3rd.

ADDINGTON.—The early part of the month was wet. No frost to speak of occurred until the 16th, when there was a great fall of temperature, the min. of that day being 19°, the 9 a.m. temp. 22°, and the max. 27°. On the 17th, the shade min. was 16°, the 9 a.m. temp. 20°, and the grass min. 13°. I have no other record of so low a temperature so early in the month. On both days the trees were a beautiful sight. Dense fog on 20th and 21st. High wind on 26th and 27th.

CULFORD.—A cold, stormy month, with frequent frosts and fogs.

LANGTON HERRING.—The month began with very stormy weather and low pressure; the first ten days were showery; cold weather then prevailed till the 24th, the max. temp. being below 44° on 12 consecutive days. From the 9th to the 24th inclusive, the wind at 9 a.m. was N.E. The storms of the first three days were accompanied by T and L. The mean temp. at 9 a.m. was 3°·2 below the average; the month being the coldest November for 16 years, with the exception of 1878 and 1879. Rainfall slightly above the average, but the deficit from the beginning of the year was 8.67 in. at the close of the month. Fog and solar halo on 21st.

BODMIN.—The finest November recorded, with, happily, no fogs. Nine brilliant days and five very fine. Mean temp. 40°·7.

WOOLSTASTON.—A cold month; mean temp. 38°·5. A sea eagle was seen on one of the Shropshire hills on the 1st.

ORLETON.—The temperature of the first 14 days was rather above the average, with R every day till the 12th. From 14th to 24th, the weather was very cold, with severe frosts. The last week was variable, with slight falls of R, and a few frosts. Up to the close, the R had not caused the drains to flow. Pressure was subject to much fluctuation; very low on 3rd. Mean temp. 3° below the average. No S fell.

LEICESTER.—A very changeable month, with some sharp frosts and some bright sunshine, dense fogs and bright clear days.

MANCHESTER.—On the whole a fine month; very mild in the earlier part, cold about the middle, and mild again towards the end. Rainfall small.

WALES.

HAVERFORDWEST.—A great storm occurred on the 1st, doing much damage to roofs and trees; pressure 28.811 in., corrected; T, L and large H at intervals on the 2nd, and very stormy on 3rd, with violent squalls and heavy showers of R and H. Pressure was below 29 inches for more than 48 hours. A cold and very frosty period occurred from 11th to 19th. The month ended wet and unusually mild. Mean temp. considerably below the average.

LLANDUDNO.—Stormy and wet at the commencement. T and H on 4th. S on distant mountains on 20th. S.W. gale of considerable strength on 26th. H on 27th.

SCOTLAND.

CARGEN.—The mean temp. (39°·5) was 2° below the average. The sky was unusually overcast, the duration of sunshine being only 55 hours, the average for the month being 88 hours. The R during the month had little or no effect on the deep wells and springs in the district. The total rainfall for the 11 months was 26.30 in., 13.62 in. below the average. The driest year previously was 1880, with a fall of 28.19 in. for the 11 months. Severe T S on 1st.

JEDBURGH.—The weather on the whole was seasonable, though it was rather stormy at the beginning and at the end of the month. Three inches of S fell on the morning of the 15th.

OBAN.—The early part of the month was very fair with a prevalence of S.E. winds, and with frosts until the 20th. On the 21st there was a very fine aurora, and on the 24th the weather changed, and the month closed with the usual gales and heavy R. The mean pressure was low. H and T on 24th.

BRAEMAR.—A month of very changeable weather.

ABERDEEN.—The weather of the month was open and seasonable; rainfall about half-an-inch below the average. S showers on 14th.

LOCHBROOM.—The first half of the month was very fine, on the whole; the latter half was a mixture of varied weather. Frost prevailed to a greater degree than usual. On the 25th a storm of wind and R occurred, and thence to the end real winter weather prevailed. S and sleet on 20th, 21st and 22nd. R, H and S on 24th.

CULLODEN.—A favourable month for outdoor work, dry periods occurring from 8th to 13th, and from 15th to 21st. At the close of the month there was much wind, with heavy showers at intervals.

IRELAND.

BLACKROCK.—Cold, with breezy showers during the first week, then the proverbial November weather to the end. The thirteenth month in succession with rainfall below the average. Mean temp. ($40^{\circ}5$) 2° below the average of 11 years.

DROMORE.—On the whole very fine, with a little frost now and again, but only of short duration.

O'BRIENSBRIDGE.—Fine open weather for the season, quite in keeping with the remarkable weather of the preceding ten months, the rainfall of the eleven months being barely half the average. Some strong winds from S.W. occurred in the early part of the month.

DUBLIN.—November differed from all the previous months of 1887, in having a rainfall decidedly above the average; due to a fall of $\cdot87$ in. on the 5th. The month was cold and very unsettled, damp and dull. Fog was very prevalent in the third week. Pressure was extremely low at the commencement and remained unsteady throughout. Temperature also varied remarkably and quickly, the highest and lowest readings being recorded within some 48 hours. The prevailing winds were westerly (S.W. to N.W.), but in the second week a *warm* easterly breeze was experienced. The mean temp. ($42^{\circ}6$) was, as in September and October, decidedly below the average ($44^{\circ}4$). In the preceding 22 years, November was coldest in 1878 ($38^{\circ}2$), and in 1870 ($42^{\circ}2$). High winds on 10 days, gales on three days. Fog on nine occasions. H on four days. Shade temp. exceeded 50° on seven days. Mean humidity 88; mean amount of cloud $6\cdot3$.

EDENFEL.—The first and last weeks were rather wet and unsettled, the intervening fortnight was remarkably fine. Rainfall and temperature were both below the average.

ERRATUM, *Met. Mag.*, No. CCLXI., October, 1887.

An absurd, but very obvious error, occurs in our article on the Climate of the British Empire during 1886, in the October number of the current volume. On p. 128, lines 12 and 13, below *zero* should in each case be below *freezing-point*.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCLXIV.]

JANUARY, 1888.

[PRICE FOURPENCE,
or 5s. per ann. post free.]

THE BOLIDE OF NOV. 20TH, 1887.

To the Editor of the Meteorological Magazine.

SIR,—The evidence collected in your December number appears conclusive as to the passing of a meteoric body through our atmosphere and in close proximity to the earth; but I venture to think that it is also conclusive against the theory of its having “exploded” or broken up in its passage.

Having marked on a map all the places where the sound is reported to have been heard, and bearing in mind the other points mentioned by the various observers, I think the actual line passes slightly to the north of Cambridge, Thame, and Upper Lambourne. This line, it may be observed, skirts for the greater part and lies wholly to the north of the escarpment of the chalk. Now except Risely, Brackley, and Reading, it does not appear that the sound was heard at any point lying more than 10 miles (or, except in very few places, more than 7 miles) N.W. or S.E. of this line, and it is expressly stated that no report was heard at Hertford, which would lie about 18 miles off the line.

If the noise was due to an explosion at any point in the 84 miles between the vicinity of Newmarket and that of Lambourne, it is inconceivable that it should be heard (if it took place at the central point) for 42 miles to the N.E. and S.W., and yet be heard only over such a narrow belt from N.W. to S.E.

But Mr. Mathison's evidence makes the point stronger. He heard the sound as from the S.W. If, therefore, it was due to explosion, the sound from it must have travelled back to Newmarket at least 70 miles, and yet the farthest points at which it was heard right and left near Thame were Brackley and Reading, or about 18 miles from the supposed point of explosion.

But again Mr. Mathison's postscript is most important—“To me it was decidedly S.S.W. ; some say just the opposite quarter.”

Surely these facts, and many others which a reperusal of the evidence will bring to notice, all point to this, that the sound was not a momentary but a continuous one along the whole line of flight

and due solely to the resistance of the air to the high speed of the meteor. When we consider that (putting aside diurnal revolution) the earth would meet even an object stationary in space at the rate of about 18 miles a second, and that we have no means of measuring the rate of motion of the meteor itself, or therefore the actual or relative speed at which it passed through the atmosphere, and recollect the amount of sound that so small a body as a rifle ball can produce in its flight at a comparatively low rate of speed, while again we cannot measure the size of the meteor, we have, I think, sufficient to account for the sounds (mostly described as rumblings) which your correspondents heard.

Again, as far as can be judged, the sound was comparatively uniform, which is quite inconsistent with an explosion at one point in so great a length of line. No doubt it appears to have been loudest near Thame. Possibly at this point the line of flight would be tangential, and so nearest, to the earth's surface, or the formation of the ground may have pent in the sound.

That the sound was heard exceptionally at Risely, Brackley, and Reading would be due to local causes. The first two places lie in valleys of denudation (on the oolite and lias respectively), lying so as to catch a sound from the S.E. Reading again lies in the Thames Valley, which runs thence nearly at right angles to the supposed line, and would therefore conduct the sound. On the other hand, the chalk escarpment and the Welwyn Valley would cut off the sound from Hertford.

Hoping to see further details this month,

I remain your obedient servant,

JAMES G. WOOD.

8, *Lansdowne Crescent, W.*
January 3rd, 1888.

[As intimated in our last, we have forwarded all fresh accounts of the phenomenon to Mr. Fordham. The above belongs, however, to a different category, and we are glad of the privilege of inserting it. We think that while Mr. Wood has proved the existence of the meteor almost as thoroughly as if it had been seen throughout its path, and has also established the continuity of the sounds and the probable accuracy of his explanation, he might have left a small portion of noise for the flaking-off of the coat of the meteor by excessive heat, which, in other cases, has been observed to be accompanied by loud reports. Although we still think that there was a final explosion near Thame, and probably were minor ones at points on the route where the crust flaked-off, we are quite prepared to believe that there was a roar all along the track. It must, however, be remembered that the air, at the altitude at which the meteor probably passed, would not be at all dense.—ED.]

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday evening, the 21st instant, at the Institution of Civil Engineers, 25, Great George Street, Westminster, Mr. W. Ellis, F.R.A.S., President, in the chair.

The Rev. R. Barker, Mr. W. W. Day, M.D., Mr. H. N. Dickson, Mr. H. Harries, Mr. P. S. Jeffrey, B.A., Mr. H. A. Johnstone, and Mr. J. Wolstenholme were elected Fellows of the Society.

The following papers were read :—

(1). "The mean Temperature of the Air at Greenwich from September 1811 to June 1856," by Mr. H. S. Eaton, M.A., F.R. Met. Soc. This is a discussion of the Meteorological Journals of the late Mr. J. H. Belville and those of the Royal Observatory. The general results of this investigation are :—1, That there was no appreciable change in the mean annual temperature of the air at Greenwich in the period 1812 to 1855 inclusive. 2, That on the eminence on which the Royal Observatory is situated the average temperature at night, or rather in the early morning, is in all cases higher than over the lower grounds. 3, That with a north-wall, or possibly a north-window exposure, higher maximum temperatures are found at the lower stations. 4, That the movements of the thermometer are retarded with a north-wall exposure, as compared with an instrument on an open stand, especially where the situation is a confined one, the indications of the thermometer not following changes of temperature so promptly owing to the modifying influence of the adjacent building.

(2). "Report on the Phenological Observations for the year 1887," by the Rev. T. A. Preston, M.A., F.R. Met. Soc. The past season was a most exceptional one. For flowers it was disastrous; fruit was generally a failure, though there were exceptions; those kinds which promised well turned out very small or spoilt by insects. Vegetables were universally poor, roots were destroyed by insects or drought, and green crops soon passed off. The wheat crop, however, was better than was expected. Barley on light lands was poor, but that which was sown early was satisfactory. Meadow hay was not up to an average crop, but clover and seed hay were much more nearly so. In Kent the fruit crops turned out lighter than usual, but the prices have ruled higher.

(3). "Earth Tremors and the Wind," by Prof. John Milne, F.R.S., F.G.S. The author has made a detailed examination of the tremor records obtained in Tokio, and compared them with the tri-daily weather maps issued by the Imperial Government of Japan. From this comparison the following conclusions have been drawn :—1, Earth tremors are more frequent with a low barometer than with a high barometer. 2, With a high barometric gradient tremors are almost always observed, but when the gradient is small it is seldom that tremors are visible. 3, The stronger the wind the more likely it is that tremors should be observed. 4, When there has been a

strong wind and no tremors the wind has usually been local, of short duration, or else blowing inland from the ocean. 5, When there has been little or no wind in Tokio, and yet tremors have been observed, in most cases there has been a strong wind in other parts of Central Japan. 6, From 75 to 80 per cent. of the tremors observed in Tokio may be accounted for on the supposition that they have been produced either by local or distant winds. 7, The only connection between earth tremors and earthquakes in Central Japan is that they are both more frequent about the same season.

(4). "Pressure and Temperature in Cyclones and Anticyclones," by Prof. H. A. Hazen. The author has made a comparison of the observations at Burlington and on the summit of Mount Washington, U.S.A., and as the result of a study of about 4,000 observations from two days before till two days after the passage of cyclone and anti-cyclone centres, he has arrived at the following conclusions:—1, In both cyclones and anticyclones the pressure lags from ten to eleven hours at the summit of Mount Washington. 2, The temperature change at the base precedes very slightly the pressure change, but at the summit the change occurs nearly twenty-four hours earlier. 3, The temperature appears to be a very little earlier at the summit than at the base, and certainly varies much more rapidly at the former. 4, In a cyclone the difference in temperature between base and summit is less than the mean before the storm, but the difference rapidly increases after the centre has passed. Just the contrary is true in an anticyclone. 5, The total fall in pressure in a cyclone at the summit very nearly equals that at the base, and likewise the rise in an anticyclone. 6, The fluctuation of temperature, that is from the highest to the lowest, at the summit is double that at the base in a cyclone, but it is only a little greater in an anticyclone.

ANOTHER QUEER EARTHQUAKE STORY.

We showed in our last that the reported earthquake of November 20th was not an earthquake shock, but the bursting of a bolide or meteor.

We have now tidings of another earthquake, but we are not prepared to vouch for its authenticity—we give the reports just as we have found them—but the writers' ideas of the transmission of earth tremors are very funny, especially the notion that a shock felt at Bolton at 6 a.m. took an hour to travel the twelve miles thence to Chorley and arrived there at 7 a.m.

EARTHQUAKE SHOCK IN LANCASHIRE.—On Thursday, December 1st, a slight shock of earthquake was felt in South-East and North-East Lancashire. It appeared to commence in the Bolton district, and was felt in the north end of the town about six in the morning, shaking crockery and slightly moving furniture. It then seemed to travel still further north, and was felt very severely at Chorley about seven o'clock, where the inhabitants were greatly alarmed, some rushing from their houses in their sleeping attire.

A Bolton correspondent, writing on Thursday, December 1st, says:—This morning, about six o'clock, a slight but unmistakable shock of earthquake was felt in Bolton and neighbourhood. It lasted for several seconds. Crockery was shaken, and in one case furniture was slightly moved. The disturbance seemed to be travelling in the direction of Preston, and this is borne out by reports from the Chorley district. No damage was done in the Bolton district.

Later accounts of the shock of earthquake at Chorley state that the earth tremor was of several seconds' duration, and appeared to move along a line from south-east to north-west. The shocks were accompanied by a peculiar rumbling sound something like the distant murmur of thunder. Several people who were in bed state that the room seemed to be moving round as if the building were about to collapse. Many people in Park-road and at Botany were so alarmed that they ran into the street in their night dresses, while in most of the houses the crockery rattled and in some the furniture was moved from its position. In two instances watches were thrown to the floor. Clocks were stopped, and the Town Hall chimes just before the hour of seven were noticed to chime erratically. Singular to say, persons in the street at the time did not feel the earth disturbance, but heard distinctly the accompanying rumbling sound.

WHITE FOG BOWS.

To the Editor of the Meteorological Magazine.

SIR,—From about 11 a.m. to 1 p.m. to-day there was visible a fine, colourless rainbow here, a phenomenon which I never before saw in my day, though now 46 years old. The reflection was also well marked with a dark band between. The sun was, of course, shining, but the sky where the bow appeared was thinly clouded; no rain fell. We had had a black frost last night, but a thaw set in about noon. The bow, when first observed, was about north, and moved round to north by east before it disappeared. The effect was very striking. It may interest you to know of it.

Yours truly, GEO. F. TRENCH.

Abbeylands, Ardfert, Co. Kerry, December 22nd, 1887.

[Another was seen by Prof. Tyndall, F.R.S., and thus described by him.—*Ed.*]

To the Editor of the Times.

SIR,—Twice, on the elevated moorland of Hind Head I have noticed a very beautiful phenomenon, sometimes named after the Spanish traveller Ulloa, who, I believe, first described it. Its comparative rarity may, perhaps, render a brief reference to it interesting to your readers. A few years ago, while walking in the morning near the edge of the "Devil's Punch Bowl," I found the air around me swarming with extremely minute aqueous particles; and it immediately occurred to me that they must exert some peculiar action on the solar light. Turning my back to the sun, I was startled and delighted by the appearance of a majestic white bow—it could not

be called a rainbow—which spanned the Punch Bowl from side to side. Yesterday morning, on walking out, I found myself surrounded by a host of similar aqueous particles, and, turning to the part of the sky in which a rainbow, if rain were falling, would be seen, a white bow, not quite so well defined as that above mentioned, but in all other respects similar, was observed.

Your obedient servant,

JOHN TYNDALL.

Hind Head, Haslemere, Jan. 10.

THE WEATHER AT CAMBRIDGE.

[It is the province of the Royal Meteorological Society, and of the Meteorological Council, rather than of a periodical, to deal with the general meteorology of England, but many years since Mr. Nutter sent us a table, so compact, that we printed it for that reason. As he has favoured us with another for the past three years, and as many of our readers may not have seen the previous one and may be glad of the pattern, we insert it below.—Ed.]

The Weather at Cambridge in 1885, 1886 and 1887.

	1885	1886	1887
Mean Temperature	46°·2	46°·4	45°·6
Hottest by Day	July 25 & 26	July 4 & 21	July 3
	78°	80°	80°
Coldest by Day.....	Dec. 10	Dec. 21	Jan. 1
	30°	29°	21°
Hottest by Night.....	July 26	Aug. 29	July 8 & 26
	61°	64°	62°
Coldest by Night ...	Dec. 10	Dec. 31	Jan. 1
	19°	16°	15°
Days on which the maximum was at or under 32°.....	6	13	9
Nights on which the minimum was at or under 32°.....	84	97	106
Mean of Barometer	29·85	29·82	29·94
Barometer highest	March 14	Feb. 8	Feb. 7
	30·50	30·60	30·62
Barometer lowest.....	Jan. 11	Dec. 8	Jan. 5
	28·70	28·10	28·79
Rainfall	24·36 in.	23·43 in.	15·35 in.
Rainy Days	168	168	162

J. NUTTER.

PAMPHLET EXCHANGE.

Copies of the following pamphlets can be had on application, provided the cost thereof be enclosed in the same cover. When all the copies have been distributed, the stamps (less postage) will be returned.

Author.	Title.	Price.
HANN, DR. J.	Bericht erstattet dem zweiten Internationalem Meteorologen-Congress ueber die Beobachtungen auf hohen Bergen und im Luftballon.....	2½d.
" "	Theorie des Psychrometers.....	2½d.
" "	Bemerkungen zur täglichen Oscillation des Barometers	2½d.
HELLMANN, DR. G.	Die täglichen Veränderungen der Temperatur der Atmosphäre in Norddeutschland.....	2½d.
" " "	Feuchtigkeit und Bewölkung auf der Iberischen Halbinsel	3½d.
" " "	Vorschläge an den Meteorologencongress.....	3d.
" " "	Der zweite internationale Meteorologencongress abgehalten zu Rom im April, 1879	2½d.
" " "	Ueber den jährlichen Gang der Temperatur in Norddeutschland.....	3d.
" " "	Ueber gewisse Gesetzmässigkeiten im Wechsel der Witterung aufeinanderfolgender Jahreszeiten.....	2½d.
" " "	Klima des Brocken.....	2½d.
JELINEK, DR. C.	Ueber die Reduction der Kappeller'schen sogenannten Stations-Barometer, d.h. Gefäss-Barometer mit unbeweglichem Boden	2½d.
ROTCH, A. L.	The Blue Hill Meteorological Observatory; an Account of its Foundation and Work	2½d.
" "	Results of Observations at the Blue Hill Meteorological Observatory in 1886	3d.
SCOTT, R. H.	Notes on the Reports of Wind Force and Velocity during the Tay Bridge Storm, December 28th, 1879.....	2½d.
" "	On a Series of Barometrical Disturbances which passed over Europe between the 27th and the 31st of August, 1883	2½d.
" "	On the History of Thermometers	2½d.
" "	Climatology of the Sea.....	2½d.
WALLIS, H. SOWERBY	The Snow Storm of January 18th and 19th, 1881	3d.

G. J. SYMONS.

62, Camden Square, N.W.

STORM REPORTS.

The Hydrographic Office of the United States calls special attention to a new form for reports of storms, fog, ice, and derelicts, issued for the use of trans-Atlantic steamers. This form replaces those hitherto issued by that Office and by the Signal Service, and the information thus collected is immediately utilised in preparing the telegrams sent daily to France by the United States Signal Service for the benefit of westward-bound vessels. Captains of trans-Atlantic steamships are requested, in the interest of navigation, to send in prompt and complete reports. No doubt British shipowners will instruct their officers to co-operate in this enterprising experiment, as this country has at least equal interest with others in the safety of Atlantic navigation.—*Nature*.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1887.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days	Cloud.
	Temp.	Date.	Temp.	Date.									
England, London	85·3	15	43·0	27	73·8	51·3	51·0	70	130·4	38·2	·91	3	4·6
Malta.....	92·3	2	60·2	9	82·6	66·3	63·1	70	144·7	53·7	·09	2	1·8
<i>Cape of Good Hope</i> ...	79·8	26	34·9	17	66·8	47·0	...	87	...	...	2·78	8	4·4
<i>Mauritius</i>	76·0	3a	58·2	11	73·9	64·0	59·1	72	124·4	47·8	1·68	12	4·6
Calcutta.....	94·0	7	72·6	6	89·8	78·5	77·6	76	159·5	69·6	6·45	16	7·6
Bombay.....	91·2	4	73·9	11c	85·2	77·6	75·9	83	147·6	70·7	24·07	23	8·4
Ceylon, Colombo	85·9	14	72·8	1	84·2	75·1	69·4	75	150·2	68·0	6·58	23	7·7
<i>Melbourne</i>	65·0	1	33·0	27	53·9	43·4	45·5	87	112·9	27·0	3·04	19	7·3
<i>Adelaide</i>	67·3	1	39·2	19	58·3	46·2	45·5	78	119·6	31·0	6·02	25	6·8
<i>Wellington</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Auckland</i>	64·5	20	39·0	29b	59·9	49·4	48·0	79	115·0	27·0	6·32	25	7·0
<i>Falkland Isles</i>.....	...	...	17·0	7	...	30·9	32·9	93	91·1	18·7	3·89	25	7·4
Jamaica, Kingston.....	92·1	2	68·4	6	88·5	73·0	71·2	71	...	...	4·82	...	...
Barbados	85·0	30	70·0	var.	82·0	72·0	71·9	83	143·0	...	7·53	18	7·0
Toronto	89·5	16	47·4	25	72·9	54·0	56·3	77	...	43·0	2·65	11	5·9
New Brunswick, Fredericton	91·7	30	36·0	5	72·7	48·6	52·6	67	...	...	5·10	16	4·9
Manitoba, Winnipeg	88·0	14	33·3	23	77·4	51·5	56·2	74	...	...	2·94	12	5·0
British Columbia, Victoria	86·0	21	36·0	2	65·3	45·1	...	...	...	..	·48	7	...

a And 4, 5. b And 30. c And 12.

REMARKS, JUNE, 1887.

MALTA.—Mean temp. 73°·4. Mean hourly velocity of wind 6·7 miles. Sea temp. rose from 70°·5 to 79° 5. L on 28th. J. SCOLES.

Mauritius.—Mean temp. of air 1°·1, of dew point 1°·3, and rainfall ·33 in. below average; mean pressure 30·169 in., slightly above average; mean hourly velocity of wind 10·7 miles, 0·9 mile below average; extremes 30·3 miles on 12th, and 2·5 miles on 11th; prevailing direction S.E. by E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·2, and pressure ·119 in. below average; mean temp. of dew point 2°·2, humidity 7, amount of cloud 0·7, and rainfall 1·10 in. above average. Prevailing wind N.; strong on 7 days. Hoar frost on 20th and 27th. Ice on 27th. Dense fog on 7 days. R. L. J. ELLERY, F.R.S.

Adelaide.—The wettest June since the commencement of the Observatory records, the rainfall being more than double the average and nearly an inch in excess of any previous record. Pressure 30·051 in., ·082 in. below average, the lowest mean pressure for June since 1875. Mean temp. 1·2 below average. C. TODD.

AUCKLAND.—An exceedingly wet and stormy month, the rainfall being fully two inches above the average. Mean temp. above the average, pressure much below it. T. F. CHEESEMAN.

KINGSTON.—Rainfall 1·50 in. above average. At Boston, 13·50 in. of R fell in 24 hours on the 5th, 8 inches falling in 4 hours. MAXWELL HALL.

BARBADOS.—Pressure pretty steady. Mean temp. (76°·2) same as 30 years' average, wind velocity equal to 15 years' average. Rainfall considerably above average. TSS on 6th and 23rd. Eight days were overcast. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
DECEMBER, 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	1·97	XI.	Castle Malgwyn	4·02
„	Margate, Birchington...	2·03	„	Rhayader, Nantgwillt..	6·68
„	Littlehampton	2·43	„	Carno, Tybrith	5·55
„	Hailsham	2·53	„	Corwen, Rhug	3·75
„	Ryde, Thornbrough	2·58	„	Port Madoc	4·85
„	Alton, Ashdell.....	2·45	„	I. of Man, Douglas	3·18
III.	Oxford, Magdalen Col...	1·37	XII.	Stoneykirk, ArdwellHo.	3·44
„	Banbury, Bloxham	1·90	„	New Galloway, Glenlee	7·13
„	Northampton	1·32	„	Melrose, Abbey Gate...	2·16
„	Cambridge, Beech Ho...	1·04	XIII.	N. Esk Res. [Penicuick]	2·50
„	Wisbech, Bank House..	·91	XIV.	Ballantrae, Glendrisaig	4·13
IV.	Southend	1·38	„	Glasgow, Queen's Park.	2·66
„	Harlow, Sheering	1·17	XV.	Islay, Gruinart School..	4·14
„	Rendlesham Hall	1·24	XVI.	St. Andrews, PilmourCot	1·59
„	Diss	1·37	„	Balquhiddel, Stronvar..	6·17
„	Swaffham	1·43	„	Dunkeld, Inver Braan..	...
V.	Salisbury, Alderbury ...	1·83	„	Dalnaspidal H.R.S. ...	4·32
„	Warminster	2·52	XVII.	Keith H.R.S.	2·74
„	Ashburton, Holne Vic..	6·99	„	Forres H.R.S.	1·98
„	Holsworthy, Clawton...	...	XVIII.	Strome Ferry H.R.S....	6·73
„	Hatherleigh, Winsford.	3·10	„	Tain, Springfield.....	...
„	Lynmouth, Glenthorne.	4·44	„	Loch Shiel, Glenaladale	11·08
„	Probus, Lamellyn	4·02	„	S. Uist, Ardkenneth ...	...
„	Wincanton,StowellRec.	2·81	„	Invergarry	3·95
„	Taunton, Lydeard Ho ...	2·79	XIX.	Laig H.R.S.	4·69
„	Wells, Westbury.....	2·78	„	Forsinard H.R.S.	3·69
VI.	Bristol, Clifton	2·41	„	Watten H.R.S.	3·11
„	Ross	2·00	XX.	Dunmanway,Coolkelure	7·16
„	Wem, Clive Vicarage ...	2·17	„	Fermoy, Gas Works ...	3·12
„	Cheadle, The Heath Ho.	2·13	„	Tipperary, Henry Street	3·41
„	Worcester, Diglis Lock	1·77	„	Newcastle West .....	...
„	Coventry, Coundon	1·95	„	Miltown Malbay.....	4·46
VII.	Melton, Coston	1·23	XXI.	Gorey, Courtown House	2·56
„	Ketton Hall [Stamford]	1·12	„	Navan, Balrath	1·35
„	Horncastle, Bucknall ...	1·28	„	Mullingar, Belvedere...	2·45
„	Mansfield, St. John's St.	2·06	„	Athlone, Twyford	2·57
VIII.	Macclesfield, The Park.	...	„	Longford, Currygrane...	2·61
„	Walton-on-the-Hill.....	2·40	XXII.	Galway, Queen's Coll...	3·33
„	Lancaster, South Road.	2·94	„	Clifden, Kylesmore	6·44
„	Broughton-in-Furness..	4·80	„	Crossmolina, Enniscoe..	5·80
IX.	Wakefield, Stanley Vic.	1·04	„	Collooney, Markree Obs.	4·67
„	Ripon, Mickley	2·47	XXIII.	Rockcorry	2·84
„	Scarborough, West Bank	2·14	„	Warrenpoint	2·90
„	EastLayton[Darlington]	1·74	„	Newtownards .....	...
„	Middleton, Mickleton..	2·43	„	Belfast, New Barnsley..	2·85
X.	Haltwhistle, Unthank..	3·36	„	Cushendun	4·51
„	Shap, Copy Hill	5·43	„	Bushmills	3·63
XI.	Llanfrechfa Grange	3·26	„	Stewartstown	3·14
„	Llandoverly	4·62	„	Buncrana	4·85

DECEMBER, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Difference from average. 1870-9	Greatest Fall in 24 hours.		Days on which .01 or more fell.	Max.		Min.		In shade.	On grass.
				Dpth	Date.		Deg.	Date	Deg.	Date		
		inches.	inches.	in.								
I.	London (Camden Square) ...	1.38	— .79	.30	14	13	53.8	8	24.3	27	16	24
II.	Maidstone (Hunton Court)...	1.93	— .47	.42	14	19	...	...	...	...	...	...
III.	Strathfield Turgiss	1.47	— .55	.32	8	14	53.8	8	19.9	29	18	27
IV.	Hitchin	1.23	— .82	.21	8	19	52.0	8	19.0	28	25	...
V.	Winslow (Addington)	1.25	— .86	.24	8	19	52.0	2,8b	17.0	29	22	27
VI.	Bury St. Edmunds (Culford) .....	...	...	...	...	...	...	...	...	...	...	...
VII.	Norwich (Cossey)	1.09	— 1.23	.35	21	...	...	...	...	...	...	...
VIII.	Weymouth(LangtonHerring)	2.69	...	.73	12	16	51.0	8,13	23.0	13	15	...
IX.	Barnstaple	3.74	— .02	.69	7	16	53.5	5	...	...	...	...
X.	Bodmin	3.78	— 1.67	.53	12	20	52.0	13	20.0	28	12	14
XI.	Stroud (Upfield)	1.88	— .55	.24	19	17	51.0	13b	20.0	28	...	...
XII.	ChurchStretton(Woolstaston)	2.93	+ .50	.75	14	21	51.0	8	23.0	27	20	27
XIII.	Tenbury (Orleton)	2.43	+ .14	.36	14	20	55.0	8	20.5	29	18	22
XIV.	Leicester	1.37	...	.24	12	18	54.0	9	23.2	20	15	...
XV.	Boston .....	.71	— 1.36	.21	12	11	52.0	8	19.0	27	21	...
XVI.	Hesley Hall [Tickhill].....	.92	...	.23	6	14	52.0	3	22.0	12	18	...
XVII.	Manchester (Ardwick).....	2.30	— .23	.39	6,18	16	49.0	1,13	25.0	27	19	...
XVIII.	Wetherby (Ribston Hall) ...	1.62	— .59	.42	14	13	...	...	...	...	...	...
XIX.	Skipton (Arneliffe)	5.33	+ .05	.76	8	19	49.0	4,13	20.0	11	...	...
XX.	Hull (Beverley Road) .....	...	...	...	...	...	...	...	...	...	...	...
XXI.	North Shields	3.50	+ .41	.54	21	23	53.0	3	22.0	22	21	23
XXII.	Borrowdale (Seathwaite).....	1.58	— 2.15	1.97	7	25	...	...	...	...	...	...
XXIII.	Corkdiff (Ely)	3.49	— .42	.62	12	18	...	...	...	...	...	...
XXIV.	Haverfordwest	4.70	— .43	.66	5	23	53.0	8	22.5	27	15	20
XXV.	Plinlimmon (Cwmsymlog) ...	4.44	...	.62	8	14	...	...	...	...	...	...
XXVI.	Llandudno	2.92	+ .07	.42	13	19	54.8	13	26.4	29	5	...
XXVII.	Cargen [Dumfries]	5.76	+ 1.23	1.16	6	17	50.4	1	19.2	22	16	...
XXVIII.	Jedburgh (Sunnyside).....	2.27	— .18	.36	23	13	54.0	2	13.0	13c	19	...
XXIX.	Old Cumnook	4.65	+ .77	.85	6	20	50.0	3	13.0	21	...	...
XXX.	Lochgilthead (Kilmory)	6.23	+ .05	.98	16	19	...	...	...	...	...	...
XXXI.	Oban (Craigvarren)	6.07	...	.78	5	20	52.8	1	25.0	22	12	...
XXXII.	Mull (Quinish)	6.16	...	.69	15	22	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	1.60	— 2.06	.50	9	6	...	...	...	...	...	...
XXXIV.	Arbroath	1.64	— 1.26	.40	8	9	52.0	3	23.0	31	17	...
XXXV.	Braemar	2.35	— 1.08	.38	20	17	50.0	3	8.5	22	25	28
XXXVI.	Aberdeen	3.20	...	.46	8	21	54.0	1,3	22.0	21d	19	...
XXXVII.	Lochbroom	5.39	...	1.12	3	25	...	...	...	...	...	...
XXXVIII.	Culloden	1.35	— .49	...	...	...	54.0	3	20.0	11	16	23
XXXIX.	Dunrobin	4.20	...	1.18	19	15	56.5	3	20.0	11	20	...
XL.	Kirkwall (Swanbister).....	4.39	...	.50	6	29	50.6	2	22.5	8	13	...
XLI.	Cork (Blackrock).....	3.27	— 1.49	.76	12	20	54.0	8	23.0	27	17	...
XLII.	Dromore Castle	6.30	...	1.25	7	18	55.0	1	28.0	29	...	...
XLIII.	Waterford (Brook Lodge) ...	2.58	...	.54	12	18	55.0	8	24.0	22	14	...
XLIV.	O'Briensbridge (Ross)	3.45	...	.57	15	17	52.0	1	23.0	28	11	...
XLV.	Carlow (Browne's Hill)	2.14	— 1.37	.30	5	18	...	...	...	...	...	...
XLVI.	Dublin (FitzWilliam Square)	1.22	— 1.36	.24	15	19	55.1	3	25.1	22	7	26
XLVII.	Ballinasloe	2.72	— .76	.40	5	21	48.0	3	22.0	28	21	...
XLVIII.	Waringstown	1.98	— .98	.30	8	20	52.0	1,3	19.0	21	21	23
XLIX.	Londonderry (Creggan Res.)..	4.51	...	.58	6	25	...	...	...	...	...	...
L.	Omagh (Edenfel)	3.42	+ .02	.52	15	23	51.0	3	23.0	11	20	...

a And 14. b And 16. c And 14. d And 22.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON DECEMBER, 1887.

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

ENGLAND.

STRATHFIELD TURGISS.—A fine winter month, without S, but with low temperature about the 11th and the 29th. L on 17th. TS on 18th.

ADDINGTON.—A fine month. Although E fell on a good many days, it was generally in small quantities, so that the land, for the time of year, was very firm and dry. A little S fell on 19th, and again on 27th. Sharp frost on 29th, the min. temp. on grass being 12°. Dense fog on 31st.

LANGTON HERRING.—Rainfall '54 in. below the average of 12 years, the total for the year being as much as 9'21 in. below that average. The weather till the 18th was very mild, unsettled and wet, but from the 19th to the close it was cold and dry. Mean temp. at 9 a.m., 1°'6 below average. The mean temp. for the year (48°'3) was 1°'9 below average, and the lowest in 16 years, with the exception of 1879, when it was 47°'3. Temp. fell to, or below, 32° on each of the last 13 days. A few flakes of S fell on 28th, but there was none to cover the ground.

WOOLSTASTON.—A cold month, with much frost. Mean temp. 36°'1. S on 6th, 18th, and 19th.

ORLETON.—The first three days were dry and warm for the season. The weather was then very unsettled, with E almost every day, and temperature variable, but above the average till the 16th, when it became cold and frosty, and the temperature for the remainder of the month was more than 4° below the average. The mean temp. was more than 1° below the average of 26 years. Rain was frequent, although it did not amount to the average for the month. Pressure was generally steady, but lower than the average. A little S fell on the 7th, 18th, and 19th, and remained on the hills for a few days.

MANCHESTER.—Not a very wintry month, although there was some skating, and on two or three occasions towards the close S gave a wintry appearance for a few days. T on 6th, fog on 22nd, 23rd, and 29th, S on 6 days.

WALES.

HAVERFORDWEST.—A very wet month, with scarcely a dry day till near the end, when a very cold period set in. There were many sharp night frosts throughout. Mean temp. rather below the average. Very stormy, with T, L, and H, about the 14th. The Precelly hills were white with S on the 20th.

SCOTLAND.

CARGEN.—The month was remarkable for sudden fluctuations of pressure and temperature, the pressure on several occasions varying from 6 to 8 tenths of an inch, and the temperature from 20° to 25° in 24 hours. Frost at night occurred frequently, but generally it did not continue during the day. A severe S storm occurred on the 7th, the S being 8 inches deep. S fell also on the 18th. Thirty-nine hours of sunshine were recorded, 20 hours below the average.

JEDBURGH.—The weather, on the whole, was marked by variableness, often changing several times a day; out-door work, however, was but little retarded. High winds prevailed at the beginning of the month. S fell on 4th, 6th, 18th, 19th, and 21st, but had almost disappeared at the close. The river Jed was frozen over on the 11th.

OBAN.—A very changeable month, stormy at the commencement; mean temp. high. H on 4th and 7th. Lunar rainbows on 21st and 27th. Gales on 7 days.

ABERDEEN.—Rainfall slightly below the average. S on 9th, 18th, 19th, and 21st. Aurora on 6th.

LOCHROOM.—A very stormy month, as wintry as any remembered, with only six fair days.

CULLODEN.—Not a severe month. Out-door work was carried on without any interruption. Little S fell.

SWANBISTER.—Weather variable—raining, freezing, and thawing alternately. H and sleet on 7th, gale on 9th, aurora on 7th, 13th, and 16th.

IRELAND.

BLACKROCK.—With the exception of a few fine days, the month was damp, raw, and cold, and often misty, with a slight fall of S, and T and L at night on the 5th.

WATERFORD.—Snow on the Comeragh mountains on 18th. H on 13th ; S on 6th and 26th.

O'BRIENSBRIDGE.—Ordinary winter weather, with frequent heavy showers and an occasional gale, marked December up to 18th. Dry, fine weather prevailed from that date to the close, with low temperature and steady pressure.

DUBLIN.—A damp and chilly month. In the earlier part both pressure and temp. were very unsteady. After the 16th temp. remained constantly low, never rising above 44°·3 in shade, and falling on the 22nd to 18° on grass. During this cold period the sky was sometimes densely overcast, indeed, after the 27th, the sun was scarcely seen. The mean temp. (39°·9) was again decidedly below the average (41°·3). T on 18th, faint aurora on 16th, H on 17th, 20th and 27th, S or sleet on 6 days, fog on 7 days, gales on 2 days. Mean humidity 86 ; mean amount of cloud 5·9.

EDENFEL.—Dark, wet and gloomy, with cold fogs. and daily alternating frosts and thaws. S on 6th and 20th.

A GARDEN BAROMETER.

One of the simplest of barometers is a spider's web. When there is a prospect of rain or wind, the spider shortens the filaments from which its web is suspended, and leaves things in this state as long as the weather is variable. If the spider elongates its threads it is a sign of fine calm weather, the duration of which may be judged of by the length to which the threads are let out. If the spider remains inactive, it is a sign of rain ; but if, on the contrary, it keeps at work during the rain, the latter will not last long, and will be followed by fine weather. Other observations have taught that the spider makes changes in its web every twenty-four hours, and that if such changes are made in the evening, just before sunset, the night will be clear and beautiful.—*La Nature*.