SYMONS'S

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METEOROLOGICAL BIBLIOGRAPHY.

READERS of this Magazine must be fully aware of the importance which I have always attributed to the subject of Meteorological Bibliography, and they will, I believe, share my pleasure in feeling that at last one—nay, more than one—important advance has been made.

I am always reluctant to occupy space in these pages with reference to matters in which I am personally concerned, and with papers by myself which will be printed elsewhere. On the present occasion I do not see how to avoid transgressing in both respects, for it would be sheer affectation to re-write what I have elsewhere expressed as clearly as I could, and, therefore, without further preface, I insert a paragraph from the Presidential Address which I read to the Meteorological Society on January 18th :—

"Another obstacle to meteorological progress, and a great cause of wasted labour, has been the difficulty of ascertaining what has been done in, and what has been written upon, each of the various branches of meteorology. I could give, but I will not weary you, details of many experiments and investigations tried over and over again, each new investigator fancying that it had never been tried before, This is one of the leading arguments in behalf of meteorological bibliography, a subject which has received the approval of nearly all meteorologists, notably at some of the International Congresses, yet towards which little has been contributed except the catalogue of our own library, the value of which has been recognised wherever the subject has been discussed. Our recently-published Index will doubtless be accepted as another very useful publication.

"It is generally known that Prof. Cleveland Abbe, of Washington, U.S.A., extracted from the splendid *Catalogue of Scientific Papers*, published by our Royal Society, all the titles of papers bearing upon meteorology. For nearly twenty years I have myself been forming a bibliography of works upon Astronomy, Meteorology, and Terrestrial Magnetism, and that catalogue which now fills thirty-four volumes, has always been at the disposal of any one who would undertake to complete it and print it. Strong interest in it has

often been expressed, but the cost of printing was always regarded as prohibitory; and although I have more than once expressed my desire that our own country should have the credit of doing it, nothing has been proposed, far less arranged.

"Life slips away from all of us, and I began to fear lest the bibliography which has cost me considerable labour should be left a mere mass of MS. A few months since, Prof. Abbe wrote for some details respecting the scope of my work, and in my reply I expressed a strong desire to see his catalogue and my own united and published. This letter was, I believe, laid before the Regents of the Smithsonian Institution; at any rate mine and one from the Smithsonian Institution were laid before General Hazen, the Chief Signal Officer of the United States, and, therefore, Director of the Government Meteorological Office, with the result that that department has undertaken to repay all the expenditure which I may incur for copyists, and the entire cost of editing and printing, in America, a catalogue embracing every work, either in that formed by Prof. Cleveland Abbe, or in my own. The execution of my share of the task will involve the gratuitous devotion of many hundred hours to it; but far from begrudging them, I rejoice at the prospect of, as I believe, usefully employing them, and I trust that when all is ended, the United States Government will receive those hearty thanks from all meteorologists which its liberality will in my opinion merit."

Readers of these pages will remember how repeatedly I have urged the Directors of all Meteorological Institutes to follow the example of our own Government Office, and print complete lists of all their publications. Hitherto my appeals have seemed to be in vain, and if, when the United States Bibliography comes out, some of my friends find the lists of their works imperfect, they will know to whom to attribute the omission. For myself, and I believe I may speak also for Gen. Hazen, my desire is to spare no effort in rendering the work as full and as accurate as possible.

Sweden, I am glad to say, has set an example which, if *very promptly* followed by other countries, would be of extreme utility. Dr. Hildebrandsson requested one of his assistants, M. C. G. Fineman, to compile an "index" to the meteorological publications from Sweden during the last 25 years. The work has been done, the "index" is published,* and if not absolutely perfect, is at any rate far better than any which any foreigner could have compiled.

Dr. Hildebrandsson, in a letter which he has been good enough to send me upon the subject, remarks that he limited the Index to the last 25 years, because the development of modern meteorology falls wholly within that period, and because it is much more easy to compile such an Index for recent, than for earlier, years. Dr. Hildebrandsson says that, as soon as time can be spared, the period

* "*Förteckning på Svenska arbeten och uppsatser i Meteorologi.*" Publicerade 1856–1881. Upprättad af C. G. Fineman.

before 1856 shall be taken in hand; but he concludes by advising a similar division of the work for other countries, viz., first the preparation of a catalogue of works published within 25 years and then another for earlier dates. There are some reasons in favour of adopting this course, and perhaps the strongest of them is the respect due to the proposer; but considering that it would involve the cutting in halves of the whole of Professor Cleveland Abbe's classification, the lists of the works of many authors, *e.g.*, of Dove's, of Jelinek's, &c., that it would involve the division of the whole of my own catalogue, and would result in the postponement, probably for some years, of the publication of much which would, I think, be generally useful, my present opinion is adverse to any chronological separation.

Gen. Hazen, in a recent letter, most modestly remarks—"These two combined catalogues can make no pretension to being a complete bibliography of meteorological literature, yet they will, I hope, be acceptable as a working index and a first contribution towards the exhaustive work that is desired." With this view of the case I thoroughly agree, but as my own catalogue has to be copied on cards for mixture with Professor Abbe's, a few hundred, or even a few thousand, extra titles would, I am sure, be welcomed by Gen. Hazen, as every one of them would add to the utility of the forthcoming volume.

I therefore conclude by inviting authors, directors of Meteorological Institutes, and all others who may be willing to help, to send—

(1). Complete lists of Meteorological works published by them. If these are sent in MS., extremely legible (unmistakable) writing is indispensable; but, of course, printing is preferable.

(2). Copies of the papers or books. If any instructions as to the disposal of the works are sent, they shall be obeyed; if none are sent, the books will be added to my own library if a copy is not already there, or they will be distributed among the libraries of The Meteorological Society, The United States Signal Office, The Meteorological Office, The Société Météorologique de France, and The Scottish Meteorological Society.

I must, however, once more insist upon promptitude, for I cannot promise to get cards written from any list or book unless it reach me before May 1st.

G. J. SYMONS.

62, *Camden Square, N. W., Feb.* 13*th.*

THE METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on Wednesday evening, the 18th inst., at the Institution of Civil Engineers, Mr. G. J. Symons, F.R.S., President, in the chair.

The Secretary read the report of the Council for the past year, which shewed the Society to be in a very flourishing condition, for while in 1871 the Society continued its work without an office, accessible library, or an Assistant Secretary, and the number of the Fellows was 314, the staff, at present very fully employed, consists of an Assistant Secretary and three computers, with 555 Fellows on the roll. The receipts and expenditure in 1871 shew a marked contrast to the year just past; the receipts amounted to only £244, against more than £840 in 1881. The expenditure was only £197 against £780 in 1881. The Society also now receives Second Order and Climatological Observations from 83 stations, the results of which are published quarterly in the "Meteorological Record." In addition to the "Quarterly Journal," two publications have been prepared and issued under the direction of the Council, viz. :– "Hints to Meteorological Observers, with Instructions for taking Observations, and Tables for their Reduction," and "Index to the Publications of the English Meteorological Societies, 1839 to 1881."

The President (Mr. Symons) then delivered his address, which was devoted to the consideration of the present state and future prospects of Meteorology. He began by asking in what respects is our present system of observation capable of improvement? Should it be extended, either as regards distribution of stations, additional instruments, or additional hours of observation? Can any of the millions of entries at present made annually, be safely dispensed with? These questions can only be properly answered after considering two others—What observations are being made? and for what object? After referring to the different patterns of barometers, and the number of observations made, Mr. Symons said that he was aware there were several grounds upon which the maintenance of numbers of stations in excess of all possible requirements can be defended. In the first place, there is the constant difficulty which arises from the removals and deaths of the observers, and from the extension of buildings and growth of trees, &c. This renders it necessary that we should have two or three stations wherever we desire to make sure of a continuous record. But a far better and more scientific plan would be to choose a few unexceptionable localities remote from towns, purchase the freehold of a few surrounding acres, erect thereon stations identical in design and in every respect, and endow them with moderate funds, so that the observations may, humanly speaking, be established on an unalterable basis. That would be the way to detect secular changes. For climatic purposes the numerous climatological stations started by the Society are of great value. After speaking of hygrometers, anemometers, and

ozonometers, the President referred to daily maps of Atlantic weather, which should be on a scale of not less than 1 inch for 300 miles. The compilation of such charts is essentially national work, and falls wholly within the domain of the Government office. After referring to Weather Forecasts, the lack of original workers in discussing meteorological observations, the absence of academical encouragement, and the little prospect of those who devote themselves to meteorology obtaining more than a bare livelihood, the President concluded as follows:—"It is quite possible that the severe manner in which I have criticised a few of our existing arrangements, may have lead someone to consider that meteorology is languishing, feeble, or even moribund. I believe that the very contrary is the fact; when a case is weak, one hesitates to point out its weaknesses, for fear of a total collapse. No; the Meteorological Society never advanced so rapidly in numbers as it has in the two last years, and if it will but apply the pruning knife to fruitless observations, and try to secure the application of more brain power to the many problems yet unsolved, it will continue to receive an ever increasing amount of recognition and support, and to maintain that high position among kindred societies which it at present holds."

The following gentlemen were elected Officers and Council for the ensuing year:—

President.—John Knox Laughton, M.A., F.R.A.S., F.R.G.S.

Vice-Presidents.—William Ellis, F.R A S.; Rogers Field, B.A., M.Inst.C.E.; Joseph Henry Gilbert, Ph.D., F.R.S., F.C.S.; Baldwin Latham, M.Inst.C.E., F.G.S.

Treasurer.—Henry Perigal, F.R.A.S.

Trustees.—Hon. Francis Albert Rollo Russell, M.A.; Stephen William Silver, F.R.G.S.

Secretaries.—George James Symons, F.R.S.; John William Tripe, M.D., M.R.C.P.E., V.P. Soc. Anal.

Foreign Secretary.—Robert Henry Scott, M.A., F.R.S., F.G.S.

Council.—Edmund Douglas Archibald, M.A.; Arthur Brewin, F.R.A.S. John Sandford Dyason, F.R.G.S.; Edward Ernest Dymond; Henry Storks Eaton, M.A.; Charles Harding; Robert John Lecky, F.R.A.S.; William Marcet, M.D., F.R.S., F.C.S.; Edward Mawley, F.R.H.S.; Richard Strachan; George Mathews Whipple, B.Sc., F.R.A.S.; Charles Theodore Williams, M.A., M.D., F.R.C.P.

THE GALE OF OCTOBER 14TH, 1881.

EXTENSIVE PURCHASE OF BRITISH TIMBER.—Serious havoc was committed in the policies and woods of Dunse Castle by the gale of the 14th October, thousands of trees having been uprooted. In the avenue and parks around the castle sixty fine old trees—many of them of large dimensions—have been replanted. The remainder of the fallen timber (estimated at over 50,000 trees) has been sold to Messrs. Brownlie, Earlston, who engage to remove it within four years. The purchasers are to be allowed to erect saw-mills on the estate to cut up the wood.—*Timber Trades' Journal.*

REVIEW.

The Water Supply of England and Wales; its Geology, Underground Circulation, Surface Distribution, and Statistics. By C. E. DE RANCE, Ass. Inst. C.E., F.G.S., &c. 8vo., x.-623 pages and 6 maps. London: Stanford. 1882.

THIS book reminds us of a temporary fit of idleness in which we lately indulged. We had occasion to look for a word in Ferrall and Repp's *Danish-English Dictionary*, and instead of doing so began to read the Preface. Such a caustic *exposé* of book-making and literary dishonesty as forms that Preface we never read. At first sight, this remark may appear uncomplimentary to Mr. De Rance; but when we have gone into a little history, it will be found that he need by no means dread such a criticism as that in the Danish Dictionary. As a general rule, Mr. De Rance makes ample recognition for every quotation, and he gives an Index of authorities cited, which fills three pages with double columns. Four years ago the late Professor Ansted brought out a book almost identical in size, in subject, and in treatment with that now before us. Professor Ansted's was entitled, "*Water and Water Supply, chiefly in reference to the British Islands*—SURFACE WATERS." We are not going to wander off into a review of this earlier work, but mentior it rather as an illustration of, perhaps unconscious, literary lynch law. Professor Ansted's book was apparently chiefly compiled from the Ordnance Maps—whole pages of text are merely descriptive of what one would learn far more readily by looking at the Map. Peterman's Hydrographic Map, cut up into watersheds and very badly re-engraved, seems to have afforded the illustrations, and with a few other sources, supplied the bulk of the matter. Not one of these quotations was acknowledged. A very able reviewer of that work, after complaining bitterly of "the almost invariable absence of citation of authority," wrote as follows:—

"For the lecturer, who expects to be listened to as speaking with academical authority, or for the merely popular writer, exact citation of authority may be to some extent considered as a matter of taste or of honesty. But for the serious writer, for the man who would produce a standard work on any scientific or historic subject, clear, full, and accurate, citation of authority is essential."

Moreover, the very plan upon which the data in Professor Ansted's book were arranged, was almost identical with one laid laid down by Mr. F. R. Conder, in a paper which he read before the Society of Arts, and yet Mr. Conder's name is not mentioned on one of the 580 pages of Professor Ansted's book.

Mr. De Rance has been taken to task for not mentioning Professor Ansted's work, but (1) we doubt whether he has taken a single statement from it; (2) considering the mass of information given in the later work, we think it probable that much of it was written before the earlier one was printed; and (3) the quotations which we have given

indicate that if any one deserved to suffer from scant acknowledgment it was the author of "Water and Water Supply."

This rather long note is by no means intended to apply specially to the work before us. We have said that, as a general rule, Mr. De Rance makes ample recognition, but we find that appropriation without acknowledgment is increasing, and think that a lesson in a "matter of taste or of honesty" is needed.

The first two chapters are devoted to "Rainfall and Percolation of Rainfall" and to "Composition of Water," the following thirty-two chapters treat of rivers and groups of rivers, and the last chapter takes up the difficult subject of the propagation of epidemics by potable water.

The book is crammed with information topographical, geological, and statistical; consequently it is not by any means an agreeable book to sit down and read through. On the other hand, it contains a mass of information which can be found combined in no other book, and much of which is entirely new and based on the wide experience of the author, who, we may remind our readers, has special qualifications for the task he has undertaken, (1) in that he is on the staff of the Geological Survey, and (2) in that he has been, from its formation, Secretary to the British Association Committee on Underground Water.

By cross references, by excellent maps, and by no fewer than three separate Indexes, Mr. De Rance affords great help to those who desire to extract all the information on some given point. But a fourth or general Index would have been useful, for scattered about the book, in all sorts of unexpected places, are little gems of information which nothing but systematic reading through the book would bring to light.

In a work like this, containing thousands of figures and hundreds, if not thousands, of proper names, misprints are unavoidable. We are glad to see that the author has had the industry and the courage to track a few and quote them as errata—a practice far too rarely followed. We are glad to be unable to add to the list except the following very trifling items:—On page 9, Gaspain should be Gasparin; on page 12 (last line of note), 32·50 should be 22·50; and on page 129, Austy should probably be Ansty.

As a general rule the language is extremely clear, but sometimes the author, like everybody else, nods—only one should not nod in print. Here is an illustration, our notes are in italics:—

"In this classification I am inclined to think that the term 'Waterstones' does not include the compact Lower Keuper building stone and grit, which was evidently classified with the Bunter Beds beneath in the papers (*but the Beds were not in the papers*) by Mr. Ormerod and others of the period (*What period? Surely Mr. Ormerod did not belong to the period of the formation of the Lower Keupers*). This restricted use of the term 'Waterstones' is one which it is of importance to maintain, as they, probably, and not the building

stones beneath it, (? *them*) are the equivalent of the typical Waterstones of Warwickshire."

Putting aside trifles, we accept this work as a useful contribution towards the, at present, miserably scanty literature of British Hydrology.

BAROMETRIC AND THERMOMETRIC EXTREMES IN JANUARY, 1882.

THE past month will probably, for many years to come, be regarded with considerable interest, as being remarkable

(1). For the barometric maximum on the 18th.
(2). For high mean atmospheric pressure.

As regards the first and most exceptional feature, we purpose saying little, because duplicate work is generally waste of time, and, therefore, understanding that Mr. H. Sowerby Wallis was preparing a paper upon the subject for the Meteorological Society, we handed to him all the information bearing upon it which we received, a course which we doubt not, will meet with the approval of our correspondents.

We may, however, state that according to letters published in *The Times*, the sea level pressure indicated by the observations at Camden Square between 1857 and 1881 exceeded 30·7 on only five occasions, viz.:—

1859.	January 9.....	11.40 p.m.	... 30·830 in.
1865.	December 15...	9.0 p.m.	... 30·782 in.
1867.	March 2.....	9.0 a.m.	... 30·788 in.
1873.	February 18 ...	11.0 a.m.	... 30·826 in.
1879.	December 23...	10.0 a.m.	... 30·793 in.

Mr. Symons quoted also the three following instances of very high pressures in or near London as the only ones which he could find fairly comparable with that of Jan. 18th, 1882, viz.:—

London (on the authority of Sir G. Shuckburgh, F.R.S.) 1778 30·935.
Greenwich (,, ,, Mr. Belville) 1825, Jan. 9th, 30·958.
Royal Observatory, Greenwich, 1849, Feb. 11th, 9.0 p.m. 30·895.

The maximum value indicated by the Camden Square observations in January, 1882, was 30·955, at 10.30, a.m., on the 18th.*

Hence we see that there is, within half-a-century, no instance of a pressure nearly equal to that recently experienced, and only one instance even by going back upwards of a century.

The mean pressure for the month was extremely high, 30·355 in. at Camden-square. According to Mr. Eaton's paper† the mean pressure reduced to sea level for January in London is 29·945 in.,

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* *Quar. Jour. Met. Soc., Vol. VI.*

† Curiously enough agreeing almost to an hour with the time on the same day in 1881 on which the great snowstorm gale reached serious intensity.

and during the ninety years, 1790—1879, the mean exceeded 30·3 only in the following years:—

1825 = 30·324.
1858 = 30·357.

Observations were, however, made from 1774 to 1781, and in one of those years a higher mean value was reached, viz., 30·387 in 1779.

If, as we think probable, the mean value for Greenwich in 1882 should be a few thousandths higher than that at Camden Square, we shall find the mean for the month without precedent for ninety years.

We put temperature in the heading of this article, because we desired to say a few words respecting it. It has not been at all unprecedentedly high, but coming immediately after the coldest of three extremely cold Januarys, it naturally excites attention by the contrast—the mean temperature at 9 a.m. in January, 1881, was 30°·2; in the corresponding month of 1882 it was 40°·4. As a general rule, high barometric pressure and low temperature go together, and *vice versa*. But those relations are chiefly due to the passage of storms across these islands. And the exceptional occurrence of high pressure and high temperature characterizing the same month is due to the anomalous distribution of pressure which has prevailed. As to the cause of this we offer no opinion, but merely quote a few words by Dr. Hann from the *Zeitschrift*, and a note from the *Colonies*, which, though written in a style of half banter, seems to us of considerable importance, and a most appropriate sequel to Dr. Hann's opinion.

"I think that the explanation of these barometric maxima, of their constancy and of their oft-repeated appearance in certain winters, lies in the distribution of temperature in countries to the S. or S.W. of Europe. In consequence of unusual heat in these districts, the air overflows, and passes to higher latitudes, where it checks the diminution of barometric maxima, and so maintains a pressure sufficient to prevent the barometric minima following their usual paths."—*Dr. Hann* in the *Zeitschrift der Osterreichen Gesellschaft für Meteorologie*, Feb., 1882.

AMERICAN STORMS IN AFRICA.

The *Gibraltar Guardian* records a curious fact which, if the circumstances are correctly reported, indicates the existence of a new danger to navigation along the North-West Coast of Africa. The Atlantic coast of Morocco, which, it appears, has long been remarkable for its immunity from storms, was suddenly visited at the end of last year by one of the "depressions" which we are warned are "developing energy" as they cross the Atlantic, and will strike our shores with dangerous force, so continually, that the belief is gaining ground that they are somehow manufactured for our benefit by Fenians, or other ill-disposed individuals in America. One of these storms, which was to have brought bad weather to our shores, took a more southerly track than

was expected, and visited the coasts of Morocco, doing considerable damage to the town of Mazagan, and carrying away the massive stone roofs of houses which had never before been so rudely disturbed by any of the winds of heaven. Since then the coast has been visited by similar storms, and it would seem that the calm which has reigned from time immemorial on the shores of Morocco is to give place to periodical hurricanes. The open roadsteads which have hitherto given sufficient shelter to shipping at all periods of the year will consequently be useless, and the navigation of the coast will be attended with a new and utterly unforeseen danger. If the facts are as reported, and if a recurrence of the storms is experienced, they will lend force to the theory that the whole climate of the Northern hemisphere is undergoing a permanent change. The present season, however, is altogether phenomenal; and it may happen that when the seasons are restored to their normal conditions, the coasts of Morocco will regain their perennial calm. If not, Art will have to step in to make up for the deficiencies of Nature, and supply, by means of breakwaters and harbours of refuge, that shelter for shipping which the natural conformation of the coast denies.—*The Colonies, February* 10, 1882.

NEWSPAPER METEOROLOGY.

In few respects is the increased interest taken in Meteorology more evident than by its treatment in the newspapers. There are now few daily papers without their daily weather chart, or curve of barometric pressure at "our office," completed up to 2 or 3 a.m., as the case may be.

It is, however, in the quaint old town of Magdeburg, in Saxony, that the latest and fullest development of journalistic meteorology has occurred.

There are in Magdeburg two daily newspapers; with one of these alone are we concerned—the *Magdeburgische Zeitung*—its printing offices seem to be rather extensive, and include a tower 13ft. in diameter and 112ft. high, erected for meteorological purposes, and forming an imposing feature at the angle of two of the principal streets.

The basement of the tower is 16ft. deep, and is appropriated to a Fuess's standard syphon barometer and a Sprung's barograph. The flat roof of the printing offices is 52ft. above the ground, and, therefore, the tower rises 60ft. above this roof. Outside the eastern window of that room of the tower of which the floor is level with the roof of the printing office, is fixed a Reinert's window screen, containing max., min., dry and wet thermometers. The next story may be regarded as a workshop with sundry tools, apparatus for testing thermometers, &c. The next story is devoted to the library, and to the storage of blank forms, tables, &c. Above this comes the office of the Director and his two assistants. This must be rather close quarters, for the outside diameter of the tower is only 13ft.; it is octagonal inside, and from its total floor space must be deducted that occupied by the steps to pass from floor to floor, and also a few inches for another standard barometer.

The top story is very much like a lighthouse lantern without a lamp—for all its sides are glazed with heavy glass, and an outside iron balcony completes the resemblance.

Here are placed not merely another set of shade thermometers, but a self-recording anemometer and rain gauge, a sun thermometer, a sunshine recorder, a cloud mirror, a cloud camera, a spectroscope for observations of the "Rainband," and a telescope for determining the transparency of the air.

There are earth thermometers in the courtyard, and various rain gauges and other instruments in the immediate vicinity.

The regular observations are made at 8 a.m., 2 p.m., and 8 p.m., with an extra one for the International Series at 0.56 p.m. daily. All these values are printed daily in the *Zeitung*.

This is, however, the least part of the duties of the director, Dr. Assmann, and his staff. There are two issues daily of the *Zeitung*, one at 1 p.m., the other in the early morning. At about 11 a.m. a cypher telegram arrives from the Deutsche Seewarte (the Government Naval Observatory) at Hamburg, in which are given the principal data for that morning at several places in the German Empire. Reports are also received from various parts of Saxony. At noon the forecast issued at Hamburg arrives, and it (modified if necessary according to the readings of the instruments in the observatory) together with all the actual observations, is prepared for the 1 p.m. issue. A full telegram is received from Hamburg at 2 p.m., giving indications of the general direction of the isobars over Europe, and from this and all the data collected up to the time, is compiled the weather map for the next day's paper.

This, however, is not all; the *Magdeburg Zeitung* is forming an Agricultural Meteorological Society, with a merely nominal fee for membership (7½d. !) but as there are already more than 6000 members, the Society has an income of nearly £200 per annum, and we suppose every member is also a purchaser of the *Zeitung*. Be that as it may, the Society is evidently a powerful body, with 20 second order, 30 third order, and upwards of 100 rain gauge stations, all reporting to the *Zeitung*, many of them in time for their observations to be utilized in the journal, and all interested in the success of the enterprise.

This is all very well, and we congratulate the proprietors on a bright idea well carried out. But there is one thing for which we thank them especially, viz., that it seems to be a rule of the office to rigorously examine their forecasts *after* they have been issued, and, both at the Observatory and by the members of the Society, to seek earnestly for the reason of every failure, in order to guard against it, and profit by it in the future. In our opinion it is impossible to devote too much time and care to that practice.

[For nearly all the facts in the above note we are indebted to the *Zeitschrift*, September, 1881, and *Ciel et Terre*, January, 1882.]

SUPPLEMENTARY TABLE OF RAINFALL IN JAN., 1882.

[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	1·54	XI.	Castle Malgwyn	5·50
,,	Margate, Acol	·79	,,	Rhayader, Nantgwillt..	7·39
,,	Littlehampton	1·20	,,	Carno, Tybritle	6·53
,,	St. Leonards	1·06	,,	Corwen, Rhug	3·87
,,	Hailsham	1·60	,,	Port Madoc	4·70
,,	I. of W., St. Lawrence.	1·45	,,	Douglas.....	2·78
,,	Alton, Ashdell.....	2·06	XII.	Carsphairn	5·96
III.	Great Missenden.....	1·74	,,	Melrose, Abbey Gate...	2·57
,,	Winslow, Addington ...	1·44	XIII.	N. Esk Res. [Penicuick]	...
,,	Oxford, Magdalen Col...	1·15	XIV.	Ayr, Cassillis House ..	4·16
,,	Northampton	1·52	,,	Glasgow, Queen's Park.	3·65
,,	Cambridge, Beech Ho...	1·38	XV.	Islay, Gruinart School..	4·15
IV.	Southend	·85	XVI.	Cupar, Kembach.....	1·16
,,	Harlow, Sheering	1·03	,,	Aberfeldy H.R.S.	2·96
,,	Diss	1·47	,,	Dalnaspidal	7·04
,,	Swaffham	1·74	XVII.	Tomintoul.....	2·72
,,	Hindringham	2·01	,,	Keith H.R.S.	1·70
V.	Salisbury, Alderbury...	1·28	XVIII.	Forres H.R.S.	2·06
,,	Calne, Compton Bassett	2·04	,,	Strome Ferry H.R.S....	6·60
,,	Beaminster Vicarage ...	2·07	,,	Lochbroom	6·47
,,	Ashburton, Holne Vic..	4·93	,,	Tain, Springfield.....	2·55
,,	Langtree Wick	2·88	,,	Loch Shiel, Glenaladale	14·53
,,	Lynmouth, Glenthorne.	4·76	XIX.	Lairg H.R.S.	3·09
,,	St. Austell, Cosgarne...	3·39	,,	Forsinard H.R.S.	...
,,	Taunton, Fullands	1·41	,,	Watten H.R.S.	1·79
VI.	Bristol, Clifton	2·72	XX.	Fermoy, Glenville	3·79
,,	Ross	2·99	,,	Tralee, Castlemorris ...	4·78
,,	Wem, Sansaw Hall.....	2·67	,,	Cahir, Tubrid	2·25
,,	Cheadle, The Heath Ho.	2·71	,,	Newcastle West	2·69
,,	Worcester, Diglis Lock	1·97	,,	Kilrush	2·75
,,	Coundon	2·34	,,	Corofin	2·98
VII.	Melton, Coston	1·96	XXI.	Kilkenny, Butler House	..
,,	Ketton Hall [Stamford]	1·80	,,	Carlow, Browne's Hill..	1·88
,,	Horncastle, Bucknall ...	1·75	,,	Navan, Balrath	2·08
VIII.	Macclesfield Park	2·86	,,	Athlone, Twyford	2·52
,,	Walton-on-the-Hill.....	2·51	XXII.	Mullingar, Belvedere...	2·57
,,	Broughton-in-Furness ..	4·65	,,	Ballinasloe	2·53
IX.	Wakefield, Stanley Vic.	2·27	,,	Clifden, Kylemore	6·57
,,	Ripon, Mickley	3·12	,,	Crossmolina, Enniscoe..	3·76
,,	Scarborough.....	1·60	XXIII.	Carrick-on-Shannon ...	2·06
,,	EastLayton[Darlington]	1·67	,,	Dowra	2·76
,,	Mickleton.....	2·64	,,	Rockcorry.....	2·46
X.	Haltwhistle, Unthank..	2·78	,,	Warrenpoint	2·51
,,	Shap, Copy Hill	5·39	,,	Newtownards	1·60
XI.	Llanfrechfa Grange	4·21	,,	Belfast, New Barnsley .	2·43
,,	Llandovery	5·21	,,	Bushmills	2·23
,,	Solva	3·40		Buncrana	2·94

JANUARY, 1882.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	1·30	— 1·05	·56	8	7	53·4	6	27·4	25	7	15
II.		Hunton Court	·96	— 1·61	·32	8	8	...	...	...	...	...	...
,,		Strathfield Turgiss	1·29	— 1·26	·39	2	10	52·8	6	23·8	21 *i*	8	24
III.		Hitchin	1·19	— 1·03	·55	8	10	51·0	6	25·0	24 *k*	14	...
,,		Banbury	1·90	— ·48	·87	8	17	52·0	6	24·0	25	9	...
IV.		Bury St. Edmunds	1·63	— ·21	·87	8	10	53·0	6	23·0	31	10	..
,,		Cossey	1·76	+ ·06	·68	8	8	54·0	6	28·5	25	10	10
V.		Bridport	1·39	...	·39	2	12	53·0	11	18·0	24	15	...
,,		Barnstaple	2·56	— 1·70	·52	2	16	54·0	28 *a*	28·0	24	...	...
,,		Bodmin	3·08	— 3·43	·76	2	14	54·0	28	27·0	24	1	7
VI.		Cirencester	2·82	— ·56	·79	8	12	...	...	...	...	...	...
,,		Woolstaston	3·17	— ·26	·85	28	16	51·0	5, 6	29·0	20 *l*	5	12
,,		Orleton, Tenbury	2·57	— ·42	·64	8	15	55·6	6	25·0	25	6	13
VII.		Leicester	2·11	...	·59	8	12	52·3	5	37·0	18	4	17
,,		Boston	1·63	— ·09	·51	28	7	53·0	6	29·0	19	6	...
,,		Grimsby	1·95	+ ·19	1·02	29	18	52·0	5	31·0	25 *m*	3	...
,,		Mansfield	3·23	+ ·80	1·75	29	12	...	...	...	...	...	...
VIII.		Manchester (Ardwick)	2·90	— ·34	·48	2	15	50·0	2,5,6	33·0	27	0	...
IX.		Ribstone Hall	2·50	+ ·28	...	...	...	...	...	...	...	...	...
,,		Arncliffe	6·88	— ·05	1·50	2	22	49·0	5	31·0	3	3	...
X.		North Shields	·57	— 1·27	·11	6	13	55·0	5	30·0	4, 27	5	6
,,		Seathwaite (Borrowdale)	11·40	— 7·35	2·54	4	21	...	...	...	...	...	...
XI.	WALES.	Ely	3·16	— 1·55	·77	2	13	...	...	...	...	...	...
,,		Haverfordwest	6·73	+ ·46	1·24	9	15	52·0	5, 6	30·0	22	1	5
,,		Plinlimmon (Cwmsymlog)	...	...	...	...	...	...	...	...	...	...	.
,,		Llandudno	3·19	+ ·23	·69	29	15	55·5	14	33·1	29	...	...
XII.	SCOTLAND.	Cargen	2·63	— 3.48	·41	5	16	51·4	15	31·0	4	2	...
,,		Hawick	1·78	— 1·44	·44	2	11	...	...	..	...	...	...
XIV.		Newmains	4·97	— ·47	·96	2	21	...	...	...	...	...	...
XV.		Kilmory	7·32	— ·55	·95	2	23	...	...	...	...	...	...
,,		Appin (Airds)	6·29	...	...	...	...	...	...	...	...	...	...
,,		Quinish (Mull)	5·48	...	1·12	4	23	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·10	— ·72	·50	3,5,6	12	...	...	...	...	...	...
,,		Arbroath	1·15	— 1·30	·36	2	11	52·0	5	29·0	29	4	..
XVII.		Braemar	2·89	+ ·11	·60	7	17	50·4	18	21·7	4	7	14
,,		Aberdeen	1·06	...	·32	4	10	55·0	18	29·0	4, 11	8	...
XVIII.		Sligachan	18·31	...	2·64	28	29	...	...	...	...	...	...
,,		Culloden	2·43	+ ·66	·68	6	7	55·5	15	28·0	29	5	18
XIX.		Dunrobin	3·05	...	·55	2	17	55·8	15	27·0	4	6	...
,,		Sandwick	3·15	— ·19	·44	6	20	51·9	17	32·0	30	1	5
XX.	IRELAND.	Blackrock	4·27	— 1·75	·81	30	19	53·0	15 *b*	30·0	3, 29	4	...
,,		Dromore Castle	5·38	...	·95	2	16	57·0	2	30·0	29	1	...
,,		Brook Lodge	3·78	...	·83	30	17	52·0	14 *c*	33·0	3, 20	0	...
,,		Killaloe	3·67	...	·69	4	14	54·0	12 *d*	31·0	1 *n*	4	...
XXI.		Portarlington	2·32	— ·74	·70	27	22	53·0	15	32·0	6	2	...
,,		Monkstown	1·56	...	·26	27	16	55·0	5, 6 *e*	28·0	18 *o*	...	...
XXII.		Queen's College (Galway)	3·06	...	·61	3	14	55·0	13 *f*	29·0	30	1	...
XXIII.		Waringstown	...	...	...	...	...	...	...	...	...	...	...
,,		Londonderry	2·98	...	·48	6	15	55·0	14 *g*	32·0	29	1	13
,,		Edenfel	2·09	— 1·68	·47	4	20	53·0	14 *g*	29·0	28	8	...

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

a And 29. *b* And 16, 17. *c* And 27. *d* And 13. *e* And 14. *f* And 17. *g* And 15.
i And 25. *k* And 31. *l* And 21, 27. *m* And 27. *n* And 12, 18. *o* And 19.

METEOROLOGICAL NOTES ON JANUARY.

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.—Altogether a mild pleasant month, exceptionally warm during the first fortnight. All agricultural products very forward. Blackbirds, thrushes, and rooks busy building nests on 12th and 13th. Snowdrops in flower on 21st.

BANBURY.—Mean temperature of the month, 40°·5; high wind on six days.

CULFORD.—Month throughout very fine; fruit trees forward; everything beginning to have quite a spring-like aspect.

COSNEY.—Very high barometer from the 12th to the end of the month, with dull misty weather. Bar 30·92 in. on the 18th.

BODMIN.—Average temp. of the month, 44°·1. On the 18th, the bar. rose to 30·95 in. (reduced), being the highest ever known here. The winter hitherto has been by far the mildest on record.

CIRENCESTER.—A mild, genial month with no snow. After the middle, a long continuance of high barometer.

WOOLSTASTON.—Mean temp. of the month 39°·6. A singularly mild and genial month. Bar. (corrected), 30·80 in. on 18th.

TENBURY, ORLETON.—The first 8 days were generally cloudy, with a high temperature, rough winds, and frequent R. The barometer then became high, and the weather dry, warm, and cloudy. On the morning of the 15th, the barometer rose to 30·43in. (uncorrected), and it did not fall again below 30·30in. till the 26th. On the morning of the 18th it registered 30·72in., and it remained above 30·60in. from the evening of the 16th to the evening of the 19th. The highest point registered before with the same barometer was 30·65in., on the 11th of February, 1849. After the 15th the weather became colder with S. wind, and was very cloudy, dark, and gloomy, with frequent fog and no sun; the air generally calm. Much R fell on the 28th and 29th, and the barometer went down to 29·75 in. on the latter day, but rose again to 30·45 in. on the 31st. Lunar halos were seen on the 1st and the 5th, and the wind was very high on the 6th and 7th. The ground was never covered with S, and frosts were not frequent. The mean temp. of the month was more than 2°·5 above the average of 20 years.

LEICESTER.—Fog at 9 p.m. on 17th; all day on 18th, and at 9 a.m. on 19th.

BOSTON.—Temperature 3° above the average. Weather generally fine. Remarkably high barometer (30·95 in. 25 feet above sea level) on the 18th. In the middle of the month, in addition to the usual January flowers, the following could be gathered: aconite, primrose, anemone, periwinkle, snowdrop, crocus, polyanthus, hepatica. In a sheltered place a geranium still survives, and also some mignonette.

GRIMSBY.—A very remarkable month:—(1) For the unprecedented and long continued height of the bar.; (2) The total absence of snow and the very slight frosts; (3) For the amount of fog and cloud, and consequent absence of sunshine. On the 17th, the bar. was 30·90 in. at 11 p.m.; on the 18th, at 9 a.m., bar. 30·87 in., noon 30·90 in.; on the 19th, 9 a.m., the bar. was 30·90 in., at 10.45 p.m. 30·84 in.

ARNCLIFFE.—Weather of the month remarkably mild, and the thermometer only once falling below freezing point.

NORTH SHIELDS.—Plants in flower on Jan. 1st: yellow primrose, cowslip, polyanthus, pansy, carnation, Christmas rose, wallflower, white rock cress, double daisy, chrysanthemum, yellow jessamine, auricula, heath. Snowdrops in flower on 19th.

WALES.

HAVERFORDWEST.—The year commenced very wet and stormy, the air bleak and wintry, and low bar. After the 12th, a rather sudden change took place, the

air became colder and drier, sky over-cast, and the nights intensely dark and misty with remarkable high barometric pressure, which culminated on the 18th, the reading on that day at 9 a.m. corrected for temperature, (154 feet above mean sea level) was 30·920in., which, with the addition for mean sea level, would be 30·963 in.; it remained at a very high point up to the 25th, when it stood, at 9 a.m., at 30·702 (corrected); on the 26th, another stormy and very wet period set in continuing till the end of the month; lowest barometric reading 9 a.m., 28th, 30·105 in.

LLANDUDNO.—With the exception of a storm of wind and snow on the 29th, the month was characterised by fine calm weather. Both the rainfall and mean temp. were as near as possible the average. Being from home the first half of the month, I have no record of the duration of sunshine for that period, but it amounted to 24·8 hours from the 17th to the 31st inclusive. The bar. was generally very high, especially after the 9th, from which date to the end of the month it did not fall below 30 inches.

SCOTLAND.

CARGEN.—Bar. remarkably high from 15th to end of month, highest 30·920 on 18th. Mean temp. 43°·1, being 5°·2 above the average. Great want of sunshine, only 30 hours during the month, the average being 66 hours; for 13 consecutive days (8th–20th) only one hour of sunshine was recorded: rainfall below the average. Early rhododendron, mahonias, Pyrus japonica, yellow jasmine, &c., in flower. A very fine lunar halo occurred on the night of the 28th, an inner ring of pale crimson shading off to violet was seen when the halo was at its brightest, between 9.30 and 10.30 p.m. the crimson was inside, nearest the moon.

SILVERBUT HALL, HAWICK.—A terrible storm of wind, hail, and rain, occurred on the 6th and 7th. From the 12th to the 27th very mild and spring-like. Hills white with snow on the 29th. No one living here remembers such a mild January before. The roads were so clean that coachmen did not require to wash their carriages. A blackbird's nest with four eggs was found in a hedge here on the 26th. Many of the rose-buds are over an inch in length, and the grass fields are greener now than they were last year at the beginning of April.

BRAEMAR.—Hurricane from 9 a.m. to 2 p.m. on 6th, and 6 inches of S on 7th, with the exception of which the month was exceedingly mild. Mean temp. 39°·9.

ABERDEEN.—Mild, genial weather prevailed during the greater part of January; he prevailing wind being south-westerly, rainfall fully an inch and a half below the average. Fresh gale on 27th, H on 29th. There was a marked absence of aurora, although for about a dozen nights the sky was practically cloudless.

CULLODEN.—The month all through was particularly mild, frost and snow entirely absent; frequent strong gales from S.W. and S.S.W.; pasture land fresh and green; labour well forward. Temperature ruling high; weather between 9th and 23rd very fine and dry.

SANDWICK, ORKNEY.—The month was mild, but stormy. There were gales of 50 miles an hour or more on the 2nd, 5th, 6th, 9th, and 10th. On the 6th it was 80 miles an hour from 5 to 6 p.m. L in the morning on 7th, a house struck, and the occupiers stunned; a barn was also struck and burnt, and a bullock killed; several flashes again on the 9th.

IRELAND.

DROMORE CASTLE.—A very fine month, though cattle suffered from the constant wet of December, and of the first fortnight of January. There is perceptible growth of grass already, and spring operations are forward. Mean temp. 44°·8.

WATERFORD.—Primroses in flower on 6th. S on Comeragh Mountains on 28th, S to S.W. gale on 2nd. Bar. 30·9in. on 17th.

KILLALOE.—Very fine weather from the 10th to the end of the month. Quite spring-like in mildness of temp. Bar. extraordinarily high in the middle of month, nearly reaching 31in.

MONKSTOWN.—The great feature of the month was the extraordinary high barometer, reaching 30·95 (uncorrected) on the 18th. The weather was extremely mild, the lowest shade temp. being 28°, also on 18th.

LONDONDERRY.—Wind principally S.W. One of the finest Januarys we have had for many years; almost all hedges, fruit-trees, shrubs, &c., being covered with buds. Only one gale during the month, on the morning of the 6th. Temperature of soil (4 feet below the surface) at the end of the month 43°·8. Mean height of bar. 30·134 in.; max. 30·884 in. on 18th; min. 29·112in. on 6th.

EDENFEL, OMAGH.—A month of extraordinary fineness and mildness. Many days almost cloudless, the 11th absolutely so, and many nights clear, yet frostless. From an old record in my possession, I find that the winter of 1831-2 was almost identical with this, and was followed by an early and favourable spring, and a fairly productive year.

A PLEA FOR THE RAINBAND.

To the Editor of the Meteorological Magazine.

SIR,—In answer to a suggestion from a Fellow of the Meteorological Society, will you permit me to state that Mr. John Browning, of 63, Strand, has prepared and submitted to me a Spectroscope so arranged as to give a spectrum of the same breadth and length as those shewn in the lithographed plate which accompanied my paper. Of course, such an arrangement is not absolutely necessary, as any Spectroscope of small dispersion will shew the Rainband; but it will be found in practice that an estimate of intensity is much easier formed where similar conditions of dispersion and slit length prevail. Such an instrument is, of course, also available for general Spectroscopic work.

J. RAND CAPRON.

Guildown, February 2nd.

THE MEAN TEMPERATURE, 1881-82.

To the Editor of the Meteorological Magazine.

SIR,—The mean temperature out of doors in January, 1882, as compared with January, 1881, at this place, strikingly shows the difference of the seasons:—

	Max.		Min.
	°		°
1882	44·3	...	36·3
1881	34·0	...	23·5
Difference	10·3	...	12·8

The mean min. of 1882 being 2°·3 more than the max. of 1881.—Yours truly,

W. B. CLEGRAM.

Saul Lodge, Stonehouse, Gloucestershire, 1st Feb., 1882.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CXCIV.] MARCH, 1882. [PRICE FOURPENCE, or 5s. per ann. post free.

CLIMATOLOGICAL DATA FOR THE BRITISH EMPIRE.

IN the year 1873 I was requested by the Editor of *The Colonies* to endeavour to arrange for publishing in that periodical a monthly synoptical table from some of the leading colonies. Through the kindness of the Directors of the various observatories, I was able to commence by giving for January, 1874, meteorological returns from sixteen stations in Europe, Asia, Africa, Australia, and America; and from that time to the present, the system has continued in uninterrupted operation.

Recent changes in *The Colonies and India*, however, led the Editor to decide upon terminating the publication of these tables, and it then became my duty to consider what, in the interest of meteorology at large, was the best course to adopt.

Originally I believed that these tables would be useful, or I would not have undertaken their preparation. Seven years' experience has confirmed that opinion, and therefore I resolved to continue them.

Then arose the questions—how? and where? As regards the first question there could be but one answer—the returns for half of 1881 had been printed in *The Colonies*, the other six months must be prepared in the same form, and it can only be when beginning the tables for 1882 that any modification can be introduced. The place of publication required much consideration. On the one hand there were two arguments in favour of offering them to some Colonial journal:—(1) Its greater circulation in the Colonies than that of this Magazine; (2) The fact that the cost of preparation and the extra cost for printing tabular matter would then not fall upon me. But, on the other hand, I thought that these tables were too valuable for me to allow them to be lost to the readers of this Magazine, and on that ground I resolved upon their regular appearance in these pages. As the publication has fallen rather into arrear, I shall for a few months give two tables a month so as to bring the publication up as close as the collection of data from such remote parts of the world will allow. At the same time as the publication will in future be entirely under my own control, it will be systematic, and I am sure that I may rely upon the continued kindness of my Colonial friends in making their returns as prompt as they are accurate.

G. J. SYMONS.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1881.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	94·6	15	44·3	28	77·9	55·8	52·8	64	137·7	38·3	1·85	14	5·3
Cape of Good Hope	78·0	16	33·0	20	64·0	42·3	46·4	80	...	...	2·82	9	3·4
Mauritius	76·1	30	59·6	16	73·9	65·1	60·5	74	...	...	4·43	20	5·8
Calcutta	91·7	13	76·7	31	87·5	79·0	78·7	87	160·7	75·1	13·42	26	8·2
Bombay	86·9	8	75·1	6	84·5	77·7	77·1	88	149·1	74·1	29·47	31	9·2
Ceylon	87·6	30	74·0	13	85·2	77·4	74·4	80	148·0	69·0	2·21	7	6·5
Melbourne	63·9	21	34·5	28	56·6	42·4	40·9	75	98·4	25·9	·68	10	5·6
Adelaide	66·5	21	35·0	14	58·3	43·8	42·4	73	133·0	28·0	2·06	16	...
Wellington	60·3	12	35·5	5	53·3	43·4	...	...	106·0	28·0	11·25	18	...
Auckland	66·6	...	35·2	...	...	...	...	81	109·1	...	2·76	22	5·9
Falkland Isles	44·6	16	18·1	2	40·0	32·8	34·9	94	85·8	15·8	3·09	22	7·8
Jamaica	93·8	7	71·8	22	90·0	74·4	72·3	76	...	..	6·05	14	6·4
Barbados	84·0	15	71·0	var.	82·0	73·0	73·4	80	150·0	70·0	7·64	21	7·0
Toronto	92·1	5	56·1	1	80·3	60·7	59·6	69	148·0	48·5	1·84	9	4·8
New Brunswick, S. John	72·0	15	49·0	7	64·5	52·6	53·7	83	...	...	4·53	15	6·4
Cape Breton, Sydney	82·7	10	41·3	3	68·5	51·3	54·7	83	...	...	3·93	15	7·1
Newfoundlnd, S. John's	74·3	17	43·3	2	64·6	50·0	53·0	88	147·0	44·0	6·79	11	6·5
Manitoba, Winnipeg	93·5	18	39·0	9	82·1	55·6	59·6	68	...	...	·61	10	5·1

REMARKS, JULY, 1881.

LONDON.—A hot month, temp. being 3°·5 above the average, but especially noticeable for the high temp. in the first week, and also from 11th to 19th. The max. of 94°·6 is without precedent in my records. G. J. SYMONS, F.R.S.

Mauritius.—Rainfall, 1·94 in. above average; mean bar. (corr. and red.), 30·216 in. Mean hourly velocity of wind, 11·9 miles; greatest, 26·9 miles on 22nd; least, 1·7 miles on 30th; prevailing direction of wind, E.S.E. to E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. and pressure, 0°·9 and 0·160 in. respectively above the average of 22 years; temp. of dew-point and amount of cloud both below it; rainfall, 1·15 in. below the 22 years' average. Prevailing direction of wind, N., the strongest breezes occurring from that quarter on the 3rd, 4th, 6th, 15th, and 22nd; heavy dew on 8 days, hoar frost on 4 days, and dense fog on 3 days. R. L. J. ELLERY, F.R.S.

Wellington.—First 3 days wet and stormy from N.W.; fine, bright, pleasant weather from 4th to 15th, the wind being light and changeable. Dull weather commenced on the 16th, and the remainder of the month was generally stormy and cold, with continuous R. T on 3rd; H on 30th. Atmospheric pressure and temp. both above the average of 17 years; rainfall, 5.03 in. above average. R. B. GORE.

Barbados.—Pressure and temp. both slightly below the average of previous 17 years. Wind, N.E. on 29 days and S.E. on 2 days, the average velocity being 12 miles per hour, and the extremes 17·4 miles and 6·4 miles. Rainfall, 19 per cent. above the average of 25 years; greatest fall in 24 hours, 2·35 in. on 6th; evaporation, 20 per cent. above the average. Ten days were overcast, TSS on 16th and 24th. R. BOWIE WALCOTT.

NEWFOUNDLAND.—The first week was fair, but the remainder of the month was unsettled, wet and dry alternately; not good for either agriculture or fishery operations. J. DELANEY.

CLIMATOLGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1881.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	84·6	5	42·3	28	69·3	51·3	51·3	76	126·3	37·8	4·89	19	6·8
Cape of Good Hope	77·0	28	38·4	27	64·8	46·8	50·0	81	...	...	3·54	14	4·5
Mauritius	75·4	18	57·5	15	73·6	63·8	58·6	71	...	...	1·72	21	5·4
Calcutta	91·5	17	75·8	23*	86·7	78·0	78·8	89	156·7	75·1	19·16	25	8·5
Bombay	86·3	29	75·0	var.	84·4	76·9	76·5	87	146·5	73·2	19·06	28	8·9
Ceylon	86·7	3	73·8	11	84·9	76·8	74·3	81	149·5	69·0	6·17	13	7·5
Melbourne	74·7	16	33·1	24	59·4	45·0	41·5	70	109·0	25·9	2·97	14	6·8
Adelaide	70·0	26	35·0	2	60·8	45·8	44·3	71	137·5	75·0	1·45	12	6·5
Wellington	60·0	21	35·3	3	53·9	44·5	...	...	115·0	30·0	6·77	18	...
Auckland	64·8	...	35·2	...	...	...	...	81	112·0	...	4·31	22	6·3
Falkland Isles	49·4	29	24·0	11†	41·0	32·7	36·3	92	96·3	20·7	2·01	20	6·4
Jamaica	91·0	23	70·0	14	88·3	73·7	72·9	79	...	...	4·75	11	5·6
Barbados	87·0	21	70·0	16‡	83·0	73·0	73·6	76	152·0	70·0	10·57	19	5·0
Toronto	91·0	31	52·2	25	79·7	60·1	58·7	68	141·0	44·0	1·51	8	5·3
New Brunswick,S.John	80·0	19	51·0	17	65·4	55·2	57·3	90	...	...	3·17	14	8·2
Cape Breton, Sydney	83·5	1	40·3	30	71·2	59·3	61·2	88	...	...	4·08	16	7·6
Newfoundlnd, S.John's	79·0	1	44·0	30	67·2	55·4	56·0	93	145·0	41·0	3·91	14	6·0
Manitoba, Winnipeg	88·7	25	38·5	6	79·3	52·8	57·0	71	...	...	2·05	12	5·5

* And 24 † And 12 ‡ And 17

REMARKS, AUGUST, 1881.

LONDON.—Temp. below the average; rainfall nearly twice the usual amount, and falling on nineteen days, seriously injured the harvest. G. J. SYMONS, F.R.S.

Mauritius.—Rainfall ·53in. below average; mean bar. (cor. and red.) 30·243in.; mean hourly velocity of wind, 13·2 miles; greatest, 28·8 miles on 20th; least, 1·8 miles on 16th; prevailing direction E.S.E. to E. C. MELDRUM, F.R.S.

CEYLON.—Thunder was heard on 1st and 6th. A. B. FYERS, Col. R.E.

Melbourne.—Mean temp., 1°·1; mean pressure, ·089in.; rainfall, 1·09in; and amount of cloud, ·7; respectively above the average of 22 years. Prevailing winds, W. and N.E.; strong breezes occurring on 4 days; hoar frost on 3 days; heavy dew on 4 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure 30·216in., slightly above the average. Rainfall between Adelaide and Lake Torrens about the mean, but S. of Adelaide the fall was about 50 per cent. below the mean, and no R was recorded N. of lat. 30°. Mean temp. at Adelaide about 1° below average. C. TODD.

Auckland.—Wet dull weather, with S.W. and W. winds, frequently strong; average velocity 12·7 miles per hour; greatest in 24 hours, 761 miles on 9th. Max. fall of R, 1·08in. on 15th. E. B. DICKSON.

Wellington.—Pleasant weather from 3rd to 14th, with occasional showers, wind chiefly W. and N.W., strong on 7th and 9th; from 15th to 20th, wet and cold; next three days fine, then wet and cold again till 27th. S on hills on 23rd; L on 28th; very slight earthquake on 8th. Mean pressure about the average; mean temp. 1°·2 above it. R. B. GORE.

Barbados.—Mean pressure and temp. both below the average. N.E. winds prevailed on 24 days, average velocity 6 miles per hour; extremes 9·9 miles and 2 miles. Rainfall 26 per cent., and evaporation 33 per cent. above the average. TSS on 6 days, and L on 4 other days. Very little ozone. R. BOWIE WALCOTT.

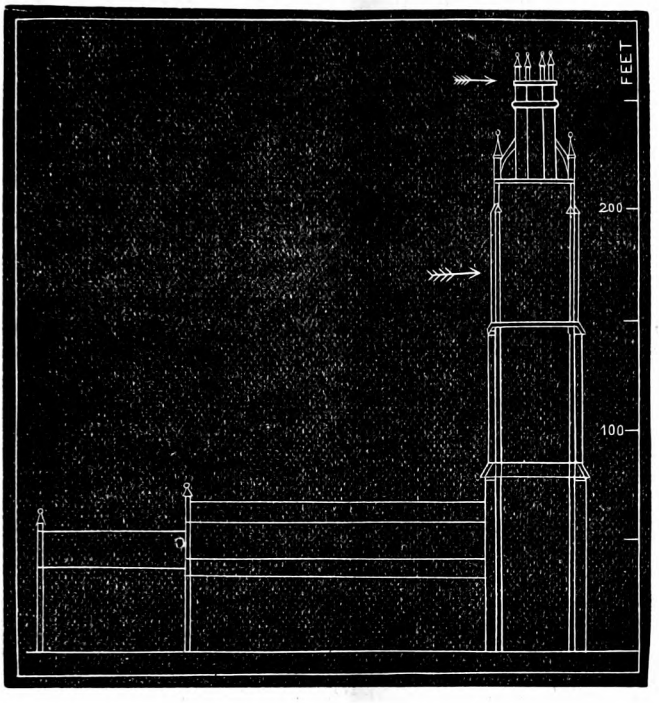
NEWFOUNDLAND.—With the exception of a few days the month was rainy, foggy, and unsettled. J. DELANEY.

TEMPERATURE OBSERVATIONS AT BOSTON, LINCOLN.

During last year the Council of the Meteorological Society, having regard to the recent rapid progress of statistical meteorology and to the uncertainty that still prevails regarding important points bearing on the physics of the atmosphere, considered it desirable that the Society should supplement the ordinary observations by a series of well-conducted experiments destined to throw light on such questions as the vertical decrement of temperature, the rate of ascension of vapour, the height of cloud-strata, the variation in the velocity of the wind at different elevations, &c. Steps have recently been taken to obtain information upon the first of these questions, by the placing of thermometers at the summit of, part way up, and at the base of, Boston Church Tower, which is 270 feet high. This tower is admirably situated for making such experiments, as it is isolated and free from any obstructions, and the country is quite flat for miles round. By permission of the vicar (the Rev. Canon Blenkin), the instruments have been placed as follows :—At the summit, one of Dr. Siemens' electrical thermometers (kindly placed at the Society's disposal by Messrs. Siemens, Bros. and Co.) and an ordinary thermometer are mounted in a small screen fixed to one of the pinnacles of the tower; on the roof of the belfry, which is 170 feet above the ground, a Stevenson screen has been mounted containing maximum, minimum, dry and wet bulb thermometers. In the churchyard another Stevenson screen has been fixed containing a similar set of thermometers, for comparison with those above. All the thermometers will be read every morning at 9 o'clock. The electrical thermometer consists of a coil of wire wound round a cylindrical piece of wood enclosed in a small brass tube; a third wire is joined to one of the wires, and the three, insulated by gutta percha, form a light cable which is brought down to the base of the tower and connected to a galvanometer, the terminals of which are in connection with the two poles of a six-cell Leclanché galvanic battery. The instrument is read by depressing a key which causes the needle of the galvanometer to deflect; a pointer or vernier (moving a contact roller upon a wire in a circular groove) is then pushed to the right or to the left upon a divided scale until the needle remains stationary on the zero point, when the electrical resistance of the wire is measured upon the scale. The number indicated by the vernier is then read off, and by referring to a table of equivalents the actual temperature in degrees of Fahrenheit is readily ascertained.

Simultaneous readings of the electrical thermometer at the summit of the tower and of the dry bulb thermometer in the churchyard will be made frequently during the day by Mr. E. C. Hackford, the verger of the church, who, by originally erecting, and commencing a record of the fall of rain by, a gauge at 270 feet above the ground—the highest ever observed—practically suggested the locality of the experiments now commenced.

The following engraving will show clearly the relative situations of the three sets of thermometers, the arrows pointing to the respective positions of the upper sets.



THE METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday, the 15th ult., at the Institution of Civil Engineers, 25, Great George-street, Mr. J. K. Laughton, M.A., F.R.A.S., President, in the chair. The following gentlemen were balloted for and duly elected Fellows of the Society:—W. Armstrong, J.P., W. G. Birchby, J. Rand Capron, P. Crowley, F.Z.S., W. W. Culcheth, M. Inst. C.E., D. Cunningham, M. Inst. C.E., F.S.S., S. Cushing, W. N. Greenwood, E. Kitto, J. Mansergh, M. Inst. C.E., G. Oliver, M.D., H. S. H. Shaw, Assoc. M. Inst. C.E., G. W. Stevenson, M. Inst. C.E., F.G.S., and W. H. Tyndall.

The papers read were:—(1). "Notes of Experiments on the Distribution of Pressure upon Flat Surfaces perpendicularly exposed to the wind," by C. E. Burton, B.A., F.R.A.S., and R. H. Curtis, F.M.S. In the present state of æro-dynamics, it seems impossible to make an *a priori* investigation of the distribution of pressure on a surface exposed to the impact of the fluid in motion, without introducing such limitations as render the solutions arrived at widely divergent from the results obtained by the experiments hitherto made. The authors, therefore,

proposed to themselves to attack the problem from the experimental side only, by a method which, as far as they know, has not been applied in the case of air—viz., the application of Pitot's tube, suitably modified in form, to the simultaneous measurement of the pressures at the centre, and at any ex-centrically situated point of a pressure plate of known dimensions. The results of the preliminary experiments are given in the present paper.

(2) "The Principle of New Zealand Weather Forecasts," by Commander R. A. Edwin, R.N., F.M.S.

(3) "The high Atmospheric Pressure of the middle of January, 1882," by H. Sowerby Wallis, F.M.S. On January 7th the barometer in London rose to about 30 inches, and for the next few days was rather unsteady, but after each fall it rose higher than before, until on the 12th it was above 30·4 in. From this time it was very steady, rising gradually, 30·900 in. being reached at 3 a.m. on the 17th, and the maximum, 30·955 in. at 10.30 a.m. on the 18th.

At this time an area of high pressure, which had had its centre over the continent for some days had gradually moved westward and reached our islands, the highest readings being in the southern part of England. The following are the max. readings at several stations.

St. Leonards	30·990 in.	...	10·23 to 10.37 a.m.	on 18th.
Cheltenham	30·984 ,,	...	10.30 a.m.	,,
Macclesfield	30·984 ,,	...	10.30 ,,	,,
Brighton.....	30 983 ,,	..	10.30 ,,	,,
Kew	30·980 ,,	...	11.0 ,,	,,
Banbury.....	30·980 ,,	. .	10.30 ,,	,,
Torquay, Babbacombe	30·980 ,,	...	11.0 ,,	,,
Maidstone	30·979 ,,	...	10.0 ,,	,,
Falmouth	30·979 ,,	...	10.0 ,,	,,
Tonbridge	30·977 ,,	...	10.15 ,,	,,
Croydon, Addiscombe	30·976 ,,	...	10.0 to 11 a.m.	,,
Greenwich	30.975 ,,	...	10.0 a.m.	,,
Weybridge	30·970 ,,	...	10.0 ,,	,,
Sidmouth	30·968 ,,	...	11.15 ,,	,,
Camden Square	30·955 ,,	...	10.30 ,,	,,

At Camden-square the pressure was continuously above 30·9in. (higher than any point previously reached in nearly a quarter of a century) for 43 hours. It was above 30·8in. (a point only twice reached in 23 years) for 90 consecutive hours; above 30·7in. for 6 days 1 hour; above 30·6in. for 7 days 14 hours; and above 30·5in. for 12 days 12 hours.

It is believed that pressures so high for such continuously long periods are quite without parallel.

M. Renou, in a note to the Paris Academy of Sciences, states that the maximum pressure registered at the Parc St. Maur was 786·92$^{mm.}$ (30·981in.) at 10 a.m. on the 17th, and adds that during nearly a century only once has a pressure slightly exceeding this been recorded at the Paris Observatory. On February 6th, 1821, at 9 a.m., the height was 787·52$^{mm.}$ (31·004in.) and it would appear

that at Paris, with these two exceptions, the bar. has never exceeded 785·1mm. (30·910in.) during two centuries. In the *Zeitschrift*, Dr. Hann says—"The max. pressure of the 16th, at 10 a.m., 787·9mm. (31·020in.), is probably the highest in Vienna since 1775, for the sea-level pressure of 788·3mm. (31·036 in.) on February 8th, 1821, cannot be relied upon as within ·01in. or ·02in. of the truth. With the exception of that occasion, the previous maximum sea-level pressure was only 785·6mm. (30·930in.) on Jan. 9th, 1859.

The following table gives the highest readings during January, 1882, published in the daily weather reports for some of the principal continental cities.

Bern	787·7 mm.	31·012 in.	7 a.m.	17th.
Hamburg	786·6 ,,	30·969 ,,	8 p.m.	16th.
Brussels	786·4 ,,	30·961 ,,	8 a.m.	18th.
Berlin	786·0 ,,	30·945 ,,	8 a.m.	16th.
Copenhagen	785·4 ,,	30·922 ,,	8 a.m. 6 p.m.	16th. 16th.
Madrid	784·9 ,,	30·902 ,,	7 a.m.	17th.
Munich	784·5 ,,	30·886 ,,	8 p.m.	16th.
Rome	782·0 ,,	30·788 ,,	7 a.m.	16th.
Lisbon	778·5 ,,	30·650 ,,	8 a.m. 8 a.m.	17th. 18th.

The electrical thermometer, lent by Messrs. Siemens, Bros., for observing the temperature of the air at the summit of Boston Church Tower, was exhibited to the Fellows present at the meeting.

ANEMOMETERS.

A few years since, at the suggestion of Dr. Tripe, the Meteorological Society resolved upon holding annually in March, an exhibition of Meteorological apparatus; after the first year it was resolved that, in future, efforts should be made to form yearly, a collection of some one class of instrument, as nearly perfect as possible, and to admit in addition thereto only instruments designed within the twelve months preceding the holding of the exhibition.

In 1881, the exhibition was composed specially of hygrometers, forty or fifty were exhibited, and Mr. G. J. Symons, F.R.S., read a paper describing upwards of one hundred different patterns.

This year, the Council decided on collecting anemometers and photographs, &c., relating thereto, and a remarkably fine series has been collected, and, through the courtesy of the Institution of Civil Engineers, arranged in its Library, 25, Great George-street, Westminster. The meeting will be held to-morrow evening (15th), and the President of the Meteorological Society, Mr. J. K. Laughton, F.R.A.S., will give a historical note on the subject of anemometers. The Institution of Civil Engineers have papers on "The design of structures to resist wind pressure" and on "The resistance of viaducts to sudden gusts of winds," the discussion upon which

will probably occupy the evenings of March 14th and 21st; it has therefore been arranged that the apparatus shall remain on view daily until the evening of March 21st.

We are glad to be authorized to state that during this period the exhibition will be open without restriction, not merely to the Fellows of the Meteorological Society and their friends, but to all interested in the measurement of wind force.

THE LATE WINTER AND THE COMING SUMMER.

To the Editor of the Meteorological Magazine.

SIR,—It is a curious fact, which any one may verify for himself, by referring to the Registrar-General's "Weekly Returns," that there were *more mild weeks* in the winter of 1880-81, than in the winter just past. It is a still more curious fact, that in the former winter, the warm weeks exceeded the cold ones by the same number that the cold weeks exceeded the warm ones in the latter season. In the 13 weeks ending the 26th Feb., 1881, there were 7 warm weeks and only 6 cold; but, in the 13 weeks ending the 25th Feb., 1882, 7 were cold and only 6 warm. Except for 4 very cold weeks, the winter of last year would have been a decidedly *mild* one; and but for 4 very mild weeks, the late winter would have been a decidedly *cold* one. In the former winter, the 6 cold weeks more than counterbalanced the 7 warm ones, while in the latter winter, the 6 warm weeks more than counterbalanced the 7 cold ones. Of the 7 cold weeks in the late winter, the least cold was nearly 2°·0 (1°·8) below the average at Greenwich, and the most cold nearly 4°·0 (3°·8) lower than the average. In point of fact the 7 cold weeks of this winter averaged as much as 2°·7 below the Greenwich adopted mean. In the winter of 1880-81 the Greenwich minimum temperature was fractionally over 12°·0. In the winter of 1881-2 it was fractionally over 21°·0 (another curious reversal of figures).

With regard to the "remarkably high mean atmospheric pressure" of January, 1882, it appears that it was exceeded in January, 1880. According to the mean daily readings published in the "Weekly Returns," the mean pressure for the month of January last, at Greenwich was 30·185 in., but in January 1880 it was as much as 30·204 in. The mean pressure of the air at Greenwich from the 12th of last January to the 23rd of February—a period of rather more than six weeks—was 30·309 in., which, reduced to sea level, would give a pressure only slightly below 30·5 in. Such an elevation, for so long a period as six weeks, appears to have *no parallel in the last* 90 *years.*

The temperature has not been at all remarkable for excess. In the last 40 years 12 winters have been decidedly milder than the one just past; and 5 others had about the same mean temperature. I may here remark that my prediction for the winter of 1880-81 was exactly

fulfilled in these parts; the temperature having been "not much below the mean" (see *Met. Mag.*, vol. xvi., pp. 57-58).

In every case when extremely high pressure has occurred about the end of December, in January, or early in February, the following summer has been remarkably hot, or the harvest remarkably good. In most instances both occurred. Many meteorologists will know that after the notable barometrical maxima of December, 1778, January 1825, January 1835, February 1849, and January 1859, this was the case. So we may expect a warm summer and a good harvest to gladden us in the present year. A very high max. temp. for so early in the season, ought to occur about the end of next May or in the first ten days of June, unless the very abnormal atmospheric conditions which have not yet ceased to prevail should interfere with the rule.—I am, &c.,

GEORGE D. BRUMHAM.

Barnsbury, March 3rd, 1882.

To the Editor of the Meteorological Magazine.

SIR,—The Winter at this elevated station has been so unusually mild, that I have extracted some figures from the Weekly Reports of the Meteorological Office, in order to compare this with average winters over England generally.

Here are the means for 13 weeks, ending February 27th, 1882, and the departure from the average, and a few of my own figures :—

London.....	41°·0	+0°·6
Oxford	40°·9	+0°·6
Nottingham...	40°·1	+0°·6
York.....	40°·2	+0°·9
Durham	40°·1	+1°·5
Aysgarth	39°·3	+3°·3

AYSGARTH. 660 ft.	1880–1.	1880–2.	Diff.
December ...	37°·4	37°·6	+ 0°·2
January	26°·6	39°·9	+13°·3
February.....	33°·4	40°·5	+ 7°·1
3 Months ...	32°·5	39°·3	+ 6°·8

My average for Aysgarth is that of the last 8 years, and is perhaps too low, while the averages which the Meteorological Office discarded at the end of the year 1881, were generally too high. The excess, therefore, at their stations is certainly not less than is shewn above.

I purposely avoid Greenwich averages; I do not understand them. I hear that one set is derived from photographic observations, which, according to the Meteorological Office, are 1½° too high. I know that from another set our good friend Mr. Brumham made out the winter of 1880–1 to have been almost an average, and I quite expect to hear that the past winter has not been mild at all. There is something too uncanny for simple folk about them.—I am, Sir, your obedient servant,

FENWICK W. STOW.

Aysgarth, Bedale.

To the Editor of the Meteorological Magazine.

SIR,—Now that the winter proper is over, I may call your attention to Mr. Brumham's predictions.

They were, that the past winter would prove "somewhat colder than the average," and that February would prove decidedly cold. Now the mean temperature of December, January, and February, have been here, and I suppose generally the same in other places, respectively, 1°·0, 4°·1 and 8°·1 above the average. I think this confirms my opinion, previously expressed, that prognostications founded on such grounds as Mr. Brumham gives, are entirely untrustworthy.—Yours truly,

S. KING.

Elswick Lodge, March 1, 1882.

DENSE FOG AND BLACK RAIN IN THE ISLE OF MAN.

To the Editor of the Meteorological Magazine.

SIR,—A few notes on the fog of Tuesday, February 7th, may be interesting to some of your readers. In the morning the fog gradually crept up from the sea. About noon it became very dense, assuming a yellow tint which gradually deepened into a greenish black, and from 2 to 2.30 p.m., we were enveloped in almost absolute darkness. During this remarkable half hour, a heavy shower of rain and hail fell yielding ·12 in., which on being examined proved to be quite black and to be loaded with minute particles of carbon, which, even after standing for 48 hours, did not fall to the bottom. These black particles were no doubt wafted to us from the "black country" in England and were retained in the atmosphere by the abnormally high barometric pressure which has prevailed so long (*i.e.* the atmosphere was heavy enough to retain these particles which would under ordinary conditions have fallen to the ground). At 2.30 the darkness began to decrease and the fog gradually departed in a northerly direction. From the reports of various correspondents in different parts of the Island I have been able to trace its course—at Port Erin and Castletown there was nothing but a mist; at St. John's and Kirk Michael it was dull and a few drops of rain fell, but there was no fog, while the mountains were enveloped in it; so it was confined to the eastern side of the mountains. At Ramsey there was dense fog with soft hail and rain about 3 p.m., when the gas had to be lit in the shops. Two huge black columns of cloud passed over Andreas and Bride between 3.15 and 4 p.m., and it rained briskly at the same time, but the fog was not very dense. All the "oldest inhabitants" I have "interviewed" combine in saying that they never witnessed such a phenomenon before in the Isle of Man, and this must be my excuse for writing at such length.

Yours truly,

A. W. MOORE.

Cronkbourne, Isle of Man, Feb. 23, 1882.

A "MOCK SUN" AT FALMOUTH.

To the Editor of the Meteorological Magazine.

SIR,—I send you an extract from the *Falmouth Packet*, relating to a "mock sun" which appeared here on Thursday morning last, the 16th inst., in case you should think it of sufficient interest to insert in the *Meteorological Magazine.*

I witnessed the phenomenon myself, and can therefore answer for the accuracy of the description given. The sun and "mock sun" as I saw them, were both over the sea.

I saw a similar one some four years ago, towards sunset, and about fourteen years ago a very beautiful phenomenon, consisting of crosses of light in each side of the sun and a "mock sun" above the real sun; both when I was in this neighbourhood. As far, therefore, as my personal experience goes it may be called a "rare phenomenon" as these are the only times that "mock suns" have come under my notice.

Yours very truly,
WILSON L. FOX, F.M.S.

Falmouth, 20th February, 1882.

A "MOCK SUN" AT FALMOUTH.—The very rare phenomenon of a parhelion was observed in Falmouth on Thursday morning, 16th February, 1882, soon after sunrise; it lasted for a half-hour, and was exceedingly distinct. Its first appearance was like that of a small part of a rainbow—minus the blue colour—at about 20 degrees west of the sun, and at the same elevation; it speedily gathered itself into a ball of light, a "mock sun," so like the true one that any one not seeing the real sun would not have known but that it was the actual sun. It had, however, this peculiarity—the eastern limb, or side next the sun, was of a dusky red, shading away to a very pale, almost whitish hue on the opposite side, In about 25 minutes it became elongated, again assuming the rainbow appearance, and soon afterwards disappeared. It was not accompanied by any halo round the sun.

BAROMETRIC EXTREMES IN JANUARY.

ALL the figures quoted, and very nearly all the statements made, in the article under the above title in our last number were correct, but we had overlooked the extremely high pressure of January, 1880. This extreme strengthens our argument as to the rarity of high mean pressure and high mean temperature occurring in the same month. This will be best shown by a short table of all the Januarys with mean pressure above 30·3.

Year.	Mean Pressure. in.	Mean Temp. °	Diff. of Temp. from average. °
1779	30·387	34·8	−2·7
1825	30·324	38·4	+0·9
1858	30·357	37·5	0·0
1880	30·385	33 2	−3·3
1882	30·366	40·0	+2·5

THE RECENT HIGH BAROMETRIC PRESSURE.

In connexion with the recent high barometric pressure some noteworthy phenomena have occurred. Thus, at Antibes (a seaport in the South-East of France) the sea level was depressed about a foot, laying bare portions of shore over which boats can usually sail, and exposing surprised sea slugs and other marine animals to the direct rays of the sun. This continued about a fortnight, and is attributed by M. Faye to the high air-pressure. Again, General de Nansouty reports from the Observatory at the top of the Pic du Midi that the lowest temperature there this winter has been only —5° C, (23°·0 F), and during the recent high pressure from January 8th to 20th, the air being in a state of exceptional purity, temperatures as high as 26° C, (78°·8 F) were registered. The highest at Bagnères-de-Bigorre is considerably short of this, so that we have here an inversion of temperature altitude. The General states further that from the 1st of January the zodiacal light was distinctly made out; probably this has never happened before in our climates, so near the winter solstice. Once more, the General and his assistants, on January 20th, at 6.30 p.m., saw distinctly the earthshine on the moon and the thin crescent, though only 25 hours 46 minutes old.—*Times, Feb. 10th.*

A MEMORABLE AUTUMN.

The weather returns for last autumn show that both October and November were months well worthy of the exceptional year to which they belonged. The former month was signalised by a violent gale on the 14th; but the report makes no special mention of the heavy winds which prevailed later in the year. It is, however, in the matter of temperature that the late autumn of 1881 was by far the most remarkable. October was colder than in any year since 1817, when the mean temp. was registered as 45°—that is to say, only 0°·3 lower than in the past year. There was a colder October in 1876; but the coldest ever remembered was two years earlier, when the mean readings of the thermometer descended to 43°·9. This extraordinary lowness of temp., which became still more marked towards the end of October, 1881, naturally led the weather prophets to predict a severe winter. They fancied on the 1st November that the winter had already begun, and would continue without abatement till Christmas; and they were little prepared for the speedy refutation which Nature was preparing for their vaticinations. As the facts turned out, November was still more notable for its high temp. than the preceding month had been for the cold. The ther. stood at an average of 48°·7, or nearly 3½° higher than in October. If a comparison is made between it and the previous 110 years, the registers show that there have been only two other autumns in which there was so warm a November; and in the warmest of these (1818) the excess over last year amounted to only ·5. It thus appears that although neither of the months stands absolutely at the top or the bottom of the list, yet there have never been two together in which the extremes of heat and cold were nearly so great.

SUPPLEMENTARY TABLE OF RAINFALL, FEBRUARY, 1882.

[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	2·28	XI.	Castle Malgwyn	5·24
,,	Margate, Acol	1·01	,,	Rhayader, Nantgwillt..	6·04
,,	Littlehampton	1·49	,,	Carno, Tybritle	3 96
,,	St. Leonards	1·19	,,	Corwen, Rhug	3·02
,,	Hailsham	2·11	,,	Port Madoc	4·18
,,	I. of W., St. Lawrence.	1·13	,,	Douglas.....	3·55
,.	Alton, Ashdell.....	1·82	XII.	Carsphairn	8·62
III.	Great Missenden.....	1·56	,,	Melrose, Abbey Gate...	2·21
,,	Winslow, Addington ...	2·02	XIII.	N. Esk Res. [Penicuick]	3·25
,,	Oxford, Magdalen Col...	1·75	XIV.	Ayr, Cassillis House ...	2·83
,,	Northampton	1·71	,,	Glasgow, Queen's Park.	3·89
,,	Cambridge, Beech Ho...	1·40	XV.	Islay, Gruinart School..	3·38
IV.	Southend	·75	XVI.	Cupar, Kembach.....	2·19
,,	Harlow, Sheering	1·12	,,	Aberfeldy H.R.S.	2·66
,,	Diss	1·62	,,	Dalnaspidal	5·75
,,	Swaffham	1·65	XVII.	Tomintoul.....	1·65
,,	Hindringham	1·71	,,	Keith H.R.S.	1·03
V.	Salisbury, Alderbury...	1·87	XVIII.	Forres H.R.S.	1·44
,,	Calne, Compton Bassett	1·84	,,	Strome Ferry H.R.S....	6·37
,,	Beaminster Vicarage ...	2·33	,,	Lochbroom	4·97
,,	Ashburton, Holne Vic..	4·94	,,	Tain, Springfield.....	2·02
,,	Langtree Wick	2·80	,,	Loch Shiel, Glenaladale	11·96
,,	Lynmouth, Glenthorne.	3·45	XIX.	Lairg H.R.S.	4·80
,,	St. Austell, Cosgarne...	3·86	,,	Forsinard H.R.S.	3·38
,,	Taunton, Fullands	1·44	,,	Watten H.R.S.	1·26
VI.	Bristol, Clifton	2·44	XX.	Fermoy, Glenville	6·16
,,	Ross	3·12	,,	Tralee, Castlemorris ...	3·16
,,	Wem, Sansaw Hall.....	1·83	,,	Cahir, Tubrid	3·51
,,	Cheadle, The Heath Ho.	2·79	,,	Newcastle West	...
,,	Worcester, Diglis Lock	2·28	,,	Kilrush	...
,,	Coundon	1·72	,,	Corofin	2·94
VII.	Melton, Coston	1·68	XXI.	Kilkenny, Butler House	2·95
,,	Ketton Hall [Stamford]	1·60	,,	Carlow, Browne's Hill..	3·36
,,	Horncastle, Bucknall...	1·27	,,	Navan, Balrath	2·91
VIII.	Macclesfield Park	2·86	,,	Athlone, Twyford	2·95
,,	Walton-on-the-Hill.....	1·75	XXII.	Mullingar, Belvedere...	3·08
,,	Broughton-in-Furness..	5·44	,,	Ballinasloe	2·38
IX.	Wakefield, Stanley Vic.	1·51	,,	Clifden, Kylemore	6·91
,,	Ripon, Mickley	1·67	,,	Crossmolina, Enniscoe..	3·43
,,	Scarborough.....	1·42	XXIII.	Carrick-on-Shannon ...	1·93
,,	EastLayton[Darlington]	1·22	,,	Dowra	1·89
,,	Mickleton.....	3·48	,,	Rockcorry.....	2·29
X.	Haltwhistle, Unthank..	3·53	,,	Warrenpoint	4·00
,,	Shap, Copy Hill	7·29	,,	Newtownards	1·57
XI.	Llanfrechfa Grange	3·74	,,	Belfast, New Barnsley .	3·00
,,	Llandovery	5·12	,,	Bushmills	2·40
,,	Solva	2·92		Buncrana	3·17

FEBRUARY, 1882.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	1·30	— ·34	·38	28	8	56·2	26	24·6	2	7	11
II.		Hunton Court	1·30	— ·32	·43	28	9	...	...	...	...	...	...
,,		Strathfield Turgiss	1·47	— ·29	·55	28	12	57·4	14	22·0	2	8	19
III.		Hitchin	1·64	+ ·04	·61	14	10	54·0	26	22·0	1	12	...
,,		Banbury	2·02	+ ·18	·58	28	14	54·0	26	25·0	4	8	...
IV.		Bury St. Edmunds	1·56	— ·21	·55	28	10	56·0	26	20·0	1	11	..
,,		Cossey	1·44	— ·32	·51	14	13	55·5	26	22·0	2	11	11
V.		Bridport	...	...	...	...	...	...	..	...	...	...	...
,,		Barnstaple	2·72	— ·47	·72	25	13	58·0	15	30·0	5	...	...
,,		Bodmin	4·22	— ·65	1·10	28	14	55·0	25	26·0	5	2	7
VI.		Cirencester	1·97	— ·67	·53	28	8	...	...	...	...	...	...
,,		Woolstaston	3·27	+ ·77	·73	26	14	54·5	13	29·0	2	2	5
,,		Orleton, Tenbury	3·41	+ ·94	1·13	28	12	55·7	13	25·0	2	6	7
VII.		Leicester	2·32	...	·81	14	14	55·0	13	27·2	4	3	7
,,		Boston	1·48	— ·30	·62	14	10	56·0	25	27·0	2	7	...
,,		Grimsby	1·36	— ·44	·62	26	10	55·0	25	28·5	2	2	...
,,		Mansfield	1·99	— ·18	·74	28	12	53·2	18	27·4	2	5	10
VIII.		Manchester (Ardwick)	2·25	+ ·06	·97	27	13	54·0	13	28·0	2	2	...
IX.		Ribstone Hall	·92	— 1·23	·74	27	4	...	...	...	...	...	...
,,		Arncliffe	4·55	— ·09	1·23	25	17	54·0	21	25·0	1	...	...
X.		North Shields	·53	— 1·31	·25	28	10	58·0	26	28·5	2	6	8
,,		Seathwaite (Borrowdale)	14·07	+ 2·62	4·16	25	23	...	...	...	...	..	...
XI.	WALES.	Ely	2·88	— ·78	·65	28	13	...	...	...	...	...	...
,,		Haverfordwest	4·47	+ ·02	1·18	28	10	53·5	25	30·0	20	1	4
,,		Plinlimmon (Cwmsymlog)	5·40	...	1·32	26	15	...	...	...	...	...	...
,,		Llandudno	1·66	— ·63	·38	27	15	...	...	31·8	2	1	...
XII.	SCOTLAND.	Cargen	3·54	— ·27	·79	12*a*	16	55·8	21	50·8	16	1	...
,,		Hawick	2·67	+ ·38	·70	24	14	...	...	..	...	...	...
XIV.		Newmains	3·05	— ·12	·68	16	18	...	...	...	...	...	...
XV.		Kilmory	4·79	+ ·40	·65	12	21	...	...	...	...	..	...
,,		Appin (Airds)	5·85	...	...	...	...	...	...	...	...	..	...
,,		Quinish (Mull)	...	...	...	...	...	...	...	...	...	...	.
XVI.		Loch Leven Sluices	3·90	+ ·94	1·00	13	11	...	...	...	...	...	...
,,		Arbroath	1·51	— ·65	·41	26	8	56·0	21	31·0	16	1	...
XVII.		Braemar	2·10	— ·57	·42	12	14	33·5	21	23·9	15	9	23
,,		Aberdeen	·85	...	·25	26	14	56·0	26	27·0	15	3	...
XVIII		Sligachan	14·15	...	3·25	10	22	...	...	...	...	..	...
,,		Culloden	2·14	+ 1·09	·70	27	9	55·0	25	26·5	16	2	13
XIX.		Dunrobin	2·51	...	·60	16	14	53·9	21	23·5	16	4	...
,,		Sandwick	3·20	+ ·65	·45	17	22	50·0	18	29·6	28	3	6
XX.	IRELAND.	Blackrock	5·29	+ ·70	1·39	9	19	55·0	17*b*	30·0	18	3	...
,,		Dromore Castle	4·95	...	1·38	10	16	51·5	...	39·8	...	...	...
,,		Brook Lodge	4·64	...	1·10	28	15	57·0	21	31·0	20	1	...
,,		Killaloe	4·22	...	·87	9	15	59·0	21	30·0	19	1	...
XXI.		Portarlington	2·52	+ ·31	·37	10	19	56·0	25	32 0	2	2	...
,,		Monkstown	1·95	...	·59	28	12	...	...	...	...	...	...
XXII.		Queen's College (Galway)	2·71	...	·52	28	18	55·0	13	36·0	3, 15	0	...
XXIII.		Waringstown	2·14	— ·11	·46	28	19	58·0	26	31·0	2*c*	3	5
,,		Londonderry	3·16	...	·56	12	17	55·0	25	33 0	19	0	7
,,		Edenfel	2·31	+ 0·3	·53	12	20	54·0	25	31·0	14	2	...

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

a And 25. *b* And 26. *c* And 11 and 14.

METEOROLOGICAL NOTES ON FEBRUARY.

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.—An extremely mild and pleasant month, all nature being about one month in advance. Crops wonderfully good and forward. Season so far most favourable. Aurora borealis on 20th. Gale on 28th.

BANBURY.—Mean temp. of month 40°·5. S and H on 15th; high wind on 8 days.

CULFORD.—The month was unusually mild and dry; most favourable for out-door work, making it very difficult to keep pace with advancing vegetation. S and sleet on 15th.

BODMIN.—This month, like the last, was singularly mild and un-wintry. Average barometric pressure 30·20in. On the 20th the mercury rose to 30·90in., the highest I ever registered, except on the 18th January, when it reached the unprecedented height of 30·95in. Mean temp. 44°·4.

THE FIRS, CIRENCESTER.—Remarkable absence of severe frost. Wind principally south-east and south-west.

WOOLSTASTON.—A singularly mild and genial month. Mean temp. 42°·0

ORLETON.—The temperature during the month was steady with only a few frosty nights, and the mean was rather more than 1°·5 above the average of 20 years. The weather was generally cloudy and dull, with the bar. very high and steady. On the 20th it stood at 30·58in. (uncorrected), but on the 26th it fell to 28·73in. With the exception of the nights of the 8th and 13th, very little R fell till the 24th, after which the fall was very heavy, especially on the night of the 28th, causing all the rivers to overflow on March 1st. The high hills were covered with S on the morning of the 15th.

GRIMSBY.—Remarkably fine and dry until towards the close of the month.

ARDWICK.—A somewhat dull month, but mild, not at all like a winter month; the temperature ranged rather high; dense fog occurred on several days in the early part of the month.

ARNCLIFFE.—An unusually dry month, with the exception of the 25th and 26th. Bar. unusually high till the 24th.

SEATHWAITE.—First part of month very mild; very stormy on 12th, with 2·93 in. of R. Thunder on 21st, S on 27th.

WALES.

HAVERFORDWEST.—The high barometric pressure of January continued up to the 7th of February, when a gradual fall of the mercury began, followed by broken weather; the mercury again rose, culminating on the 19th (9 p.m. corrected reading 30·882 in.), pressure continued very high up to 9 p.m. on the 22nd, when it stood at 30·554 in. (corrected), afterwards it gradually fell. From the 24th to the 28th, very stormy, and much R; heavy gale on the last day of the month, bar. at 9 p.m., 28·787 in. (corrected.) The month was charactertized by remarkable mildness, and absence of frost; fields beautifully green, and many primroses and daffodils in bloom. In the remarks for last month, the altitude above sea-level of the bar. at this station was incorrectly stated to be 154ft., it is 54ft.

LLANDUDNO.—On the whole a fine month, and very mild. The mean temperature was about 5° above the average. Up to the 20th, there was a fair amount of sunshine (37·8 hours), after that it was more cloudy.

SCOTLAND.

CARGEN.—Mean temp. of month 43°·6, or 3°·9 above the average; duration of sunshine 65 hours, 29 hours below the average. Highest bar. 30·750 in. on 19th.

HAWICK.—Strong gales, accompanied by R, H, and S, on the 13th and 14th. The hills were whitened again on the 26th and 27th. With these exceptions, the month was a remarkably mild one.

BRAEMAR.—A fine open month; fields ploughed and in readiness for coming operations, an occurrence seldom witnessed in February in this elevated district.

ABERDEEN.—Rainfall about an inch and a half below the average. Fine, hard, dry weather, favourable for agricultural operations, was the most noticeable feature of the month. Brilliant aurora on night of 20th. On the 26th the wind shifted to the N.E., followed by sleet and S showers; the weather continuing squally and unsettled to the close of the month. Gales on 12th and 18th.

CULLODEN.—Month very mild, S and frost both being absent. Vegetation everywhere very forward, giving hope of a good season. The first twelve days very dry and particularly fine.

SANDWICK.—The temp. of the month was high till the last two days. On the 27th the ground was covered with S for the first time during the winter, but it was thawed by the bright sun during the day. Storms on 15th, 16th, 18th and 22nd, those on 15th and 18th being at the rate of 80 miles an hour, a strength which has been reached only twice before during the whole 20 years that an anemograph has been used here, one occasion being on 6th January last and the other 4 years ago. T and L from 5 to 10 a.m. on 14th.

IRELAND.

CORK.—Mean temp. of the month, 44°·4.

DROMORE.—Mean temp. of month, 45°·5.

WATERFORD.—Two gales during the month, both from S.W. Rainfall, 0·88 in. above the average of seven years.

KILLALOE.—A remarkably fine month. No frosts. Vegetation forward.

MONKSTOWN.—The month was characterized by extreme mildness and absence of frost and S.

LONDONDERRY.—Month on the whole mild and very favourable for farming operations, which are being carried on rapidly in this district. Wind principally S.W. Bar.: max. 30·733 in. on 21st; min. 28·828 in. on 26th. Temp. of soil (4 feet below the surface), 44°·9 at the close of the month.

EDENFEL.—Another abnormally fine and mild winter month. Barely perceptible frosts on two nights only. Farm labour a month in advance, but vegetation, fortunately, not so premature.

Thomas Romney Robinson.

FULL of years, for he was nearly 90; full of honours, for the Director of Armagh Observatory was D.C.L. (*Oxon.*), LL.D. (*Cantab.*), one of the eighteen Hon. Members of the I.C.E., besides being F.R.S., Hon. F.R.S.E., and holding similar rank in various societies both in Europe and America, Dr. Robinson has passed away. Few more remarkable instances of long intellectual vigour could be afforded than that of him of whom we never heard an unkind word—whose first work, written before he was 13, was printed in 1806 and whose last important work (a masterly re-investigation of the co-efficients of the anemometer, with which his name will long be associated) was published seventy-three years afterwards, or in 1879—while down to the very last his mind was as clear and his heart as just and as kind as ever, is shown by the letter dated December 3rd, 1881, printed on p. 192 of our last volume.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CXCV.] APRIL, 1882. [PRICE FOURPENCE, or 5s. per ann. post free.

THE ANEMOMETER EXHIBITION.

OUR last number was printed on the day of the opening of the exhibition of anemometers, and therefore we were merely able to announce it, and to add that it contained a remarkably fine series of instruments, of drawings, and of photographs both of apparatus and of damage by whirlwinds. Such a collection has never previously been formed; and having been held at a time when two or more historical instruments were temporarily dismounted, and therefore available, it is certain that many years must elapse before an equally fine one can be formed.

The address of the President of the Meteorological Society, Mr. Laughton, was extremely able and exhaustive, and will, we trust, in due time be published in the Society's Quarterly Journal, and in the *interim* an abstract of it will be found on page 40.

There is, however, we think, still room, and indeed a necessity for placing before our readers, who unfortunately are not all Fellows of the Society, a running commentary upon the various exhibits.

Before commencing, we think it right to mention that, by the kind permission of the Institution of Civil Engineers, in whose library the Exhibition was held, two large photographs of the collection were taken, and that copies can be obtained for a few shillings from the Assistant-Secretary, Meteorological Society, 30, Great George-street, Westminster. As all the instruments bore numbered tickets, these photographs, in which the numbers are very legible, will form a useful adjunct to the following notes, which adopt the sequence and numbering of the catalogue :—

ANEMOMETERS.

1. **Osler's Self-recording Pressure Anemometer.**—*A. F. Osler, F.R.S.*

Very fortunately for the Exhibition, the Osler anemometer belonging to the Midland Institute, Birmingham, has recently been taken down during the rebuilding of the Institute, and had not been re-erected. Mr. Osler was good enough to send it up to London, and on several occasions to attend and personally explain it. An

engraving of an early form of it will be found in Vol. II. (1867), page 111 of this magazine; but the instrument exhibited was in many respects superior. The leading features of this anemometer are (*a*), a long vane or a windmill governor to indicate direction, and also to keep (*b*) a pressure plate precisely perpendicular to the wind as regards azimuth. (*c*) Springs of various degrees of strength, so arranged that as the wind increases in force, stronger and stronger springs are brought into action, and thus as delicate a record as one or two ounces per square foot can be recorded, and yet the instrument would bear without injury nearly or quite 56lbs. per square foot. The pressure and direction of the wind are recorded on a large sheet of paper held on a cylinder with a vertical axis, on which also, by a self-weighing and emptying rain-gauge, the rainfall is continuously recorded. Lastly, as it is very desirable to ascertain the ratio, if any, between the horizontal motion of the air and its pressure, Mr. Osler has arranged a set of Robinson's cups to record upon the same sheet.

2. **Cator's Self-recording Pressure Anemometer.** — *E. E. Dymond, F.M.S.*

In this case, also, the original instrument was exhibited; its two peculiarities are, the form of the pressure-plate, and the manner in which the movement of the plate is resisted.

For the purpose of avoiding the eddy at the back of the plate, which is thought to create a species of vacuum, and so to cause the indicated pressure to be in excess of the real force of the wind, the plate is made the base of a cone.

To receive the pressure, and to enable the instrument while recording light winds to indicate also heavy gales, without a greatly enlarged scale, the chain brought down from the pressure-plate, after passing round a spiral on one side of a light circular plate, is fixed to its axle. On the other side of the plate is another spiral turned the reverse way, round which a string, fixed to the axle, and carrying a weight at the other end, is passed. The power is consequently exerted at a constantly diminishing distance from the centre, while the resistance of the weight is applied at a constantly increasing distance.

The pressure-plate has a square foot of surface. The instrument is calculated to record pressures up to 50lb. on a sheet of paper 4·85 inches wide. The first lb. occupies nearly ·4 inch; the first 5lbs. 1·36 inches; the next 5lbs. ·66, and so on diminishing, until the last 5lbs. (from 45lbs. to 50lbs.) is indicated in a space of about ·24 inch.

A further description and account of the instrument will be found in *Proc. Met. Soc.* iii. 49, 214; iv. 27, 273; and *Meteorological Mag.* ii. (1867), p. 123; v. (1870), p. 181.

3. **Whewell's Anemometer** (a new one).—*Elliott Bros.*

4. **Whewell's Anemometer.** The instrument used at the Royal Observatory, Greenwich, from 1843 to 1862.—*W. H. M. Christie, F.R.S., Astronomer Royal.*

A very good engraving of this instrument will be found in Drew's *Practical Meteorology*. Its leading features are (1) a vane which causes a pencil to mark against different portions of a paper-covered cylinder according as the wind blows from one point or another; (2) a windmill governor, which turns a very long screw, and by so doing causes the direction pencil to descend. The curve on the paper, therefore, shows from what direction the wind was blowing when the velocity of the wind was greatest. There is no indication of time—simply horizontal motion and direction.

5. **Robinson's cup and dial Anemometer.** — *Meteorological Council.*

6. ,, ,, ,, (two dials).—*L. P. Casella, F.M.S.*

These two may advantageously be taken together. We may surely assume that all our readers are familiar with the very simple form of anemometer known as Robinson's cups, in which four extremely light hollow hemispheres are fixed on four radial arms, with the opposite hemispheres facing in opposite directions, so that from whatever direction the wind may blow, the excess of pressure in the hollow of the cups over that on their exteriors, will cause the system to revolve in one direction. It was originally assumed that these cups travelled through one third of the distance of the wind which turned them and they are at present all made to indicate on their dials or recording sheets three times the space through which the cups travel, but recent experiments have shown that this is not correct, and that about $2\frac{3}{4}$ is nearer the truth.

The above were small-sized instruments, indicating by trains of wheels the total distance travelled.

7. **Fletcher's Anemometer.**—*Chadburn & Sons.*

This was an adaptation of Lind's anemometer (which will be mentioned immediately) to the measurement of currents, chiefly for ventilating or manufacturing purposes.

8. **Robinson's cup Anemometer with direction fans and Electrical Registering Apparatus,** designed by S. M. Yeates.— *Yeates & Son.*

A rather neat arrangement for electrically registering at any distance the direction and horizontal motion of the wind. The direction is obtained by a windmill governor, and the velocity by Robinson's cups—the recording apparatus is neatly mounted in plate glass frames, well adapted for a library ornament and would apparently work well. The anemometer might with advantage be mounted on a tall column or a stout mast with efficient stays, and thus the injurious effect of proximity to a building would be avoided.

9. **Lind's Anemometer.** An old form of this instrument in which the force of the wind is measured by water.— *Meteorological Council.*

If a glass tube be bent into the form of the letter U, and partly filled with water, the liquid will stand at the same height in both legs, but if one leg be bent at a right angle and held so that the wind may blow into it, the water in that leg will be lowered, and that in the other leg raised by distances the sum of which is equal to the pressure of the wind on the surface exposed, so that a difference of level of an inch corresponds to about 5lbs. per square foot.

10.—**Sir Snow Harris' Wind Gauge.** An improved form of Lind's Anemometer.—*Meteorological Council.*

This is a rather complicated form, being provided with a level to ensure its perpendicularity, and with a trigger and two caps, one fitting on to each end of the tube, the idea being that by this means the observation could be read off at leisure, the column of water being locked up under pressure.

11. **Modification of Lind's Anemometer,** one limb of the tube being inclined at a small angle to the horizon.—*Kew Committee.*

We do not know whether this was a model, or whether any observations have ever been made with it—if they have it must surely have been in Liliput—for the entire apparatus would hardly weigh an ounce, and the bore of the tube is so small that we should think it a better test of capillary action than of the velocity of the wind.

12. **Pressure Anemometer,** by Sir F. Ronalds, in which the force of the wind is determined by means of a simple balance. This instrument was erected at the Kew Observatory in 1844.—*Kew Committee.*

The best general idea of this apparatus is afforded by a pair of scales, of which the beam is about 18 inches long, and from the index of which rises a rod carrying a plate about 1 foot square. In a calm the pressure on the board is *nil ;* the bowls of the scales are level, and the board is vertical. If the wind is blowing, its pressure drives the board out of the vertical, and by adding weights to one bowl until the board is again vertical, the pressure exerted is ascertained. Obviously this gives no continuous record, and must be entirely inoperative in gusts which would not last long enough for the weight to be determined, and, moreover, from the very first impact of wind, the plate will cease to be truly vertical.

13. **Original Model of Beckley's Self-registering Anemometer,** exhibited at the Meeting of the British Association in 1856.—*Kew Committee.*

14. **Recording Apparatus for a Beckley Anemometer,** designed by Mr. De La Rue with a view of affording wind's velocity curve directly applicable to the Galton Pantagraph and Thomson Harmonic Analyser.—*Kew Committee.*

15. **Casella's Improved Self-recording Beckley Anemometer.** *L. P. Casella, F.M.S.*

These three may be taken together. No. 13 shows the first arrangement for causing a windmill governor to record direction on a paper-covered cylinder, driven by clockwork. (Although, of course, direction and time combined had been previously recorded *e.g.*, by Osler's anemometer), and the first arrangement for causing Robinson's cups to record velocity on the same paper. No. 14 differs from No. 13, chiefly in possessing what was rather irreverently described as a "fly-back-to-zero" arrangement.

No. 15 was a full sized Beckley Anemometer of the best pattern.

16. **Cups and Shaft of Robinson's Anemometer,** fixed on the dome of the Kew Observatory in 1856; dismounted in 1867. Since then it has been fitted with a simple counting apparatus (not exhibited) and employed as a standard for comparisons. In 1872 it was used at the Crystal Palace by Messrs. Jeffreys and Whipple for the purpose of determining the correct value of Robinson's factor.—*Kew Committee.*

17. **Registering Apparatus for the above Anemometer.** The wind's velocity only was recorded, the instrument being fitted inside a movable dome was not adapted for registration of direction.

18. **Howlett's Self-recording Anemometer.**—*Elliott Bros.*

This is a very peculiar pattern of pressure anemometer, consisting of a large metal ball sliding on a rod, which rod passes through a ball and socket-joint, and has on its lower end a heavy cylinder of lead, and at its lower extremity a pencil. In calm the rod remains vertical, but when there is any wind its pressure drives the ball over, and consequently forces the pencil to pass in the opposite direction, thus indicating on a paper fixed beneath it the direction of every puff of wind. A rough indication of the *force* of the wind is given by the length of the trace, but as there is evidently liability to pendulous motion being set up, the indications of force cannot be reduced to absolute measure. A facsimile of the traces of this instrument will be found in *Met. Mag.* vol. iii. (1868), p. 9. What with the ball being painted a brilliant red, and what with its pendulous motion, the apparatus bore a remarkable resemblance to a model buoy or floating beacon.

19. **Oxley's Anemometer.**—*Meteorological Council.*

This is a pressure anemometer, with a small plate 6 in. by 6 in. kept face to wind by a vane; the resistance is given by a spring which causes a hand to rotate over a graduated circular dial. Underneath the dial is a circular disc of slate, and a slate pencil carried by the indicating hand marks on this slate the extreme point to which it has been driven, *i.e.*, the max. pressure since the slate was cleaned,

and the compass point whence such pressure was exerted. We believe that a description of one form of this instrument is given in the *Mem. Lit. & Phil. Soc., Manchester*, 1869, but have not verified the reference.

20.—**Wild's Anemometer.**—*Meteorological Council.*

This, which is sometimes known as Prestel's and sometimes as the pendulum anemometer, is a modification of a very old pattern—nearly 200 years old. It is a square iron plate, freely swung, flapwise, from its two upper corners, and, therefore, deflected from the perpendicular to a greater or less extent, according to the strength of the wind.

21. **Hall's Electro-Magnetic Anemometer.**—*J. J. Hall, F.M.S.*

An early pattern (1870) for electrically registering the indications of a Robinson anemometer—the special feature being that, if desired, a striking train can be thrown into action, and a stroke given on a bell for each one-twentieth of a mile of passing wind. By timing these strokes by a seconds watch, velocities can be determined for very short intervals. It seems to us that a very careful series of such observations might be useful for comparison with the indications of pressure anemometers, at any rate they would afford much fuller information than any velocity anemometer at present at work. For engravings and details, see *Proc. Met. Soc.*, vol. v., p. 301, *Met. Mag.*, vol. v. (1870), p. 168, and vol. vi. (1871), p. 222, also *Horological Journal*, vol. xiv., p. 7.

22. **Registering Wind Gauge,** for recording gusts of wind in pounds pressure per square foot.—*J. Somerville.*

This was a large and novel form of anemometer. A funnel somewhat like a rain gauge funnel with a square aperture 12 in. by 12 in. led to a pipe about 1 in. in diameter, which communicated with an air chamber. The funnel was kept face to wind by a powerful vane. Any pressure of wind exerted upon the funnel is transmitted (? minus loss by friction) down the tube into the air chamber, and there causes a float to rise proportionately to that pressure. Attached to the float is a pen. Behind the pen, and in contact with it, is a circular disc covered with paper, which disc revolves once in 24 hours. If perfect calm reigns throughout, a line is traced near the circumference of the paper, but when wind prevails the line is carried nearer and nearer to the centre of the disc; therefore, the disc being segmentally divided, the time of each gust is shown, and being concentrically divided into rings corresponding to the pressure, its amount can also be read off. The instrument gives no record of direction.

23. **Experimental Anemograph.**—*H. S. H. Shaw.*

This, as the title implies, was not a completed instrument, but merely one fitted up for experimental purposes. The two leading novelties in it are the facts that (1) the cups are supported by friction balls, which, in order to prevent their ever remaining at rest, are turned

by a cone instead of by a flat plate; and (2) an arrangement of steam engine governors attached to the lower part of the shaft coming from the cups.

24. **Wind Indicator, constructed by Beckley for use at Telegraph Reporting Stations.** The first instrument in which chain connection was used in lieu of shafting.—*Kew Committee.*

25. **Galton's Torsion Spring Anemometer** (rough model).—*Kew Committee.*

Small-sized Robinson's cups so fitted that they could only rotate through a very small segment of a circle, and with gradually increasing resistance. Virtually the arrangement seems to amount to Robinson's cups used as a pressure anemometer.

26. **Hagemann's Anemometer** (pattern No. 1).—*Meteorological Council.*

27. **Hagemann's Anemometer** (pattern No. 2).—*Cowl Committee of Sanitary Institute.*

28. **Hagemann's Anemometer** (pattern No. 2) in pieces, showing working parts.—*Cowl Committee of Sanitary Institute.*

No. 26 may be briefly dismissed as closely resembling in general principle the reverse of Lind's (No. 9), for whereas in Lind's the water level is displaced by the wind blowing into one leg, in Hagemann (No. 26) the displacement is produced by the wind passing over an orifice, and so producing a diminution of pressure. In Nos. 27 and 28 the same principle is applied to an arrangement much resembling a gasometer (*not* a gas meter be it observed), and the force of the wind by producing diminished pressure causes a hand to revolve over a dial about 4 in. in diameter.—For further details see *Quar. Jour. Met. Soc.*, vol. V., p. 203.

29. **6 in. Air Meter,** special construction.—*Cowl Committee of Sanitary Institute.*

Following, as we are doing, the order of the catalogue, which depended to a considerable extent upon what may be classed as accidental circumstances, we are suddenly brought to an instrument differing widely, both in its construction and application, from all that we have hitherto described.

All the instruments previously described (except No. 7) have been intended for recording the motion of the wind. This air meter would of course be capable of registering the horizontal motion of the air, but it is intended only for use in determining slight currents of air, chiefly artificial ones in questions of ventilation, &c. Nearly all these air meters, current meters, &c., have for their motive power the impingement of the current on very light fans attached obliquely to the radii of a wheel—in fact, very small windmill governors. The special feature of No. 29 is that, instead of the registering dials being in the centre of the rotating fans (and thus creating an obstacle in

the very centre of the passing air stream), the registering train is carried by the external ring which surrounds and protects the fans.

30. **3 in. Air Meter,** Lowne's pattern.—*Cowl Committee of Sanitary Institute.*

A smaller pattern with the registering apparatus behind about half of the rotating fans, the dial being at a right angle to the plane of the cups.

31. **Quadrant for measuring light draughts by inclination of candle flame.**—*Cowl Committee of Sanitary Institute.*

The flame of a candle is, perhaps, almost the most delicate indicator of slight currents which we have. In this apparatus the candle is placed at the end of a radius bar which traverses a quadrant. In perfect calm the flame is, of course, vertical; if there be any motion in the air the flame will be deflected, and the amount is ascertained by moving the candle until the flame is exactly in the same straight line as the candle and the radius bar, and then the deflection is read off on the graduated quadrant.

32. **Hicks's Air Meter** on Robinson's principle.—*Kew Committee.*

We have no knowledge of the degree of accuracy attained by this instrument, but there seems no reason why it should be less than that with the small windmill governors, though at first sight of the four little cups (not an inch across), one wonders whether it is not a model or a toy—the whole apparatus, four cups, registering dial, &c., would easily go inside one cup of a Kew pattern Robinson. However, Mr. Hicks is hardly likely to turn out a toy, and it would be disrespectful to suppose that the Kew Committee would exhibit one, and as we have already said, there seems no obvious reason why small sized Robinson's cups should not work as well as large ones.

(To be continued.)

THE METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this society was held on Wednesday, March 15th, at the Institution of Civil Engineers, 25, Great George-street, Mr. J. K. Laughton, F.R.A.S., president, in the chair. The following gentlemen were balloted for and duly elected Fellows of the society:—T. H. Baker, J. T. Barber, W. H. Jackson, Captain J. Simpson, R. F. Sturge, and Sir B. J. Sulivan, K.C.B. The president (Mr. J. K. Laughton) gave a historical sketch of the different classes of anemometers. He remarked that anemometers are of different classes according as the strength is estimated by the pressure on a surface, or by the velocity, by its power of suction, or by its cooling effects. Those that measure pressure may do so either by causing the plate which receives the wind to swing backwards along a graduated quadrant, or by bridling—that is, restraining that motion, and observing the resistance called into play; or by receiving the

wind on a plate which can only move backwards against either a spring, a lever attached to a weight, or a column of liquid. Others, again, receive the wind on the surface of the liquid, and show the pressure by the disturbance of the equilibrium in a siphon tube. At the present time, and in this country, the instruments generally used are those which measure velocity, the type now commonly adopted being that known as Robinson's Cups, in which four hemispherical bowls placed at the arms of a horizontal cross cause it to rotate freely as the wind blows against them. But many very different instruments have been used for measuring velocity, the most primitive of which was a disc of cork, fringed with light feathers—a species of shuttlecock—travelling freely along a considerable length of fine wire stretched in the direction of the wind. Rotation has, however, been the favourite way of bringing the motion of the wind within reach of the observer, and to get that rotation almost every conceivable form of wheel or fan seems to have been tried. What are known as suction anemometers depend on the hydraulic principle of the lateral communication of motion by a stream. A current of air blowing across the open end of a pipe draws the air out of that pipe, causing within it a partial vacuum, which by various arrangements can be measured, the relative vacuum depending on the strength or velocity of the wind which gives rise to it. Several different methods have been adopted for measuring this vacuum; but though anemometers constructed on this principle take hold of the imagination by their neatness and simplicity, the unknown amount of disturbance due to friction, or, when long pipes are used, to vibration, prevent their being received at present as satisfactory gauges of the wind's velocity. Other anemometers have been made on the principle that the evaporation of water, or the cooling of a heated surface—other things being equal—goes on at a rate proportional to the velocity of the wind; but in practice it has been found difficult to insure the equality or uniformity of conditions, or to make correct allowance for their difference. One very ingenious instrument, by receiving the air into different pipes, and opening different valves according to its varying strength, causes them to give out two simultaneous but distinct musical notes, the one of which answers to a definite direction, the other to a definite velocity. Such things can, at present, only be considered as pretty and ingenious toys; they can undoubtedly mark a difference between one wind and another, but are quite unequal to giving any exact measure of relative, and still more of absolute force. Even the more generally recognised types of anemometers, the very commonly used pressure plates of Mr. Osler, or the revolving cups of the late Dr. Robinson, are by no means entirely satisfactory. The action of stream lines in front, or of the partial vacuum behind the exposed surface, leads to curious vagaries, difficult to understand, and as yet impossible to correct; but until they are understood and corrected, anemometry, as a science, stands on a very uncertain basis. The president, in conclusion, said that what we want is not so much

new and improved apparatus for registering or recording, for though those we have are not perfect, they are far superior to the anemometers they are applied to. What we want is rather some radical improvement in the instrument itself, or in the theory which translates its action. It is to this that he wished more especially to call the attention of all meteorologists.

THE LATE WINTER.

To the Editor of the Meteorological Magazine.

SIR,—When a general who has taken up an untenable position is compelled to retire from it in the face of the enemy, he sometimes finds it expedient to throw out a cloud of skirmishers to mask his retreat. Similarly, Mr. Brumham, having hazarded some predictions regarding the late winter, which have been somewhat signally falsified by the event, effects his retreat in your last number behind a cloud of figures. Still the fact remains that Mr. Brumham made two definite predictions—1st, that the winter of 1881-2 would be "colder than the average," and 2nd, that the month of February especially, would be "decidedly cold,"—and that neither of these predictions has been fulfilled.

Mr. Brumham finds "a curious reversal of figures," in the fact that while the Greenwich minimum temperature for the winter of 1880-1 was 12 degrees; in the winter of 1881-2 it was 21 degrees. This seems to me to be very instructive; I am not writing ironically, but in all seriousness, for it is very suggestive of the purely arbitrary nature of the coincidences and contrasts on which Mr. Brumham relies, that he should find anything "curious," or worth directing attention to in the fact that the minimum temperature of a given winter, *read backwards in degrees of the Fahrenheit scale*, should be identical, or nearly identical, with that of another winter.

As regards the Greenwich averages, quite apart from the question raised by Mr. Stow as to the reliableness of the methods by which they have been arrived at, it has long seemed to me a great misfortune, meteorologically speaking, that they should have been adopted as the standard for England. It is true that no one observatory could furnish averages that would be generally suitable for a country like England, with so many local varieties of climate; but Greenwich, situated as it is in the extreme S.E. corner of our island, on the E. edge of a Sahara of a hundred square miles or so of brick and mortar, and slate and asphalte, with its semi-continental climate, its short spells of almost tropical heat in summer, and its smoke-fogs in winter, is probably about the very worst that could have been selected to represent England generally.—I am, Sir, yours faithfully,

G. T. RYVES.

Tean Vicarage, Stoke-on-Trent, April 10th, 1882.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPT., 1881.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	73·7	18	41·7	16	65·4	49·7	52·0	88	119·3	36·3	2·03	11	7·9
Cape of Good Hope	90·6	25	37·0	7	71·5	50·6	52·11	77	...	...	1·23	7	4·0
Mauritius	76·4	26	58·0	4	74·3	65·0	58·3	69	...	...	1·01	14	5·9
Calcutta	92·2	11	74·5	17	88·3	78·3	78·7	87	162·3	72·8	6·75	19	7·7
Bombay	86·5	21	74·4	13	84·6	76·8	75·6	84	152·8	68·9	4·56	21	7·6
Ceylon	...	...	...	...	...	...	...	...	...	...	...	...	...
Melbourne	78·0	16	34·9	13	63·7	44·5	41·0	64	116·6	25·5	·61	10	5·1
Adelaide	85·8	16	40·2	22	65·9	48·3	44·7	63	143·0	29·0	1·81	11	5·6
Wellington	68·0	21	37·9	8	58·1	46·4	...	...	128·0	33·0	3·88	10	...
Auckland	68·3	...	38·2	...	...	...	...	81	123·5	...	2·16	13	7·6
Falkland Isles	51·3	8	27·0	23	42·6	33·9	36·4	90	105·0	19·7	1·87	22	8·0
Jamaica	92·0	10	71·4	14	88·5	73·7	72·8	83	...	...	2·28	15	6·5
Barbados	86·0	7	69·0	16	83·0	73·0	74·0	80	154·0	69·0	13·82	23	6·0
Toronto	92·7	6	45·5	12	76·9	59·2	59·6	75	144·5	39·0	·90	14	6·5
New Brunswick, S. John	80·0	1	38·0	22	64·3	51·1	52·8	85	...	...	3·48	10	5·8
Cape Breton, Sydney	76·4	7	38·6	25	64·5	48·7	52·6	85	...	...	2·26	11	6·3
Newfoundlnd, S. John's	67·6	20	40·0	30	58·1	46·6	48·0	85	126·0	40·0	5·85	9	6·5
Manitoba, Winnipeg	81·0	13	24·8	28	62·2	39·7	44·7	78	...	...	2·60	17	7·1

REMARKS, SEPTEMBER, 1881.

Mauritius.—Rainfall, 0·33 in. below average; mean bar. 30·222 in. Mean hourly velocity of wind, 12·5 miles; greatest, 31·9 miles on 11th; least, 2·0 miles on 18th; prevailing direction, E.S.E. to E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp., humidity and pressure all about the average; rainfall 1·73 in. below it. Prevailing wind, N.; strong breezes on 6 days; H, T and L on 21st, aurora australis on 13th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean bar. 30·107 in. The rainfall over the agricultural portions of the colony was below the mean, but throughout the northern pastoral district it exceeded the average, though none fell between lat 30° and 15°. Mean temp. at Adelaide, average. C. TODD.

Auckland.—Very wet up to 13th. Wind, chiefly N.W. and S.W., strong on 11th and 12th; remainder of month tolerably fine, though cloudy. Average velocity of wind, 12·9 miles; max. in 24 hours, 720 miles on 20th. Mean pressure, 30·096 in., ·100 in. above the average. E. B. DICKSON.

Wellington.—First few days fine and bright; from 8th to 22nd, fine bright weather, prevailing winds N.W., sometimes strong; from 23rd to 26th, wet and rather windy; remainder of month fine, prevailing wind N.W. Smart shock of earthquake on 1st, very slight shock on 14th. Mean pressure ·066 in., and mean temp. 1°·0 above the average of 17 years. R. B. GORE.

Falkland Isles.—Strong gales throughout the month. F. E. COBB.

BARBADOS.—Mean atmospheric pressure ·18 in. below the average of 17 years; mean temp., average. The wind was from N.E. on 26 days, and S.E. on 3 days; average velocity, 7·3 miles per hour, extremes 11·7 miles and 2·8 miles. Rainfall, 30 per cent. above the average of 25 years. 15 days were overcast, TSS on 5 days, and L on 3 other days. R. BOWIE WALCOTT.

NEWFOUNDLAND.—One half of the month was more or less fair; the remainder, rainy and foggy. On the whole weather very unsettled. J. DELANEY.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCTOBER, 1881.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	62·8	1	27·3	17	52·6	39·6	39·9	82	112·4	20·6	2·99	12	6·4
Cape of Good Hope	99·7	16	41·2	24	79·1	51·4	52·24	67	...	...	1·06	6	3·4
Mauritius	79·0	29	63·1	2	77·1	67·4	60·7	69	...	...	1·83	14	6·2
Calcutta	90·4	3	67·5	25	87·0	73·6	73·5	82	153·0	58·0	1·50	8	3·4
Bombay	92·4	23	73·1	28	87·4	75·5	74·5	79	151·4	61·8	4·17	4	2·2
Ceylon	89·0	28	72·3	29	86·8	75·9	74·3	79	160·0	64·0	9·71	20	5·0
Melbourne	84·9	29	35·4	7	68·5	47·0	44·0	68	130·2	29·5	3·05	18	6·2
Adelaide	89·3	28	41·2	22	68·5	50·4	43·9	56	154·0	29·5	1·31	15	6·1
Wellington	68·3	22	40·5	18	60·5	48·1	...	...	136·0	37·0	3·50	12	...
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Falkland Isles	62·4	25	31·6	7†	49·5	37·6	39·6	80	122·9	26·0	1·95	12	5·7
Jamaica	91·6	17	69·7	15	86·7	72·4	72·5	83	...	...	7·89	15	6·2
Barbados	85·0	6, 8	71·0	25	83·0	74·0	73·9	81	163·0	70·0	11·64	20	6·0
Toronto	77·0	3	27·0	27	58·2	40·9	49·3	80	135·0	17·4	3·82	20	6·8
New Brunswick, S. John	66·0	9	24·0	27	50·3	37·7	40·0	82	...	...	3·94	13	5·7
Cape Breton, Sydney	81·3	1	26·3	25	52·2	37·6	40·2	80	...	...	3·76	17	6·6
Newfoundlnd, S. John's	55·3	4*	27·6	21	48·3	36·4	40·0	91	125·0	24·0	4·97	13	6·5
Manitoba, Winnipeg	63·3	7	11·0	22	44·6	24·8	29·0	79	...	...	1·51	15	7·2

* And 26 † And 15

REMARKS, OCTOBER, 1881.

Mauritius.—Rainfall about the average; mean bar. 30·165 in. Mean hourly velocity of wind, 12·4 miles; greatest, 28 miles on 31st; least, 2·1 miles on 28th; prevailing direction, E.S.E. to E. by N. C. MELDRUM, F.R.S.

CEYLON.—TSS occurred on five days; L was seen on nine. J. STODDART.

Adelaide.—Mean bar., 30·105 in., about the average. Rainfall below the mean, the deficiency being more marked over Yorke's Peninsula and about Lake Torrens. In the neighbourhood of Lake Eyre, the fall exceeded the mean, but throughout the tropics it was 50 per cent. below it. Mean temp., nearly 3° below the average, the lowest ever recorded. C. TODD.

Melbourne.—Mean temp. of air, 2°·1, and of dew-point, 2°·6 below average; humidity and amount of cloud, both slightly below it. Rainfall and mean pressure slightly above the average. Prevailing winds, S.W. and S.; strong breezes occurring on 7 days Heavy dew on 6 days, H on 3, L on 2. R. L. J. ELLERY, F.R.S.

Wellington.—Fine, bright weather from 1st to 6th, showery to 8th; generally fine from 9th to 12th; showery and squally from 13th to 15th; then followed fine, bright weather to 22nd; wet on 23rd, 24th and 25th; remainder of month, fine and bright; frequent strong winds. Mean pressure, average; mean temp. above the average; rainfall, below it. R. B. GORE.

Falkland Isles.—Weather generally fine and bright; strong winds. F. E. COBB.

BARBADOS.—Mean bar. below average; mean temp., 1° above it. N.E. winds prevailed on 27 days; average velocity, 7·5 miles; extremes 15·2 miles and 3·1 miles. The rainfall was 19 per cent. above average. TSS on 23rd and 26th. R. BOWIE WALCOTT.

NEWFOUNDLAND.—The month was for the most part rainy, hazy and misty. On the 19th, 8 in. of S. J. DELANEY.

SUPPLEMENTARY TABLE OF RAINFALL, MARCH, 1882.

[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	·94	XI.	Castle Malgwyn	2·77
,,	Margate, Acol	1·32	,,	Rhayader, Nantgwillt..	4·25
,,	Littlehampton	·99	,,	Carno, Tybritle	5·17
,,	St. Leonards	1·38	,,	Corwen, Rhug	2·63
,,	Hailsham	1·37	,,	Port Madoc	3·86
,,	I. of W., St. Lawrence.	·79	,,	Douglas.....	..
,,	Alton, Ashdell.....	1·51	XII.	Carsphairn	5·89
III.	Great Missenden.....	2·04	,,	Melrose, Abbey Gate...	2·74
,,	Winslow, Addington ...	1·43	XIII.	N. Esk Res. [Penicuick]	5·50
,,	Oxford, Magdalen Col...	1·18	XIV.	Ayr, Cassillis House ...	4·05
,,	Northampton	1·23	,,	Glasgow, Queen's Park.	3·50
,,	Cambridge, Beech Ho...	1·32	XV.	Islay, Gruinart School..	3·73
IV.	Southend	·98	XVI.	Cupar, Kembach.....	2·33
,,	Harlow, Sheering	1·49	,,	Aberfeldy H.R.S.	4·20
,,	Diss	1·52	,,	Dalnaspidal	9·08
,,	Swaffham	1·41	XVII.	Tomintoul.....	3·07
,,	Hindringham	1·33	,,	Keith H.R.S.	2·96
V.	Salisbury, Alderbury...	·87	XVIII.	Forres H.R.S.	3·03
,,	Calne, Compton Bassett	1·82	,,	Strome Ferry H.R.S....	7·88
,,	Beaminster Vicarage ...	1·74	,,	Lochbroom	10·50
,,	Ashburton, Holne Vic..	2·35	,,	Tain, Springfield.....	3·30
,,	Langtree Wick	1·61	,,	Loch Shiel, Glenaladale	16·05
,,	Lynmouth, Glenthorne.	2·36	XIX.	Lairg H.R.S.	6·99
,,	St. Austell, Cosgarne...	...	,,	Forsinard H.R.S.	5·89
,,	Taunton, Fullands	·84	,,	Watten H.R.S.	2·68
VI.	Bristol, Clifton	2·29	XX.	Fermoy, Glenville	2·81
,,	Ross	1·04	,,	Tralee, Castlemorris ...	2·52
,,	Wem, Sansaw Hall.....	1·59	,,	Cahir, Tubrid	2·08
,,	Cheadle, The Heath Ho.	2·07	,,	Newcastle West	2·67
,,	Worcester, Diglis Lock	1·24	,,	Kilrush	3·20
,,	Coundon	1·86	,,	Corofin	4·17
VII.	Melton, Coston	·98	XXI.	Kilkenny, Butler House	1·73
,,	Ketton Hall [Stamford]	1·04	,,	Carlow, Browne's Hill..	2·07
,,	Horncastle, Bucknall ...	1·35	,,	Navan, Balrath	2·58
VIII.	Macclesfield Park	2·08	,,	Athlone, Twyford	4·73
,,	Walton-on-the-Hill.....	2·34	XXII.	Mullingar, Belvedere...	2·34
,,	Broughton-in-Furness..	4·96	,,	Ballinasloe	3·45
IX.	Wakefield, Stanley Vic.	1·70	,,	Clifden, Kylemore	8·68
,,	Ripon, Mickley	2·45	,,	Crossmolina, Enniscoe..	5·33
,,	Scarborough.....	1·52	XXIII.	Carrick-on-Shannon ...	3·53
,,	East Layton [Darlington]	2·26	,,	Dowra	...
,,	Mickleton.....	3·95	,,	Rockcorry.....	3·88
X.	Haltwhistle, Unthank..	3·69	,,	Warrenpoint	3·31
,,	Shap, Copy Hill	5·67	,,	Newtownards	2·16
XI.	Llanfrechfa Grange	2·61	,,	Belfast, New Barnsley .	3·33
,,	Llandovery	3·84	,,	Bushmills	3·32
,,	Solva	1·34	,,	Buncrana	3·08

MARCH, 1882.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	1·35	— ·26	·67	25	11	63·9	20	28·5	4	3	15
II.		Hunton Court	·95	— ·63	·46	25	11	...	...	...	...	...	...
,,		Strathfield Turgiss	·93	— ·47	·45	25	11	64·2	18	28·6	4, 23	9	20
III.		Hitchin	1·15	— ·33	·57	25	12	58·0	20	27·0	3, 22	13	...
,,		Banbury	1·17	— ·43	·61	25	13	59·5	18	27·0	23	15	...
IV.		Bury St. Edmunds	1·93	+ ·37	1·10	25	11	60·0	20*a*	26·0	3, 22	13	...
,,		Cossey	1·26	— ·43	·83	25	11	63·8	18	29·0	22	10	15
V.		Bridport	1·34	...	·67	31	15	...	...	...	...	...	...
,,		Barnstaple	1·71	— ·78	·39	25	16	62·5	8	31·0	4	...	...
,,		Bodmin	1·74	— 1·42	·47	25	17	58·0	18	31·0	4	1	11
VI.		Cirencester	1·99	— ·08	·53	25	14	...	...	...	...	...	...
,,		Woolstaston	2·62	+ ·46	·79	25	15	63·0	18	27·0	22	4	10
,,		Orleton, Tenbury	1·23	— ·64	·51	25	13	64·8	16	26·7	4	11	14
VII.		Leicester	...	...	...	...	...	...	...	...	...	...	...
,,		Boston	1·18	— ·11	·72	25	8	63·0	18	29·0	23	4	...
,,		Grimsby	1·31	— ·35	·43	25	13	61·5	18	31·0	22	1	...
,,		Mansfield	...	...	...	...	...	...	...	...	...	...	...
VIII.		Manchester (Ardwick)	2·45	— ·07	·51	26	13	56·0	...	32·0	22	1	...
IX.		Ribstone Hall	1·98	— ·15	·52	26	8	...	...	...	...	...	...
,,		Arncliffe	7·49	+ 2·73	1·39	24	22	57·0	15	29·0	22	6	...
X.		North Shields	·99	— ·46	·60	1	11	63·5	16	28·2	7, 23	4	7
,,		Seathwaite (Borrowdale)	13·78	+ 3·89	1·95	24	24	...	...	...	...	..	...
XI.	WALES.	Ely	1·37	— 1·32	·38	1	17	...	...	...	...	...	...
,,		Haverfordwest	2·33	— ·86	·62	25	17	57·0	16	29·0	3	6	10
,,		Plinlimmon (Cwmsymlog)	3·95	...	1·12	2	22	...	...	...	...	...	...
,,		Llandudno	2·62	+ ·74	·58	25	17	56·3	10	34·0	21	0	...
XII.	SCOTLAND.	Cargen	4·74	+ 1·96	1·06	24	20	56·2	16	32·2	22	0	...
,,		Hawick	3·23	+ 1·27	·54	9	20	...	...	...	...	...	...
XIV.		Newmains	4·81	+ 1·67	·78	9	24	...	...	...	...	...	...
XV.		Kilmory	6·84	+ 2·23	·84	7	25	...	...	27·0	31	6	...
,,		Appin (Airds)	7·48	...	...	...	...	...	...	...	...	...	...
,,		Quinish (Mull)	5·81	...	·60	28	27	...	...	...	...	...	.
XVI.		Loch Leven Sluices	3·50	+ 1·38	·60	10	16	...	...	...	...	...	...
,,		Arbroath	1·66	+ ·03	·63	1	13	59·0	16	32·0	7, 25	2	...
XVII.		Braemar	4·08	+ 1·89	1·10	2	24	55·8	16	25·0	7	11	26
,,		Aberdeen	1·86	...	·63	1	19	65·0	16	29·0	6	5	...
XVIII		Sligachan	15·57	...	2·14	24	27	...	...	...	...	..	...
,,		Culloden	3·23	+ 1·48	·46	8	13	...	...	...	...	3	18
XIX.		Dunrobin	4·61	...	·53	1	22	57·0	17	27·0	7	4	...
,,		Sandwick	5·81	+ 3·17	·74	6	29	53·2	9	28·5	7	3	5
XX.	IRELAND.	Blackrock	2·19	— ·57	·55	19	18	64·0	15	30·0	11	6	...
,,		Dromore Castle	4·50	...	·73	25	25	58·0	17	30·0	2	...	...
,,		Brook Lodge	1·76	...	·36	25	15	60·0	15*b*	29·0	30	4	...
,,		Killaloe	5·76	...	1·59	1	19	64·0	15	29·0	31	3	...
XXI.		Portarlington	3·07	+ ·91	·75	25	23	60·5	7	30·0	21	2	...
,,		Monkstown	2·64	...	·68	25	18	...	...	...	...	...	...
XXII.		Queen's College (Galway)	3·70	+ ·96	·51	7	23	...	...	...	...		...
XXIII.		Waringstown	2·44	+ ·38	·31	2	21	61·0	9	31·0	21	2	4
,,		Londonderry	...	...	...	...	...	...	...	...	...	...	...
,,		Edenfel	3·55	+ 1·46	·41	9	26	56·0	16	30·0	4*c*	6	...

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

a And 29. *b* And 24. *c* And 20 and 21.

METEOROLOGICAL NOTES ON MARCH.

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 season as a whole from November up to the present time has been the most favourable for many years. The wheat season finished with very suitable weather at the time, and the acreage in wheat will far exceed any recent year. First dog violet seen on 2nd; thrushes' nest with eggs seen on 7th; brimstone and nettle tortoiseshell butterflies flying on 9th; anemone in flower 13th; wild hyacinth, 24th; pear on 27th.

BANBURY.—Whitethorn hedges in leaf at latter part of month. Mean temp. 43°·9. High wind on 7 days; H, sleet, and S on 21st; R and S on night of 25th; bats seen flying on 18th.

CULFORD.—The weather of the early part of the month was very fine and mild; slight touches of wintry weather towards the close. Stormy on 2nd and 26th; S and sleet on 21st; S, R, and H on 22nd.

COSSEY.—A very fine month, favourable to agricultural pursuits.

BODMIN.—Another very mild genial month; first glowworm seen on 7th.

CIRENCESTER.—A mild genial month with moderate rainfall.

WOOLSTASTON.—A very warm month till 20th; then S and cold winds. Gale with sleet and S on 25th and 26th. Mean temp. of month, 45°·4.

ORLETON.—A dry month with an average amount of sunshine and frequent frosty mornings, but not severe. Mean temp. of month more than 3° above the average of 20 years, and only once exceeded in that period, viz., in 1868. A sudden fall of S occurred on the evening of the 21st, covering the ground. Weather very favourable for farming operations: plums beginning to blossom on the 21st, damsons on the 25th; brooks and rivers flooded on 1st; great wind on 2nd, 7th, and 24th.

GRIMSBY.—A very fine month; vegetation very forward and farm work going on rapidly. T, L, and S on 21st.

MANCHESTER.—The month was fine and pleasant, unlike the traditional March; the weather was generally fine and mild and quite genial; although S fell on the 21st, and the weather for a few days was stormy, it was altogether quite an exceptional month.

ARNCLIFFE.—The month on the whole was rather wet; beautiful weather from the 12th to the 18th.

NORTH SHIELDS.—S on 21st and 22nd.

SEATHWAITE.—H on 5th, 20th, 21st, and 25th. Six falls of R exceeding 1in. in 24 hours.

WALES.

HAVERFORDWEST.—The month commenced with a bleak north-wester blowing furiously, followed by a night of sharp frost, Precelly capped with S for the first time during the winter. From 7th to 10th very mild and damp, sky completely overcast; from 11th to 17th fine, clear, and bright, with sunny days and rather cold nights, slight frost at times; broken weather with some heavy gales and R from the 20th to the end; the last two days cold and stormy; on the whole a very mild March. Blackthorn in blossom on 18th; honeysuckle in full leaf; plenty of grass, fruit trees fast blossoming. I never remember such a winter and spring previously.

LLANDUDNO.—A fine and mild month, though rather showery, excepting from the 9th to the 18th inclusive, when drought and sunshine prevailed. The temp. was over 6° above the average. There was no frost, and the duration of bright sunshine was 92 hours. S on distant hills from 1st to 4th, and from 20th to 26th.

SCOTLAND.

CARGEN.—Mean temp. 44°·3, 3°·1 above average. Sunshine 107 hours, five hours above average.

HAWICK.—Fine spring-like weather from the 10th to 20th. Hills white with S on 6th, 21st, 22nd, 24th, 28th, and 29th. Sharp frost on the night of the 24th; on the whole the month was a wet and cold one. H on four days.

ABERDEEN.—The first few days of March were stormy and unsettled, strong easterly gales and snow squalls being prevalent. Thereafter the wind changed to S.W., with fine dry weather and occasional high temp. Rainfall about the average for March. Lunar halo on night of 3rd.

SANDWICK.—March was remarkably wet and stormy, the rainfall being more than twice the average of the previous 41 years, while there were gales of from 50 to 60 miles an hour on the 4th, 7th, 8th, 9th, 13th, 16th, 21st, 22nd, and 27th. The ground was white with S on 1st, 21st, and 22nd. This was most of the S we had during the winter, and it was of short duration, for the sun thawed it quickly. There was L on the 4th, morning and evening, and auroræ on 8th, 9th, and 14th.

IRELAND.

BLACKROCK.—Stormy on 25th and 26th, mean temp. 47°·1.

DROMORE.—A very favourable month for agricultural operations, everything well forward. Mean temp. 47°·8.

WATERFORD.—The month was generally very wild, blowing hard from S.W. and N.W. Snow on 21st, hailstones on 30th, as large as peas. Snow on Comeragh Mountains on 31st. On 1st gale from N.W., on 8th gale from S.W.

KILLALOE.—Rainfall much above the average for March; scarcely any frost; vegetation very forward.

EDENFEL.—With the exception of a fine summer-like week from the 11th to the 18th, the weather of the month was the most severe of this winter. There were almost constant violent squalls and gales generally accompanied by rain, but on the 20th and 21st by deep drifting snow, which, however, disappeared on 22nd. Vegetation and farm labour at a standstill.

THE COLD IN RUSSIA.

Whilst we enjoy such a wonderfully warm winter, some parts of Russia are visited by terrific cold weather. The Trans-Caucasia, which is generally warm, has been exceptionally cold this winter; the oldest inhabitants do not remember having witnessed such a persistent frost. The gigantic chain of the Caucasus is covered by snow to its very foot. The immense and flat valley of the Kur and Arax rivers present only an illimitable snowy plain Rivers which had never been seen frozen over, and rivulets which had not been so for twenty years, are now covered with a thick layer of ice. The inhabitants of that district, unaccustomed to cold, are obliged to stay in their wretchedly-built smoky little huts, packed up together round their *toundihrs* (holes dug in the ground of the hut to bake the bread), where some few pieces of charcoal are burning. The workmen and labourers, whose houses have no doors, are submitted to the most terrible privations. In the valleys the snow is several yards deep. In the forestless plains, where the wood is always very dear, it can only be had now at exorbitant prices, and the poor are almost condemned to be frozen to death. The cattle, which are generally fed on the pasturage at the bottom of the mountains, are also condemned to a sure death from starvation, as it is not the habit of the country to make provisions of hay; the flocks of sheep will doubtless share the same fate. The coming spring promises to be terrible for the Caucasian mountaineers.—*Golos.*

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CXCVI.] MAY, 1882. [PRICE FOURPENCE, *or 5s. per ann. post free.*

DAILY ATLANTIC WEATHER MAPS. *

Almost, if not quite, all our readers must be aware how long and earnestly we have pleaded for the preparation and publication of Daily Maps of Atlantic Weather—we give, below, references to four articles specially pleading for them, and as we assume that our readers are or can make themselves familiar with them, we say no more as to the attitude constantly maintained by this magazine.

There are, however, two statements respecting the subject, the reproduction of which is needed to complete the narrative. Both are by Mr. Symons, one, the concluding paragraph of a letter published in *The Times* of Oct. 28th, 1881, is as follows :—

As regards the study of Atlantic weather, no one desires its development more than I do. For years I have urged that we ought to have daily weather charts for the Atlantic, and the only reason that we have them not is that they would cost a few thousands per annum. This is, of course, work which lies wholly within the domain of the Government establishment, the Meteorological Office, and their accounts show that they could only establish such a system either at the cost of suppressing some of their existing observatories, or on receiving an increased vote. I think personally that Parliament could do few wiser things than to appropriate, say for five years, £4,000 per annum for that purpose. Being entirely unconnected with the Meteorological Office, and not a member of its council, this proposal may perhaps be appropriately made by

Your obedient servant,

October 27th, 1881. G. J. SYMONS, F.R.S.

The other reference is a portion of the Presidential Address to the Meteorological Society :—

I must, however, pass to a different class of subject, that of deductions as distinguished from that of instruments. First in that list I place Daily Maps of Atlantic Weather on a scale of not less than 1 inch to 300 miles. The compilation of such charts is essentially national or international work, and falls wholly within the domain of the Government office. Years ago Captain Toynbee showed us what could be done. I have long pleaded for their regular issue, and shall continue to do so, because, irrespective of their utility as contributions to Physical Geography and to Navigation, they are, I believe, the best helps towards increased accuracy in weather forecasting. I am glad to

* *Meteorological Magazine*, Volume vi. (1871), p. 86 ; Vol. xiii. (1878), p. 117 ; Vol. xiv. (1879), pp. 2 and 50.

plead this cause in the very words of the Meteorological Council, for when they published Captain Toynbee's charts they said—

"The Meteorological Council have authorised the present publication as a remainder of the work of their predecessors. It cannot be doubted that more work of the same nature as that here submitted would throw light on the atmospherical conditions which influence and determine the weather in the West of Europe."

Moreover, in thus writing, the Meteorological Council only repeated what Le Verrier had urged a dozen years previously, viz., on January 29th, 1864, when, speaking of the charts in the *Bulletin International*, and pleading for Meteorological Records from the Atlantic, he said—

"Unfortunately our charts embrace only Europe, which is not sufficient. They contain nothing of what is occurring on the surface of the ocean, and this is the more to be regretted since most of the storms which attack us seem to take their rise in those parts."

These being our views, it will readily be understood that it was with extreme pleasure that we saw in *The Times* the memorandum which we reprint verbatim at the end of this note.

We have, however to call attention to one decision of the Office, for which no reason is given, and which, at present, appears to us a mistake. Our readers are aware of the system of eight-hourly synchronous observations introduced by the Signal Office of the United States.* By this system observations are made at hundreds of stations all over the globe at the same instant of absolute time, viz., at 7 a.m., 3 p.m., and 11 p.m., Washington mean time, which is approximately synchronous with noon, 8 p.m., and 3 a.m. (of the following day) Greenwich mean time.

This system was expressly designed to facilitate and perfect the class of investigation which the Meteorological Office is now going to push forward.

On the other hand the log-books issued by the office are arranged for observations *not* synchronous, but made at fixed hours of local time, so that the observation to be made for log-book purposes at 8 a.m., local time would, off the West of Ireland, be made at 9 a.m. Greenwich time; and the corresponding 8 a.m. entry at Bermuda would be made at about 5 a.m. Greenwich time.

The memorandum asks for observations at 8 a.m., and at noon, local time; the first of these will range between 3 and 8 a.m., Washington time, and the second between 7 a.m. and noon, Washington time. The first may therefore be anything between four hours before, and one hour after the 7 a.m. Washington synchronous observations; and the second may be anything between identical with the 7 a.m. Washington Synchronous observations, and five hours after them.

Although it is possible that the total number of observations collected may be greater by adopting the system selected by the Meteorological Office, we think that the advantage so gained will be far out-weighed by the difficulties introduced by the abandonment of the synchronous principle.

Met. Mag., vol. xii. (1877) p. 37., and vol. xiv. (1879), p. 50.

We presume that it is intended that the charts shall represent the weather at noon Greenwich time, which, as we have said, may be taken as the equivalent of the 7 a.m. Washington synochronous observation, but curiously enough the memorandum ignores the synchronous observations, and does not say for what hour the charts are to be constructed.

We, however, believe the above surmise to be correct, and that the intention is to correct the 8 a.m. and noon (local time) readings to what it is believed they would have been at the hour adopted for the charts. Although we have implicit faith in the care with which this will be done under Captain Toynbee's supervision, we adhere to the opinion previously expressed, that the ignoring of the synchronous system is a mistake. Of course it will be urged that an observation to be made daily at a different time (because of the change of the ship's position), would be less easily obtained than two at fixed hours. But it would be very easy to prepare a printed table showing the time for each degree of longitude, and the fewer the corrections applied to observations the better.

DAILY WEATHER CHARTS FOR THE NORTH ATLANTIC OCEAN.

The following statement has been issued by the Meteorological Office :—

"The Meteorological Council propose to undertake the preparation of daily weather charts of the North Atlantic Ocean for the 13 months beginning on August 1 in the present year, and ending on August 31, 1883.

"It is well known that the changes of weather which we experience are in general caused by atmospheric disturbances which travel more or less rapidly, and undergo more or less modification during their progress. By far the larger number of the disturbances which visit the British Islands arrive on our shores from the Atlantic Ocean, and our earliest information as to any impending change is consequently derived from telegraphic reports from the Atlantic coasts, especially from the British stations at Stornoway, Mullaghmore, and Valentia, and occasionally from the continental observatories at Rochfort and Corunna. But of the origin and previous history of these systems we have no sufficient knowledge, except in a few isolated cases.

"The Meteorological Council believe that any systematic information which can be obtained as to the origin, development, and laws of motion of the atmospheric disturbances which occur over the Atlantic Ocean would promote the science of meteorology, and be of immediate practical utility. Such information could not fail to be a benefit to seamen traversing the Atlantic Ocean, and would tend directly to the improvement of the forecasts and storm warnings issued to the British coasts, by rendering the interpretation of the first indications of approaching changes observed at the western meteorological stations more easy and certain.

"The importance of a systematic study of the weather of the North Atlantic Ocean has long been recognized, and series of daily synoptic charts, more or less resembling those now in contemplation, have been prepared at various times, not only by the Meteorological Office, but also by the Association Scientifique de France under the guidance of Le Verrier ; by Captain Hoffmeyer, of the Danish Meteorological Institute ; by the Deutsche Seewarte, at Hamburg ; and (as a part of a wider plan) by the Chief Signal Officer of the United States. But none of these charts, however valuable in other respects, supply adequate materials for a satisfactory discussion of Atlantic weather, chiefly on account of the small number of the observations upon which they are founded as compared with the magnitude of the area over which they are spread.

"Evidence of the interest attaching to the connection between English and Atlantic weather is afforded by the efforts which have been made during the last few years by the proprietors of the *New York Herald* to transmit to England from America telegraphic predictions of approaching disturbances which (it is presumed) are founded on the reports of vessels arriving in America from the Atlantic Ocean. Reports such as these from a large number of vessels would be of great value; but the predictions taken by themselves cannot be utilised in a scientific investigation of weather.

"The Meteorological Council gratefully acknowledge the large measure of invaluable help which they have hitherto received from seamen and the shipping interest generally. But as the object now proposed can only be achieved by the voluntary co-operation of an increased number of observers, they feel justified in making a special appeal for assistance to the owners, captains, and officers of ships, and especially to the great companies whose steamers ply between this country and America. In a science which, like meteorology, is still in its infancy, every advance is attended with great difficulties, and the Council are well aware that it would be easy to be too sanguine as to the importance of the results to be obtained by the inquiry which they are about to undertake. But having regard to the loss of life and property occasioned by storms on our coasts,* they feel confident that their proposal will commend itself to the public generally, and will insure the active co-operation of those classes of the community for whose benefit it is primarily intended.

"It is proposed to ask for observations of the barometer, of open air and sea surface temperatures, wind (direction and force) and weather at 8 a.m. and noon each day, with the position of the ship at noon.

"Forms for recording the observations will be supplied by the Meteorological Office, 116, Victoria Street, London, S.W., on application to the Marine Superintendent."

The following is the appeal issued, with the suggested form to be filled up:—

METEOROLOGICAL OFFICE, LONDON.

The Meteorological Council propose to chart and discuss the weather of the North Atlantic Ocean for the 13 months beginning August 1st, 1882, and ending August 31st, 1883; and they request owners, captains, and officers of steam vessels and sailing vessels traversing the North Atlantic Ocean to assist in the work, by furnishing observations transcribed on forms of which a specimen is given below, and which will be supplied by the Office. The Council propose to discuss the observations as early as possible. The use of the forms will save much time and labour in the Meteorological Office, and it

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* The wreck return published by the Board of Trade for the year ending the 30th of June, 1880 (C. 2,906), (the last published), gives on p. 20 the following list of casualties on our coasts attributable to causes connected with the weather:—

		Total Losses.	Serious Casualties.	Minor Casualties.	Total.
1879–80	Founderings ...	16	0	0	16
	Strandings	81	108	176	365
	Other causes ...	0	105	405	510
Totals for 1879–80		97	213	581	891 gross total
Totals for 1878–79		121	227	761	1,109 gross total
Totals for 1877–78		138	289	1,002	1,429 gross total
Totals for 1876–77		180	367	1,258	1,805 gross total

is believed that the transcription from the log will cause but little trouble to the observers.

OBSERVATIONS TO BE TAKEN AT SEA AT 8 A.M. AND AT NOON OF SHIP'S TIME.

Barometer and (if a thermometer is attached to it) the Attached Thermometer.—Give, if possible, a few readings in port before leaving, and in each port which you visit.

Temperature of Air in the shade on Deck (if observations can be made).

Temperature of Sea Surface (if observations can be made).

Compass Deviation (that is, the error due to the iron of the ship) on the course steered.

Wind—Direction (by compass) and Force.—The force may be expressed in words, or by the figures of Beaufort's scale, whichever the observer is in the habit of using.

Weather.—In words or by the letters of Beaufort's notation, whichever the observer is in the habit of using.

Position of Ship.—At noon only.

In the column headed "Remarks" please to enter—(1) Whenever an important change of wind occurs, the time of its occurrence, and the direction and force of the wind before and after the change; (2) Whenever a gale occurs—the lowest reading of the barometer during the gale, the time of the lowest reading, and the direction and force of the wind at that time.

METEOROLOGICAL OBSERVATIONS IN THE NORTH ATLANTIC OCEAN.

Ship's Name and Description. _____

Owner's Name and Address. _____

Captain's Name and Address. _____

Year 188... Month..... Day.	Hour.	Bar. — Mercurial or Aneroid. (a)	Attached Thermometer.	Temp. Air on Deck.	Temp. Sea Surface.	Compass Deviation (due to the iron of the ship) on the course steered. (b)	Wind. Direction by Compass. (c)	Wind. Force.	Weather.	Ship's Position at Noon.	Remarks. (1) Giving the times of important changes of wind, with the direction and force before and after the change. (2) Giving the reading of the lowest barometer during a gale and the time of its occurrence, with the direction and force of wind at that time.
1	8 a.m.									Lat.	
	Noon.									Long.	

(a) Erase "or Aneroid" if it be a mercurial barometer, and "Mercurial or" if it be an aneriod; if both are on board always record the mercurial in preference to the aneroid.

(b) The Compass Deviation on the course steered should be copied from the Deviation Card. The Variation is not asked for; the correction for it will be applied in the Office.

(c) The corrections for Deviation and Variation will be applied in the Office.

THE METEOROLOGICAL SOCIETY.

The usual monthly meeting of this Society was held on April 19th, at the Institution of Civil Engineers, 25, Great George-street, Mr. J. K. Laughton, F.R.A.S., President, in the chair. C. P. Bolton, J. Dale, Capt. G. Gaye, T. T. Marks, G. Neame, A. F. Osler, F.R.S.,

and Miss E. I. Pogson, were balloted for and duly elected Fellows of the Society.

The papers read were :—1. "Barometric Gradients—Wind Velocity and Direction—at the Kew Observatory," by G. M. Whipple, B.Sc., F.R.A.S., F.M.S., and T. W. Baker, F.M.S. For the purpose of investigating the subject of the relation of the force and direction of the wind to the distribution of barometric pressure, the authors have discussed the Kew Observations for the 5 years 1875-79. The results show that the rate at which the wind blows increases almost directly with the inclination of the gradient in an arithmetical proportion, the mean rate of increase being 1·85 mile per hour for each additional ·0025 inch of difference in the barometer readings. The authors find that the angle at which the wind crosses the line of gradient at Kew does not vary to any material extent with either the steepness of the gradient or the velocity of the wind, and also that the angle generally lies between 40° and 60°, the average of the whole series of observations giving an "angle of deviation" of 52°.

2. "On Difference of Temperature with Elevation," by George Dines, F.M.S. In this paper the author gives a summary of his observations made at Walton-on-Thames during the last six years. Two stands, not Stevenson's, but similar thereto and almost identical in size and construction, were used, one being placed on the ground, and the other on the top of the tower of the house; the bulbs of the thermometers in the former being 4 feet, and in the latter 50 feet above the ground. The results show that the average maximum temperature for every month is always greater, and the average minimum lower, near the ground than that on the tower.

A SOUTH AFRICAN HAILSTORM.

THE following letter appeared in *The Scotsman* of April 6th. A copy having been forwarded to us by Mr. F. Coventry, F.M.S., of Ketton Hall, we wrote to the Editor of *The Scotsman* for permission to see the photograph, and he most kindly sent it to us. The stones when being photographed were evidently melting rapidly, but the ten shown in the photograph are nearly uniform in size, not one is less than an inch and a half in its least diameter and they average about two inches.

According to the table given in our article, entitled, "Hailstones—Relation of Weight to Size"*—at the time they were photographed these stones weighed about 2¼ ounces; these would penetrate "corrugated iron roofs" would be "as large as hen's eggs and many even larger," and would weigh from 1¼ oz. to 2½ oz., the statements are therefore all consistent. Indeed, considering that in the heat of a photographer's room in South Africa the stones would rapidly dissolving while the preparations were being made for taking the photograph, it seems probable that the writer has rather underestimated the size of the stones.—ED.

* *Met. Mag.*, Vol. xiv. (1879) p. 116.

A SOUTH AFRICAN HAILSTORM.

SIR,—As it may interest some of your readers, I take the liberty of furnishing you with a few particulars of a hailstorm of a most unusual character which broke over this town on the afternoon of Saturday, the 18th inst.

In the afternoon, the clouds began to gather, but nothing further was predicted than the usual thunderstorm which, at this season of the year, is generally the programme for the after-part of the day. Presently, however, a cloud of more than ordinary blackness and density appeared, and one instinctively felt that something was going to happen.

A flash of lightning, a boom of thunder, and then a hard, sharp crack on the housetops here and there, made the people in the streets look round, and they were naturally surprised and alarmed to find solid hail balls of an unusual size dropping occasionally at their feet. The streets were scarcely cleared before a most terrific hailstorm, accompanied by thunder and lightning, broke over the town. There is no figurative language used when it is said the hail came down in torrents; but what was remarkable was the unusual size of the stones, most of which were as large as hen's eggs, and many even larger. The stones weighed from 1¼ ounce to 2½ ounces. The damage done was very considerable. Glass panes were smashed in hundreds, and in some cases even corrugated iron roofs were pierced. £2000 or £3000, it is said, will scarcely cover the loss in merchandise destroyed. But what, perhaps, was more pitiable than all, was the fatal destruction carried by the storm to the gardens and vineyards, for which this town is justly celebrated. The grapes were just ripening, the figs were getting a flavour, the flowers were in their bloom. Now all was destruction, nothing scarcely was saved; and the fruit season, which had hardly begun, was over for another year.

I enclose a photograph of some hail-stones collected and photographed on the spot. I may add that the card introduced for contrast is one of the ordinary cabinet portrait size.

I may also mention that the only storm of a similar nature known in this district happened about three years ago, when similar results followed.

I am, &c.

Queenstown, South Africa, February 22, 1882. W. C.

THE ANEMOMETER EXHIBITION.

(*Concluded from page* 40).

33. **Casella's Air Meter,** for Mines, Hospitals and Public Buildings.—*L. P. Casella, F.M.S.*

Very nearly identical with No. 30.

34. **Lownde's Anemometer.**—*Elliott Bros.*

Medium-sized Robinson cups with a series of dials for indicating horizontal motion. Differing from Nos. 5 and 6 only in the arrangement of the dials.

35. **12 in. Biram's Patent Anemometer,** reading to 10 million feet.—*John Davis and Son.*

36. **6 in. Biram's Anemometer,** reading to 1,000 feet with disconnecting motion.—*John Davis and Son.*

37. **4 in. Biram's Anemometer,** reading to 1 million feet with disconnecting motion.—*John Davis and Son.*

38. **4 in. Biram's Anemometer,** reading to 100 feet.—*John Davis and Son.*

39. **2 in. Biram's Anemometer,** reading to 100 feet.—*John Davis and Son.*

40. **Biram's Anemometer,** reading to 10 million feet, with disconnector and stick holder.—*John Davis and Son.*

41. **Biram's Anemometer,** reading to 1,000 feet, with disconnector and stick holder.—*John Davis and Son.*

All these are applications of trains of dials to register the revolutions of windmill governors of various sizes; some of them were remarkably delicate. No. 39, *e.g.*, had its fans made of thin plates of mica, so as to minimise weight. Most of these patterns are chiefly used for watching the ventilation of mines.

42. **Model of a self-setting type machine,** for printing the hourly horizontal motion of the air.—*C. J. Woodward.*

This model was shown at the British Association Meeting at Exeter, 1869, and a short description appears in the volume for that year. It may be classed as a precursor of Theorell's apparatus, but in this case a good deal of work was proposed to be thrown upon the cups, which in Theorell's is effected by electricity, to the manifest diminution of the friction co-efficient.

43. **Model of Apparatus,** to be attached to Robinson's Cup Anemometer, to enable it to indicate the force of gusts.—*R. H. Curtis, F.M.S.*

44. **Specimen of Boxes,** loaded with different weights to test overthrow force of wind.—*G. Dines, F.M.S.*

45. **Floss-Silk Current Indicator,** as used by Mr. J. F. Campbell for the Committee on Warming and Ventilation, 1856-7.—*G. J. Symons, F.R.S.*

These three hardly need explanatory remarks. No. 46 was in many respects analogous to No. 23. No. 45 was merely the lightest filament of silk which could be seen, so light as to float from the end of a penholder, at whatever angle the air current might be moving. It was, in fact, another plan for attaining the same object as that aimed at by No. 31.

NEW APPARATUS.

46. **Self-Recording Rain Gauge (Casella's),** with extra open scale.—*E. Mawley, F.M.S.*

No. 46 was very nearly identical with the Casella Self-Recording Rain Gauge, described and engraved in *British Rainfall*, 1878, p. 41, but the scale is more open, it gives 1 inch for each 0·10 in.

47. **New Form of Snow Gauge.**—*E. Mawley, F.M.S.*

This is simply an 8-in. zinc cylinder 18 inches deep, having its lower end slightly raised above the ground, and closed with a double horse-hair sieve, so as to collect snow, hail, &c., in, as far as possible, an unmelted condition. This gauge does not require to be constantly emptied of rain-water like an ordinary snow cylinder; and when snow is deposited immediately after a fall of rain, as in the de-

structive snowstorm of October, 1880, its depth can be readily ascertained.

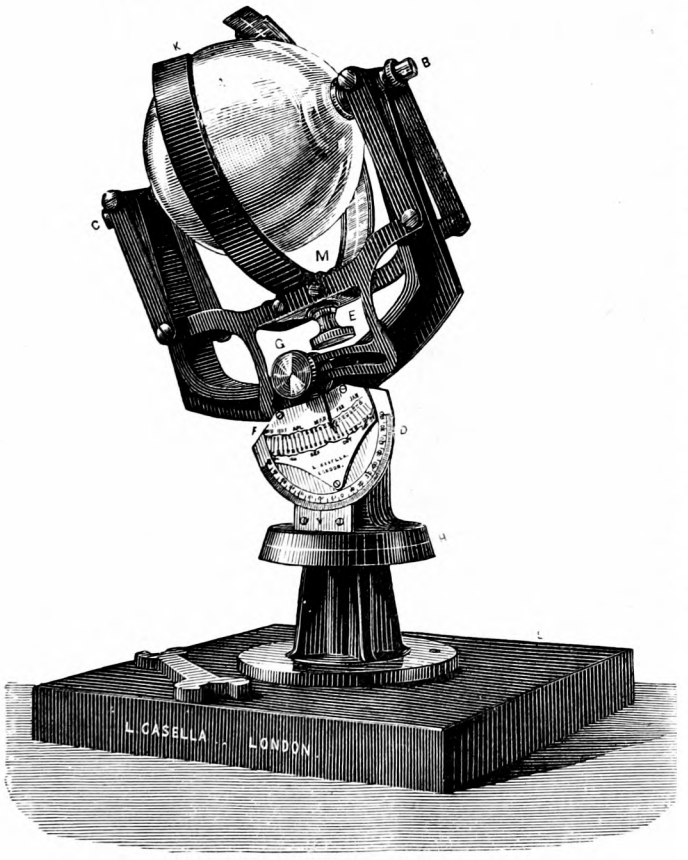
Since this gauge has been in use only one fall of snow of any importance at all has taken place. On that occasion there was more snow in the gauge than on the surface of the lawn, and it remained longer unmelted in the former than on the latter.

48. **Electrical Self-Registering Rain Gauge**, designed by S. M. Yeates.—*Yeates & Son.*

We rather doubt this being entitled to appear as a novelty; it certainly had never been shown at a meeting of the Meteorological Society, but it—or an instrument identical in principle—was in the Loan Collection of Scientific Apparatus at South Kensington, and it was described and engraved in the *Met. Mag.*, vol. xi. (1876) p. 153.

49. **Whipple-Casella Universal Sunshine Recorder.**—*L. P. Casella, F.M.S.*

Exhibited at the British Association Meeting, in August last, described in *Met. Mag.* vol. xvi. (1881), p. 158, and represented in the annexed engraving:—



A Glass sphere; B C Polar axis; D Arc for adjustment for latitude of place of observation; E Clamps of card holder; F Scale of sun's declination; G Clamp for the same; H Adjustment to the meridian; K Card holder; L Slate base; M Meridian line on card.

50. **Self-Registering Differential Solar Thermometer,** for recording the maximum Solar Intensity during a day or any other period.—*Dr. E. Frankland, F.R.S.*

Described and engraved in *Proc. Roy. Soc.*, vol. xxxiii. (1882), p. 331.

51. **Earth Thermometer for small depths.**—*E. E. Dymond, F.M.S.*

This thermometer is designed to indicate the temperature of the ground at small depths below the surface. The stem of the thermometer is bent at right angles, so that the bulb shall be at or near the required depth when the instrument has been pushed into the ground until the horizontal part is resting on the surface. The mount is made of ebonite, with a hollow iron cone screwed on at the bottom of the part entering the ground. The bulb projects below the ebonite into the hollow cone, which is filled with mercury. By this means there is metallic contact between the bulb and the ground at the depth to which the cone is pushed, and little or no conduction of heat from the surface through the instrument itself. It is not intended for use at depths of more than one foot, for which cases another arrangement has already been introduced, but it has been found much more convenient than the long straight-stemmed thermometers hitherto constructed. The scale is a very open one, and the indications can be easily read with very little stooping. A light zinc cover can be laid over the horizontal part, to keep off the rain, if it is thought desirable.

PHOTOGRAPHS, DRAWINGS, ETC.

Space will not allow us to go in detail through the thirty separate exhibits in this class. It included engravings of old anemometers, facsimiles of the records of anemometric indications on excessively open scales, photographs, tracings, drawings, and diagrams of many anemometers in different parts of Europe, and a series of maps and plans, by Mr. Symons, of whirlwinds which have passed over various parts of England, together with 37 photographs of damage produced thereby.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOV., 1881.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	62·5	5	31·9	1	54·2	43·3	44·7	85	95·2	27·2	2·75	16	7·2
Cape of Good Hope	97·9	26	43·2	14	76·9	51·9	52·9	69	...	...	1·23	9	4·3
Mauritius	80·5	var.	64·5	4	79·3	70·7	64·6	72	...	...	3·19	16	6·1
Calcutta	84·3	18	57·9	30	82·1	63·0	60·8	70	146·8	45·3	·00	0	1·7
Bombay	93·3	1	64·3	20	87·8	72·6	66·5	65	149·6	47·0	·09	3	2·9
Ceylon	88·2	15	71·0	11	85·9	74·4	72·2	77	156·0	61·0	28·78	25	7·3
Melbourne	92·0	13	43·3	5	68·9	51·5	49·3	71	136·0	35·0	5·05	15	6·5
Adelaide	103·0	27	44·2	5	76·8	53·8	46·8	50	166·5	36·0	·59	12	5·0
Wellington	70·8	8	42·0	28	63·6	50·2	...	...	142·0	39·0	1·92	8	...
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Falkland Isles	63·6	26	32·3	4	53·2	39·1	40·2	75	126·8	23·3	1·77	16	6·4
Jamaica	89·7	16	68·9	5	87·0	71·7	71·0	80	...	...	2·18	10	5·3
Barbados	83·0	var.	69·0	26	81·0	73·0	73·4	84	147·0	68·0	6·52	20	8·0
Toronto	62·5	8	12·4	28	44·0	30·0	36·0	79	111·0	4·0	3·26	19	7·4
New Brunswick, S. John	59·0	3	2·0	28	42·5	28·2	32·5	82	...	...	3·10	12	5·7
Cape Breton, Sydney	61·3	4	15·3	28	44·0	28·8	32·7	80	...	...	2·73	14	7·1
Newfoundlnd, S. John's	52·3	5	10·3	23	37·5	26·6	30·0	88	102·0	12·0	1·72	12	8·1
Manitoba, Winnipeg	44·8	6	—26·3	...	20·3	1·9	14·5	93	...	...	2·61	19	7·0

REMARKS, NOVEMBER, 1881.

Mauritius.—Rainfall, ·61 in. above average; mean bar., 30·046 in. Mean hourly velocity of wind, 12·1 miles; greatest, 29 miles on 18th; least, 1·6 on 26th; prevailing direction, E.S.E. to E. by N.; T on 10th, 11th and 27th.
C. MELDRUM, F.R.S.

CEYLON.—L was seen on 4 days, and TSS occurred on 19 other days.
J. STODDART.

Melbourne.—Mean temp. of air, 1°·1 below average of 23 years; pressure, humidity, and amount of cloud all about the average; rainfall, 2·82 in. above it. Prevailing wind, S.W.; strong breezes occurring on 7 days; TSS on 3 days, aurora australis on 9th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean bar. pressure, 29·970 in., or ·016 below average of 24 years. The rainfall S. of lat. 30° was barely half the average, except in the extreme south portion of the colony; between lat. 30° and the N. coast, the rainfall was about an average; Central Australia obtaining an excess, as likewise did the neighbourhood of Port Darwin. Mean temp., 1°·5 below average. This has been a remarkably cool summer so far, the 27th being the first really hot day; on 3 days only has the temp. exceeded 90°. C. TODD.

Wellington.—Exceedingly fine, bright weather up to 18th; remainder of month showery, but some pleasant days. Prevailing wind N.W., generally moderate in force. Mean pressure and temp. both average. R. B. GORE.

BARBADOS.—Mean temp. 74°·7, 2°·3 below average. Prevailing wind N.E.; average velocity, 13·2 miles; extremes, 19·9 miles and 4·6 miles. Rainfall, 24 per cent. below the average, and evaporation 30 per cent. above it. TSS on 1st and 4th. R. BOWIE WALCOTT.

NEWFOUNDLAND.—The weather during the month was very changeable; stormy, cloudy and hazy; S on 5 days amounting to 20·5 in. Prevailing wind, W.
J. DELANEY.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DEC., 1881.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	53·6	2	28·1	24	44·7	35·1	36·6	87	72·3	21·2	2·48	15	6·5
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	83·4	26	70·9	1	81·3	73·6	68·9	76	...	...	6·88	17	6·3
Calcutta	79·7	1	48·3	17	76·7	53·9	54·0	71	137·9	34·6	·36	2	1·0
Bombay	91·3	16	67·0	8	86·0	69·7	65·2	66	145·4	51·8	·00	0	1·5
Ceylon	88·4	6	72·6	7	85·1	74·2	72·4	79	152·0	68·0	8·57	19	7·2
Melbourne	97·1	5	46·0	10	72·5	54·0	50·3	67	136·0	41·6	3·13	11	6·5
Adelaide	105·8	4	48·2	2	82·9	57·8	48·5	46	163·5	38·4	·31	8	4·3
Wellington	73·3	26	45·2	5	65·0	54·3	...	...	143·0	41·0	5·45	12	...
Auckland	76·1	31	49·2	7†	70·6	55·5	55·9	78	149·0	49·3	3·63	16	6·8
Falkland Isles	66·6	10	33·0	31	54·1	41·2	41·4	76	128·3	26·9	3·45	24	7·2
Jamaica	89·4	13	64·4	23	85·5	68·5	68·9	82	...	...	·24	5	3·3
Barbados	81·0	3*	69·0	15	79·0	71·3	70·7	82	146·0	66·0	5·17	12	6·0
Toronto	52·1	14	12·2	31	39·9	27·4	30·0	80	101·0	5·0	2·47	18	7·7
New Brunswick, S.John	49·0	14	—1·0	16	36·7	22·0	28·0	88	...	...	5·38	16	6·4
Cape Breton, Sydney	52·2	30	12·2	17	36·6	24·2	27·0	84	...	...	4·64	13	7·9
Newfoundlnd, S.John's	48·0	31	—3·0	26	32·5	29·5	27·0	96	90·0	11·0	2·45	10	7·1
Manitoba, Winnipeg	34·5	24	—27·3	14	21·5	—2·2	12·0	92	...	...	·32	5	4·2

* And 5th. † And 8th.

REMARKS, DECEMBER, 1881.

Mauritius.—Rainfall, ·73 in. above the average; mean bar., 29·990 in. Mean hourly velocity of wind, 12·0 miles; greatest, 26·1 miles on 15th; least, 0·0 miles on 22nd; prevailing direction, E. by S. to E. by N. T and L on 10th, 16th, 17th, 18th and 21st. C. MELDRUM, F.R.S.

CEYLON.—TSS occurred on 8 days. J. STODDART.

Melbourne.—Mean temp. of air, 1°·5 below average of 23 years; mean pressure and humidity about the average; rainfall, ·80 in., and amount of cloud, 1°·0 above it. Prevailing wind, S.W.; strong breezes occurring on 7 days, and violent squalls on the 28th. Heavy dew on 4 days, TSS on 3 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean bar. pressure, 29·932 in., ·008 in. below average of 24 years. The rainfall S. of lat. 30° was about 50 per cent. below the mean, except at a few prominent localities along the S. coast; the MacDonnell Range, in Central Australia, had, however, an amount far in excess; whereas, further N., the fall was far below the mean, being barely half at Port Darwin. Temp. was about 0°·5 below the average, and though the temp. exceeded 90° on 8 days and 100° twice, the month was remarkably cool, especially at night. C. TODD.

Wellington.—Beginning of month fine; showery and unsettled from 4th to 21st; remainder, fine and dry. 2·25 in. of R on 20th, frequently stormy after 11th. Prevailing wind N.W. Mean pressure and temp. both below the average. Earthquakes on 3rd, 23rd and 31st. R. B. GORE.

BARBADOS.—Mean temp., 75°·1, average. Wind, from N.E. on 30 days, and S.W. 1 day; average velocity, 10·8 miles per hour; extremes, 16 miles and 2·5 miles. Rainfall, 9 per cent. below, and evaporation 30 per cent. above the average. Heavy spring tides on 14th and 15th. R. BOWIE WALCOTT.

NEWFOUNDLAND.—Weather very stormy and uncertain during the whole month; about 10 fair days. Prevailing wind, W.; 18·7 in. of S falling on 7 days. J. DELANEY.

SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1882.

[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	3·67	XI.	Castle Malgwyn	5·33
,,	Margate, Birchington...	2·62	,,	Rhayader, Nantgwillt..	...
,,	Littlehampton	3·94	,,	Carno, Tybritle	4·66
,,	St. Leonards	2·65	,,	Corwen, Rhug	3·48
,,	Hailsham	3·95	,,	Port Madoc	4·34
,,	I. of W., St. Lawrence.	3·30	,,	I. of Man, Douglas	4·53
,,	Alton, Ashdell.....	3·85	XII.	Carsphairn	4·14
III.	Great Missenden.....	4·18	,,	Melrose, Abbey Gate...	3·82
,,	Winslow, Addington ...	3·97	XIII.	N. Esk Res. [Penicuick]	3·20
,,	Oxford, Magdalen Col...	3·78	XIV.	Ayr, Cassillis House ...	2·11
,,	Northampton	3·48	,,	Glasgow, Queen's Park.	1·99
,,	Cambridge, Beech Ho...	2·82	XV.	Islay, Gruinart School..	2·68
IV.	Southend	1·91	XVI.	Cupar, Kemback.....	4·82
,,	Harlow, Sheering	2·80	,,	Aberfeldy H.R.S.	1·75
,,	Diss	2·87	,,	Dalnaspidal	3·58
,,	Swaffham	3·03	XVII.	Tomintoul.....	2·51
,,	Hindringham	2·39	,,	Keith H.R.S.	4·48
V.	Salisbury, Alderbury...	3·96	XVIII.	Forres H.R.S.	2·96
,,	Calne, Compton Bassett	4·25	,,	Strome Ferry H.R.S....	3·09
,,	Beaminster Vicarage ...	5·39	,,	Lochbroom	2·03
,,	Ashburton, Holne Vic..	9·96	,,	Tain, Springfield.....	2·26
,,	Torrington, Langtree W.	...	,,	Loch Shiel, Glenaladale	6·87
,,	Lynmouth, Glenthorne.	4·90	XIX.	Lairg H.R.S.	...
,,	St. Austell, Cosgarne...	...	,,	Forsinard H.R.S.	2·88
,,	Taunton, Fullands	3·59	,,	Watten H.R.S.	2·19
VI.	Bristol, Clifton	4·07	XX.	Fermoy, Glenville	6·07
,,	Ross	...	,,	Tralee, Castlemorris ...	4·25
,,	Wem, Sansaw Hall.....	2·11	,,	Cahir, Tubrid	4·18
,,	Cheadle, The Heath Ho.	4·33	,,	Newcastle West	3·26
,,	Worcester, Diglis Lock	3·21	,,	Kilrush	...
,,	Coventry, Coundon	3·78	,,	Corofin	4·84
VII.	Melton, Coston	3·27	XXI.	Kilkenny, Butler House	...
,,	Ketton Hall [Stamford]	3·34	,,	Carlow, Browne's Hill..	3·75
,,	Horncastle, Bucknall ...	2·67	,,	Navan, Balrath	3·29
VIII.	Macclesfield, The Park.	3·55	,,	Athlone, Twyford	4·37
,,	Walton-on-the-Hill.....	3·56	XXII.	Mullingar, Belvedere ...	4·15
,,	Broughton-in-Furness ..	5·93	,,	Ballinasloe	3·65
IX.	Wakefield, Stanley Vic.	2·78	,,	Clifden, Kylemore	6·31
,,	Ripon, Mickley	4·78	,,	Crossmolina, Enniscoe..	...
,,	Scarborough.....	4·74	XXIII.	Carrick-on-Shannon ...	2·50
,,	East Layton [Darlington]	4·20	,,	Dowra	...
,,	Middleton, Mickleton ..	4·73	,,	Rockcorry.....	4·07
X.	Haltwhistle, Unthank..	3·23	,,	Warrenpoint	5·40
,,	Shap, Copy Hill	5·72	,,	Newtownards	3·30
XI.	Llanfrechfa Grange	5·71	,,	Belfast, New Barnsley .	4·40
,,	Llandovery	5·48	,,	Bushmills	2·76
,,	Solva	3·37	,,	Buncrana	2·89

APRIL, 1882.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·83	+ ·81	1·08	25	14	65·5	21	32·6	16	0	9
II.		Maidstone (Hunton Court)...	2·37	+ ·52	·68	25	13	...	...	...	...	...	...
,,		Strathfield Turgiss	3·26	+ 1·35	·77	25	17	...	...	...	...	...	...
III.		Hitchin	3·14	+ 1·19	1·09	25	16	61·0	21	30·0	26	5	...
,,		Banbury	4·00	+ 1·99	·83	29	19	63·0	21	28·0	16	2	...
IV.		Bury St. Edmunds (Culford)	3·55	+ 1·76	·95	25	17	61·0	20*b*	28·0	15	5	...
,,		Norwich (Cossey)	3·19	+ 1·33	·96	25	17	66·0	21	30·5	16	3	8
V.		Bridport	...	...	...	...	...	..	..	...	...	...	...
,,		Barnstaple.....	4·94	+ 2·56	·63	21	23	65·0	14	37·0	1	0	...
,,		Bodmin	7·05	+ 3·72	1·16	12	22	61·0	8	34·0	11	0	9
VI.		Cirencester	4·36	+ 1·96	·86	25	18	...	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	2·92	+ ·60	·52	29	20	61·5	19	29·0	16	3	6
,,		Tenbury (Orleton)	3·74	+ 1·57	·87	29	19	64·2	20	27·5	16	4	7
VII.		Leicester	3·02	...	·60	29	19	65·1	21	29·0	16	1	14
,,		Boston	2·48	+ ·59	·54	28	14	66·0	21	32·0	16	...	...
,,		Grimsby.....	3·67	+ 1·91	·80	13	18	64·0	21	31·5	16	1	...
,,		Mansfield	3·54	+ 1·51	·95	14	16	60·0	21	32·0	16	1	...
VIII.		Manchester (Ardwick).....	...	...	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribstone Hall) ...	3·77	+ 1·26	1·08	14	11	...	...	...	...	...	...
,,		Skipton (Arncliffe)	6·63	+ 3·57	·90	13	19	61·0	21	27·0	15	4	...
X.		North Shields	3·04	+ 1·04	·80	13	20	63·5	20	26·5	16	3	4
,,		Borrowdale (Seathwaite).....	10·08	+ 5·14	2·47	24	17	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely).....	6·09	+ 3·75	·72	12	21	...	...	...	...	...	...
,,		Haverfordwest	5·19	+ 2·37	·91	29	19	61·5	8	28·4	10	4	13
,,		Plinlimmon (Cwmsymlog)	4·73	...	1·02	29	19	...	...	...	...	...	...
,,		Llandudno.....	3·18	+ 1·30	·64	22*d*	19	61·8	13	33·5	16	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·87	+ ·58	·68	19	14	63·0	8	26·2	16	5	...
,,		Hawick	3·18	+ ·97	·60	13	16	...	...	...	...	...	...
XIV.		Douglas Castle (Newmains)	3·49	+ 1·61	·58	14	16	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	2·53	— ·10	·83	19	13	...	...	28·0	11*e*	9	...
,,		Appin (Airds)	3·54	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	4·28	...	1·13	16	16	...	...	...	...	...	.
XVI.		Loch Leven Sluices	4·40	+ 2·19	2·10	14	10	...	...	...	...	...	...
,,		Arbroath	2·73	+ ·82	1·24	13	12	60·0	20	29·0	16	2	...
XVII.		Braemar	3·42	+ 1·34	·72	16	20	61·0	8	22·0	8	14	28
,,		Aberdeen	3·33	...	·85	13	20	61·0	20	26·0	7	4	...
XVIII		Skye (Sligachan)	6·68	...	1·52	21	14	...	...	...	...	..	...
,,		Culloden	2·43	+ 1·08	·62	17	8	58·0	20	28·8	11	9	20
XIX.		Dunrobin	2·86	...	·77	11	14	59·0	20	27·0	16	6	...
,,		Orkney (Sandwick)..... ..	1·90	+ ·03	·28	22*a*	15	54·1	22	30·3	16	2	7
XX.	IRELAND.	Cork (Blackrock)	5·51	+ 2·41	·64	11	18	63·0	4, 6	29·0	15	3	...
,,		Dromore Castle	7·34	...	·83	22	23	63·0	9	31·0	15	...	...
,,		Waterford (Brook Lodge) ...	4·41	...	·68	12	18	60·0	10	26·0	9	3	...
,,		Killaloe	4·73	...	·82	19	18	65·0	20	28·0	30	4	...
XXI.		Portarlington	3·39	+ 1·36	·79	27	22	61·5	20	28·0	15	5	...
,,		Dublin (Monkstown)	...	...	...	...	...	...	...	...	...	...	...
XXII.		Galway (Queen's College) ...	3·71	+ ·88	·78	27	18	...	...	...	...	...	...
XXIII.		Waringstown	3·00	+ 1·11	·55	27	17	67·0	19	27·0	15	5	8
,,		Londonderry...	2·62	...	·33	23	18	60·0	21	34·0	16	0	8
,,		Omagh (Edenfel)	2·55	+ ·55	·38	18	22	57·0	9*c*	26·0	15	6	9

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

a And 24. *b* And 21. *c* And 10, 11, 13, 20, and 21. *d* And 29. *e* And 27.

METEOROLOGICAL NOTES ON APRIL.

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 agricultural report of the month is very propitious. The pastures have made rapid progress since the copious rainfall; peas and beans are looking prosperous, and the orchards generally give good promise; garden strawberry in flower on 1st; felling oaks on 3rd, very early; sycamore in leaf on 8th; nightingale first heard on 10th, cuckoo on 12th; elm in leaf on 14th, horse chestnut in flower on 18th, lilac in flower and wryneck heard on 20th.

HITCHIN.—As severe a gale as that of October, 1881, occurred on the 28th.

BANBURY.—Mean temp. of the month, 46°·7; heavy TS on 2nd at Ladmarton, four miles S.W., very severe at Chipping Norton also; high wind on 22nd, 29th, and 30th; H and distant T on 30th; martins seen on 21st; hawthorn in blossom on 23rd: floods out at the end of the month.

CULFORD.—The weather was unsettled and somewhat cold; mean temp. 46°·7; high wind on 22nd and 23rd; H and distant T on 24th; very stormy on 29th.

BODMIN.—A very cold and rainy, and unsettled month; mean temp. 49°·9; a terrific but brief W.S.W. gale on 29th.

CIRENCESTER.—Rainfall considerable, but perhaps not more than was required, the previous months having been drier than usual.

WOOLSTASTON.—Mean temp. of the month, 46°·1; T and L from 2 to 3 p.m. on 2nd; S, sleet, and R on 29th; cuckoo first heard on 20th; swallows seen on 22nd.

ORLETON.—The first eleven days were cold and dry, with the exception of the second, when a sudden storm of L T and R set in at 1.30 p.m.; the remainder of the month was generally rainy, with a variable temp. and pressure. There were several severe frosts, especially that of the morning of the 16th, when the temp. fell to 27°·5. Mean temp. 1° below the average. On the 29th, after a bright morning, R commenced at 8 a.m. with a cold S.E. wind, and rapid fall of the bar. The wind was very strong and cold, and at 6 p.m., the R changed to S, which fell thickly for nearly an hour, followed by R again. The brooks were flooded, and the river Teme overflowed its banks on the following morning. The rain has checked farm operations; cherry trees began to blossom about the 2nd, the cuckoo first heard on 21st, and white-throats and willow-wrens seen on 24th.

LEICESTER.—The month was on the whole cold, and often stormy; short thunderstorm on the 24th.

GRIMSBY.—Very unsettled weather throughout; vegetation retarded by cold; farm work delayed by wet. Swallows seen on the 19th, and cuckoo heard on 29th. T L and H on 28th at noon.

ARNCLIFFE.—Lovely weather in the early part of the month, though cold at night. Heavy hail showers on 24th, snowstorm on 29th.

SEATHWAITE.—Beautiful warm weather till the 11th, remainder of the month very wet; three falls of R exceeding 1 inch in 24 hours; H on 19th; S on hills on 16th.

WALES.

HAVERFORDWEST.—First few days gloomy and wet, very fine from 6th to 12th, but with frosts at night followed by milder weather with showers; the air again became very cold about the 15th, and from that date to the end of the month cold, wet, and broken weather prevailed. Terrific gale on 28th and 29th; bar. at 1 p.m. on the latter day 28·843in. (cor. and red.); min. temp. on grass, 21°·0 on 9th.

LLANDUDNO.—The month has been true to its traditions so far as being showery, and has been very different from the corresponding month last year; rainfall this year was 3·18 in., while last year it was only ·94 in.; the number of wet days was 20 this year, in comparison with only 8 last year; polar winds on 17 days this year, and 24 last year; mean temp. 47°·1 this year, and 45°·2 last year, yet still about 1½° below the average. We had no frost this year, and last year there were 7 nights of frost; the range of temp. diurnal and monthly was this year 10°·9 and 28°·3 respectively, whilst last year the values were respectively 12°·0 and 38°·2. 134·9 hours of sunshine were registered during the month, and though several days were stormy, the weather on the whole was fine; swallow seen on the 20th, lilac in bloom on 21st, hawthorn on 25th. Very stormy on 29th.

SCOTLAND.

CARGEN.—Weather generally dull; 133 hours of sunshine, 40 hours below the average; mean temp. 1·2 below average.

HAWICK.—Cold east wind prevailed from 1st to 16th; keen frost on 9th, 10th, 14th and 15th. Rubertlaw and the lesser hills were all white with snow on the 14th and 15th. T at 6 p.m. on 22nd. The month throughout was very cold.

QUINISH.—A cold, ungenial month, but no frost. From 1st to 13th dry and fine; from 14th to 30th wet and stormy; heavy fall of wet snow on 16th.

BRAEMAR.—A very cold, unseasonable month; vegetation dormant.

ABERDEEN.—First part of the month dry, with cold easterly winds, subsequently the winds were variable, and the weather unsettled, with almost continuous rain after the 12th; rainfall consequently above the average by upwards of an inch.

CULLODEN.—The weather was dry up to the middle of the month; temp. low; land generally dry, and seed-time favourable; vegetation late.

DUNROBIN CASTLE.—Cold easterly winds during most of the month.

SANDWICK.—There were some favourable spring days during April, but some days were quite wintry with S showers. Aurora on 13th; ground white with S on 17th.

IRELAND.

CORK, BLACKROCK.—Mean temp. 48°·8; number of night frosts small. Snow on 29th; very rough night on 28th, wind pressure 23 lbs. per square foot.

DROMORE.—The wettest April on record; the first part of the month mild and genial, the latter part cold and stormy; S on the mountains during the last week; T on the 30th; mean temp. 45°·0.

WATERFORD.—The sharp frost on the 9th, and again on 15th, cut down early potatoes and even burnt young ivy leaves. Corncrake heard on 21st, cuckoo on 25th, swallows seen on 29th. H on 27th and 29th. A few flakes of S with sleet on the 29th. Comeragh mountains, Mount Linster, and Black Stairs covered with S on 29th.

WARINGSTOWN.—Grass very forward; potato planting delayed by the wet state of the ground, and will be generally very late.

LONDONDERRY.—Month mild, and generally favourable for farming operations.

EDENFEL.—With the exception of a few short intervals, the weather of the month was raw, rainy, and unfavourable to vegetation; as many and severe night frosts as in January, and more than in February or March. Summer visitants, however, arrived a week earlier than usual.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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GALE OF APRIL 29TH, AND SEA SPRAY IN LONDON.

WE remember reading, but, until Mr. Ramsay's *Scientific Roll* comes to the rescue, we cannot tell where, that in one great gale all the windows in Leeds which faced W. were covered with a thin film of sea salt. From Leeds to the sea is, in that direction, about 54 miles, and between the two runs the Pennine range of hills with an average height of quite 1500 feet.

On April 29th, 1882, a very violent gale swept over the South of England—at some stations a stronger gale than on either October 13th or November 26th, 1881—and it proved seriously injurious to the young foliage of many trees, notably horse chestnuts. The precise *cause* of this injury is disputed, and as we think the matter worthy of attention, we reprint *in extenso*, or in abstract, all the notices that we have received or seen respecting it. Some persons hold that the damage was solely mechanical, and was due to the bruising of tender foliage by the violent wind, others contend, and bring evidence in support of their contention, that it was largely due to the atmosphere being charged with salt. We regret being unable to contribute anything worthy of consideration as scientific evidence to the question; for although we noticed that our windows were more obscured than usual, even after a dirty London rain, and that they looked slightly milky or frosty, it did not occur to us to examine them before they were cleaned.

We proceed with the notices upon the subject, taking them as nearly as possible in chronological order.

SATURDAY'S GALE.

To the Editor of the Standard.

SIR,—May I draw your attention to the unusual fact that the wind during the gale on Saturday last was, to the distance of at least thirty miles inland from the South Coast, largely impregnated with sea-salt? The effect of this on the vegetation is very marked. The foliage of this part of the country, which two days ago was dressed in its freshest Spring garb, is now, after some twelve hours of wind, reduced in many cases to a state as black, shrivelled, and scorched as it was before bright and beautiful.

Few people, I imagine, will, at first sight, suspect the true cause of this blighted state of the blossoms and foliage, some no doubt ascribing it to the extreme boisterousness of the wind, which, by knocking the leaves one against the other, beat them to their shrivelled black condition, whilst others will put it down to the peculiar sharpness of the wind. But the actual cause is easily ascertained by applying the tongue to the surface of a large broad leaf which has been plucked from some tree or shrub that has stood in the face of the wind. On some of the leaves which I examined the salt was actually visible, showing how heavily the air must have been laden with it. I had no instrument for determining the extreme velocity of the wind on Saturday, but it must, judging from the effects, have exceeded anything of the kind in this part of the country for the last seven years; probably the pressure per square foot was not far short of forty-five pounds.

I am not aware how far the wind has been known to carry the sea-brine —probably to a distance greatly exceeding thirty miles. What eventual effect this highly salinous top-dressing will produce on the fruit trees of this country remains to be seen, very probably it will manifest itself in a reduction of the crop by one-half.

I am, Sir, your obedient servant,

Tonbridge, May 1st. E. L. D. S.

To the Editor of the Standard.

SIR,—Saturday's gale produced a similar effect on the trees in the Old Deer Park, in which this Observatory is situated, to that observed by your correspondent at Tonbridge, shrivelling up and blackening the leaves not only of the horse chestnuts, but also of the oaks and elms.

Seeing his letter in this morning's paper, I have examined some of the leaves. These not only give strong evidence of the presence of salt, when water in which they have been soaked is treated with silver nitrate, but on examining their surfaces, crystals may easily be seen, which, when viewed microscopically, are readily identified as salt, by their well-known cubical form.

As this observatory is over fifty miles from the sea, in the direction of south-south-east, in which the wind was blowing during the gale, the evidence of transport of salt to such a distance is interesting.

As to the velocity of the wind in the storm, although our greatest hourly run here was fifty miles, yet I timed several gusts between three and four p.m., when for two or three seconds the rate was from seventy to eighty miles per hour.

The meteorological observations at this observatory have now been made for about forty years, and I do not recollect ever seeing an entry of such an occurrence as that of last Saturday.

I remain, Sir, your obedient servant,

G. M. WHIPPLE, Superintendent.

Kew Observatory, Richmond, Surrey, May 2nd.

To the Editor of the Standard.

SIR,—Your correspondent "E. L. D. S." says that he is not aware how far the wind has been known to carry the sea-brine. I can inform him that it has been credited with conveying it a much greater distance than thirty miles. I remember a storm which occurred on a Sunday, about twenty years ago, when

I was residing at Burton-on-Trent (from which place the sea at its nearest point must be about ninety miles distant), on which occasion the *savants* of the neighbourhood declared that they discovered the presence of sea-spray in the air. For the accuracy of their researches I cannot vouch, but I can attest the fact that throughout that memorable afternoon a seagull was circling over the waters of the Trent, which were lashed by the wind into the miniature resemblance of a storm-tossed ocean.

I am, Sir, your obedient servant,

London, May 2nd. J. R.

To the Editor of The Times.

SIR,—The gale of Saturday last has entirely changed the appearance of the country in these parts, and has besides effected considerable damage on the fruit trees, especially in exposed situations.

The leaves of the elms and oaks on the south-west sides of the trees might convey the impression that they had been scorched by fire, while the more tender foliage of the lime, maple, and poplar appear to be well-nigh destroyed, and several weeks must elapse before the injuries received can be repaired by fresh growth ; though it may be doubted whether these trees will wholly recover throughout the summer, as the young shoots are in many instances entirely destroyed. Pears have suffered much, as far as the leaf is concerned, although the fruit itself, which is now mostly set, does not appear to be greatly injured; still, as every one who has any acquaintance with gardening is aware, fruit cannot grow on trees that are denuded of leaves. The plum trees, though perhaps to a less degree, are a good deal cut about, while the leaves of the apple are blackened and the blossoms crippled. Black-currants are also sufferers, whole branches being torn off from bushes growing in open places, and the remainder appearing as though frosted.

I have never recorded so severe a gale from the south-west during the month of April, nor does the recollection of a similar one occur to the memory of that proverbial individual, "the oldest inhabitant." At this season of the year, if gales take place, they blow almost without exception from the east, or north-east, but this year these winds have been confined to the first ten days in April.

With this fact in view, and considering at the same time the unusual force of wind just experienced from south-west, I have little doubt that this will be the prevalent wind for some weeks to come and, though forecasting for any length of time beforehand is always dangerous, that the early summer, at least, will be more or less wet.

I am, Sir, your obedient servant,

WILLIAM R. C. ADAMSON.

The Rectory, Ashtead, Surrey, May 2nd.

To the Editor of the Standard.

SIR,—That the interesting observation of "E. L. D. S." that a deposit containing salt was left after last Saturday's (April 29th) gale was correct, I have been at some pains to verify.

To-day, by washing a third-storey window, in an exposed situation, with distilled water and a piece of cotton wool (previously tested as to absence of chlorides, and not held in my fingers), I obtained a solution which markedly

contains chlorides (with nitrate of silver test) and its evaporated residue crystals of salt. Its taste is decidedly saline.

Yesterday (2nd) I failed to obtain satisfactory proof by testing damaged foliage, for some showed its presence decidedly, whilst on others it was absent, the reason probably being that a later rain had removed it. I was, therefore, unable, without extensive experiments, to say for certain whether the foliage in itself did or did not contain salt.

As to the destructive effect of this salt on the foliage, I cannot but disagree with "E. L. D. S." until I have made further experiments, for frequently only the side of the damaged tree exposed to the blast is the injured side. Surely the other side must have have had salt on its young and tender leaves, for they are not yet developed enough to screen one side completely from the other. Then again, each leaf has frequently only its outer edge damaged. Also I have noticed here and there a tender stem blackened in only one spot, where it has bent or been struck. I should imagine that had the destruction been due to salt in the air it would have been more universal, and not confined to those parts exposed in the teeth of the blast. Surely, battering of the leaves and branches can explain it. If due to salt, perhaps those living near the sea can say whether saline air only destroys young foliage.

I am, Sir, your obedient servant,

Tonbridge, May 3rd. A. C. H.

BUSHEY PARK.—Probably nowhere near London was such destruction caused by Saturday's gale as in the magnificent avenue of chestnut trees in Bushey Park, which the public are informed by the usual notices are "now in full bloom." From Teddington at one end, to Hampton at the other, the scene may be described as one of wreckage Many large trees were uprooted, while some hundreds of others have suffered severely.

SIR,—The gale of April 29th has here, as elsewhere, done much harm; no one seems to recollect such a gale at this time of the year. It was much worse, in its effect, than that of the 25th, lasting longer, too, though with less rain. The oak trees are blackened, as if by frost; in the less exposed situations, however, one side of the trees remain green. Birches, which last week were in full leaf, now look as bare as in winter. Pear trees have suffered severely, the fresh young leaves being black and scorched. The white cherry-blossom has been suddenly turned brown; in some gardens the currant bushes and young peas are much cut up, and I have seen even rhubarb all bruised and spoilt. The hop-bines in places are so injured as to be useless for tying up, and poles will have to wait for fresh shoots to be properly furnished. So that, altogether, we have a sad interruption to the prospects of a fruitful season.—Yours truly,

J. ELLIS MACE.

Tenterden, May 3rd, 1882.

The terrible wind and rain storm of the 29th ult. is worthy of, and will doubtless meet with, notice in your columns. I do not remember ever seeing such devastation wrought amongst vegetation. In this district of Mid-Surrey no great damage has been done, and not many trees were blown down, but the aspect of vegetation on the side from which the storm came is forlorn in the ex-

treme. The chestnut trees have suffered especially; so blackened and withered are the leaves and flowers on the storm side in all unsheltered places that it seems doubtful whether they can ever revive through the summer. The contrast between the storm-beaten and other side of trees is most remarkable. Even the bushes of currant and gooseberry bear considerable traces of damage, the very weeds and nettles by the wayside are blackened. Some of the daily papers have spoken of severe frost coming after the storm. I observed nothing of the kind here; my lowest reading at the time being 35° and 36°, and I am inclined to attribute all to the strange bitterness of the gale, and the cutting blast of hail during one portion of it.—A. C., *Journal of Horticulture, May 11th*, 1882.

ROYAL HORTICULTURAL SOCIETY.—SCIENTIFIC COMMITTEE.—May 23rd, 1882.

Sir J. D. Hooker, F.R.S., in the chair.

Foliage injured by Salt in the late Gale.—Dr. Church described experiments he had made at Cirencester during the last fifteen years to ascertain the amount of salt brought by autumnal gales, especially from S.W. He found from 5 to 7 grs. per gallon, while the ordinary amount was only 0·5 grs. The average winter amount was but little more than that of summer. He noticed that in Oakley Park one side of the trees was severely injured, and that if no rain followed for a few days after the gale, the salt sparkled on the trees even at a distance of 35 miles from the British Channel. The salt abstracted the moisture from the cells and formed a condensed solution, so that the leaf became completely dried up and perished.

Mr. McLachlan added that salt had been observed on windows at Lewisham and at Croydon and elsewhere.

Sir J. D. Hooker remarked that Dalton first noticed it at the beginning of this century. With regard to beeches withstanding the gale better than oaks, as mentioned at the last meeting, it was stated that they were unhurt at Kew and Valewood, Haslemere; but at Cirencester, in Dorsetshire, and in Cornwall, they suffered severely.

Mr. Blackmore exhibited foliage of pears, &c., from Teddington; some were quite unhurt; of other trees growing adjacent to them the leaves were severely cut. Vines and peaches showed similar differences. He suggested that it could not be salt in this case.

The opinion generally entertained was, that such discrimination was due to the trees being relatively hardy and less hardy kinds.

SIR,—My house here stands on a hill-side exposed to the S.W. I look across a valley, and on the opposite horizon see Leith Hill Tower, 5 miles distant, from which the sea is visible. Of course we felt the full violence of the gale last Saturday (29th); a torrent of rain fell and streamed down my windows for hours together. The next day (Sunday) was very dry and sunny, and I was surprised at 9 a.m. to find my window panes covered with what looked like a finely-crystallized deposit. Examining this with a lens, I detected regularly formed crystals, and on wiping them up with my finger, and tasting them, I found them to be *salt*. I did not chemically analyse it, but its taste was that of common table salt.

The gale was from the S.W., and the nearest sea-coast in that direction, in a direct line, is about 35 miles off.

When I read in the *Times* of Thursday the week's weather report from Kew, I was astonished to find that salt had been found *there* on the leaves, so many miles further from the sea than Dorking.—Yours faithfully, JAMES DIXON.

Harrow Lands, Dorking, May 5th, 1882.

SIR,—We are thirty miles, at least, from the sea, but on the previous Saturday, our windows were thickly coated with salt, and our foliage is ruined for the year, mainly, I think, by the force of the wind, certainly *not* by insects, though they now abound.—Sincerely yours, E. S. ROWCLIFFE.

Hali Place, Cranleigh, Guildford, 5th June, 1882.

Our readers have now before them all the evidence which we have been able to collect. We shall be glad to see the subject further discussed.

THE METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on May 17th, at the Institution of Civil Engineers, Mr. J. K. Laughton, F.R.A.S., President, in the chair. Miss W. L. Hall, Mr. E. J. Pearson, Dr. J. R. Somerville, and Mr. W. J. V. Vandenbergh were elected Fellows of the Society.

The following papers were read:—"On the Diurnal Variation of Wind and Weather in their relation to Isobaric lines," by the Hon. Ralph Abercromby, F.M.S. By constructing synoptic charts at different hours of the same day, and by comparing the wind and weather records at the different hours, and examining their relation to mean curves of diurnal variation, the author shows that the mean diurnal increase of the wind's velocity may be explained by the fact that for the same gradient there is more wind by day than there is by night. The mean diurnal veering of the wind may be explained by the fact that in cyclones the wind is a little more incurved, and in anticyclones a little more outcurved, by night than by day. The mean diurnal increase of the frequency of rain during the day hours may be explained by the fact that in any given cyclone the area of rain is larger by day than by night. The diurnal changes of every element are super-imposed on the larger general changes, and are independent of each other. Great stress is laid on this point, both as explaining and classifying many meteorological questions, and as simplifying the problem of weather forecasting. The author gives a simple hypothesis, from which it appears that the diurnal veering and increase of rain follow as a natural consequence of the diurnal increase of velocity.

"Mechanical conditions of Storms, Hurricanes, and Cyclones," by W. F. Stanley, F.M.S. The author pointed out many analogies between the phenomena of cyclones, &c., and those of vortex rings, and illustrated his paper by exhibiting the phenomena of the latter.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JAN., 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	53·4	6	27·4	25	45·4	36·1	38·2	92	74·4	21·3	1·30	7	8·2
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	86·4	21	68·1	7	82·6	73·7	69·3	76	...	...	11·71	17	6·1
Calcutta	84·5	27	51·9	9	79·2	56·7	58·0	73	144·2	42·7	·13	2	2·4
Bombay	90·8	20	64·0	13	84·8	69·2	65·1	66	145·1	53·6	·00	0	1·1
Ceylon	89·2	15,17	68·0	9	86·4	72·6	69·2	71	152·0	62·0	2·81	9	6·3
Melbourne	110·5	19	46·9	31	78·6	54·8	50·0	60	168·9	39·9	·29	6	4·5
Adelaide	112·0	18	50·5	13	86·1	60·4	49·6	43	180·0	40·0	·24	5	3·7
Wellington	78·3	31	48·5	13	67·9	55·1	...	...	140·0	45·0	4·00	11	...
Auckland	77·6	7	53·2	27	73·3	58·2	57·1	75	132·1	48·5	5·52	11	6·2
Falkland Isles	65·7	16	33·0	1	55·9	42·3	43·4	76	134·0	27·0	2·79	18	7·3
Jamaica	89·9	24	62·0	15	84·8	66·8	66·1	77	...	...	·44	4	2·8
Barbados	80·0	2, 3	68·0	28	78·0	70·0	68·3	80	145·0	66·0	2·02	16	6·0
Toronto	48·1	27	—17·4	24	30·3	15·5	21·2	82	108·0	—23·0	2·01	15	7·0
New Brunswick, S. John	41·0	9	—11·0	18	27·0	8·7	17·7	88	...	...	4·60	18	5·0
Cape Breton, Sydney	49·5	2	—10·0	26	28·3	9·4	17·8	86	...	...	5·01	15	5·7
Newfoundlnd, S. John's	37·6	3	—12·0	15	22·1	10·2	10·0	96	98·0	—10·0	4·70	...	7·1
Manitoba, Winnipeg	29·3	5	—39·7	23	8·7	—11·2	4·3	97	...	...	1·18	11	5·9

REMARKS, JANUARY, 1882.

Mauritius.—Rainfall, 5·01 in. above average; mean pressure, 29·972 in. Mean hourly velocity of wind, 8·6 miles; extremes, 23·4 miles on 28th, and 0·0 miles on 15th. T and L daily from 16th to 21st and from 27th to 31st.
C. MELDRUM, F.R.S.

CEYLON.—TS occurred on 4 days, and T or L on 3 other days. J. STODDART.

Melbourne.—Mean temp. 1°·1, temp. of dew point 3°·0, and rainfall 1·46 in. below the average; pressure, humidity, and amount of cloud slightly below the average also. Prevailing wind, S.W.; squally on 1st and 2nd, hot wind on 10th, 19th and 29th, with heavy duststorms on 10th and 19th; T and L on 10th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 73°·3, 1°·6 below average; although the max. in shade reached 90° on only 9 days, the heat at times was very great, particularly on 18th (see Table), when the old black glass ther. *in vacuo* rose to 168°·5, 2° higher than has ever been recorded before, and at noon the humidity was only 14. No R fell in the neighbourhood of Lake Torrens, and the fall over the agricultural districts, except in the S.E., was far below the mean.
C. TODD.

Wellington.—First two days fine, followed by stormy weather till 9th; thence fine again till 16th, again followed by stormy weather till 22nd; and the remainder of the month fine. Slight earthquakes on 9th and 17th; T on 3rd.
R. B. GORE.

Auckland.—Weather cool, with occasional very heavy R, 2·30 in. falling on 4th; mean pressure 29·865 in., below the average. Wind high from 7th to 12th; prevailing direction S.W. E. B. DICKSON.

BARBADOS.—Mean pressure below the average; mean temp. 73°·8, slightly above it. Prevailing wind N.E.; average velocity, 14·8 miles; extremes, 18·9 miles and 8·5 miles. Rainfall below, and evaporation above the average.
R. BOWIE WALCOTT.

NEWFOUNDLAND.—The first part of the month was mild; the latter part cold and stormy, with S. Strong gale from S. on 14th. J. DELANEY.

SUNSPOTS, MAGNETIC STORM, AND AURORA AUSTRALIS.

On the 16th of April last, we had the pleasure of seeing a portion of the solar disc in the great camera of M. Janssen's Observatory at Meudon, near Paris, and examining at leisure the details of the enormous spots then visible on the solar surface. When we remind our readers that the plates used in that camera are so large that the solar image is 4 ft. in diameter, they will readily understand with what ease the details of those great spots were seen.

On Saturday, June 3rd, at the visitation-day of Greenwich Observatory, one of the diagrams specially laid out for examination was one showing while these spots were nearing the sun's centre an extremely violent disturbance of the magnets. Every movement of which, as our readers are doubtless aware, is automatically recorded by photography at the Royal Observatory, Greenwich.

Thus far we had only traced two of the usual triplet of phenomena. On June 5th, we received from our correspondent at Wellington, New Zealand, written details and newspaper reports of exceptionally fine Aurora Australis, almost, if not quite, simultaneous with the magnetic storm silently photographed in the underground chambers of the Royal Observatory.

Some one may say, "Well, there's nothing new in that. We know that sunspots, magnetic storms, and auroræ go together. We know that magnetic storms occur at the same instant of time in all parts of the globe. We know that Aurora Borealis and Aurora Australis are often simultaneous, and perhaps connected." To this we reply, Quite true; some persons know it, all do not; and as no one can yet tell precisely how the phenomena are connected, we think it well to set as many brains at work upon the subject as practicable.

After this digression, we will go back to the Aurora Australis, and reprint verbatim the descriptions given in the New Zealand paper. Adding merely one or two foot notes—

THE MAGNETIC STORM AND AURORA AUSTRALIS.

A very brilliant Aurora Australis was visible intermittently for some hours last evening, 17th. The first symptoms of auroral light were perceptible as soon after sunset as the darkness was sufficient to enable them to be seen, and there is no doubt that the very remarkable colouring and conformation of the clouds which was noticeable at sunset were partially due to the same cause which produced the Aurora, namely, one of those peculiar phenomena known to meteorologists as magnetic storms, which had set in at about 4 o'clock yesterday afternoon, producing extraordinary effects on the telegraph wires over the whole colony, particularly in the South Island. The violence of the disturbance increased as the South Pole was approached,* and was greatest of

* Our Antipodæan friends write as if the South Pole were close to them, but Wellington is no nearer the South Pole than Rome is to the North Pole.

all at Invercargill and The Bluff,† from which no messages could be sent up to nearly midnight. Telegrams for all southern stations had to be refused shortly after 4 p.m., and the lines were only working again by about 9 p.m. The auroral display was at its brightest shortly after 7, and from that hour until 9 o'clock it alternately diminished and again increased in brilliancy. At one time the whole southern heavens presented the appearance of being illumined by the reflection of a vast conflagration. At another time there was a very pale bluish-green light surmounting a seemingly dense mass of pitchy blackness, which, nevertheless, was really so transparent as to permit the stars to shine through. After a time, faint rays shot upward across the background of pale glare, and these rays gradually beamed forth into marvellous vividness, shining with a peculiarly beautiful, pulsating, rosy light. Once or twice the vertical rays ran almost up to the zenith. Toward the end of the auroral display, it became "mixed up" with the light from a genuine gorse fire, which was burning in a gully among the hills to the south-west of the city, and this completely puzzled the spectators, who, by this time, were very numerous. Curiously enough, as the aurora at its outset was mistaken for a distant fire, so afterward this bush fire was mistaken for a fresh and surprising development of the aurora, the actual flames being hidden from view. It will be seen from the telegrams below that the aurora was very remarkable in the southern parts of the colony.

It appears that the phenomenon was also witnessed in the Wairarpa. Shortly before 7 o'clock (says the *Greytown Standard*) the south-eastern sky began to assume a beautiful rose colour, which deepened into a fiery red, the coruscations or streamers of light becoming stronger, until nearly the whole of the southern heavens presented an awfully grand appearance, with dim flashes of light ascending from the horizon.

CHRISTCHURCH, 17th April.

There was a wonderfully brilliant aurora this evening about 7 o'clock. The tints, as seen here, were gorgeous, and extended right to the zenith.

TIMARU, 17th April.

A very brilliant Aurora Australis is visible here to-night.

THE AURORA AUSTRALIS.

The Aurora Australis was visible again last evening (20th) for some hours. Between 7 and 8 it was peculiarly fine. The light was scarcely so bright as in Monday's display (17th); but the colouring was even more vivid, a singularly rich deep crimson tint prevailing on the upper portion of the aurora, shading off into "cardinal," scarlet and pink as the horizon was approached. Across this mass of gorgeous colouring, rays of creamy-hued light shot upward to a height of 30 or 40 degs. The variations of colour, shading, and intensity changed almost every moment, producing effects of marvellous beauty. The sky being perfectly clear the full view was not obstructed by clouds, as was sometimes the case on Monday. The streets were crowded during the evening with spectators of the display. As in the former instance, it was mistaken by many people for a fire, and one excited alarmist was only just prevented in time from ringing the fire-bell. The aurora had not wholly faded away by 11 p.m. The telegraphic wires were only slightly affected on this occasion by the magnetic

† These two stations are, it is true, at the extreme S. of New Zealand, but they are only in the same degree of S. latitude that Geneva is of N. latitude.

disturbance. A correspondent informs us that she observed an aurora on Sunday evening (16th), at 7 o'clock, in a due southerly direction. Some interesting telegrams relative to last night's display appear below.

DUNEDIN, 20th April.

The Aurora Australis was again very brilliant here to-night.

The Rev. Dr. Roseby, writing in the *Herald* this morning, says that there is a close connection between the electrical disturbances and sun-spots, and adds :—"We are just at about the epoch (the period is a little more than eleven years) of maximum sun-spots, and certainly the sun, for the last few days, has displayed a strangely unusual appearance. Two groups of spots of enormous magnitude are now to be seen on its surface. They are so large as to be distinctly visible, the eye being, of course, duly protected, without any telescopic aid whatever. It is a matter of startling and unusual interest to know that a piece of smoked glass will just now enable any person with good eyes to see spots on the sun. They will only be visible, however, for the next few days."

SIGNS OF SUMMER.

To the Editor of the Meteorological Magazine.

SIR,—I send the enclosed table of the arrival of some of our summer birds, as it may interest some of your readers :—

YEAR.	CUCKOO.	SWALLOW.	CORNCRAKE.
1873	April 22nd.	April —	May 7th.
1874	April 27th.	April 21st.	May —
1875	April 24th.	April 22nd.	May —
1876	April 29th.	April —	May 8th.
1877	April 26th.	April 27th.	May 10th.
1878	April 22nd.	April 24th.	May 18th.
1879	April 27th.	April 26th.	May 9th.
1880	April 24th.	April 24th.	April 27th.
1881	May 1st.	April 18th.	April 28th.
1882	April 25th.	April 29th.	April 21st.
AVERAGE ...	April 26th.	April 23rd.	April 30th.

Yours truly,

C. PERCEVAL BOLTON, F.M.S.

Brook Lodge, Waterford.

SUNLIGHT AND SUNSHINE.

IN the annual report of the inspector under the Alkali Acts is contained a table showing the results of an entirely new process for investigating the state of the atmosphere as a conveyer of solar light. The active power of the light, or, in Mr. Angus Smith's words, its "actinic strength," is tested by the decomposition of iodide of potassium in the presence of acid when exposed to the open air. This test has been applied at Manchester for a period of over

twelve months, ending with the July of last year, and the results are given in weekly and monthly averages extending throughout that time. It is to be noted that this actinism of the light has no direct connection with the actual sunshine, so that it cannot be estimated in any but the most vague and imperfect way by the unaided eye. "The value of the sun to us," is, however, as the inspector observes, "measured not by clear sunshine, but by total effective light." The tables now for the first time given have, therefore, according to this theory, far greater value than any mere observations of cloudy or cloudless days, such as those which have been taken by Sir H. Brand amongst other persons in late years. The figures in the Manchester return show very great diversity in the actinic strength exerted in different months and years. Although, of course, the summer months show the best results, they are by no means uniform according to their order in the calendar. Thus, in the first seven months of last year April was by far the brightest month, scoring a total of 44·2, and from the end of that month until the end of July, there was a steady falling off, until the return for July descended as low as 25·4, against a return of 55 for the July of the preceding year. December and January show the low total of 2·1, and of the months next to them November, with 13·9, stands a long way above February with 6·8. The highest score mentioned in the return is 66·6, which is credited to the month of August in 1880.—*The Globe.*

THE HEAT IN AUSTRALIA IN JANUARY.

SOME statements respecting the excessively high temperature in South Australia and in Victoria during some days of January last, will be found in the table and remarks from the observatories at Adelaide and Melbourne on a previous page (71).

We are glad to supplement them by the following table from a station more than 500 miles distant from both Adelaide and Melbourne. We may add that these two cities are about 400 miles apart :—

SHADE TEMPERATURE AT MOUNT HARRIS ON THE MACQUARIE RIVER, NEW SOUTH WALES, JANUARY, 1882.

A correspondent, writing from Mount Harris, on the Macquarie River, forwards us the following record of the temperature (in the shade) in that locality during the best part of last month :—

1882.	Deg.	1882.	Deg.
January— 9th, 3 p.m. ...	112	January—19th, 1 p.m. ...	106
10th, 2 p.m. ...	113	20th, 12 noon ...	112
11th, 2 p.m. ...	113	21st, 2 p.m. ...	114
12th, 2 p.m. ...	94	22nd, 2 p.m. ...	115
13th, 2 p.m. ...	90	23rd, 2 p.m. ...	110
14th, 2 p.m. ...	103	24th, 2 p.m. ...	104
15th, 3 p.m. ...	108	25th, 2 p.m. ...	102
16th, 2 p.m. ...	105	26th, 2 p.m. ...	104
17th, 11 a.m. ...	106	27th, 2 p.m. ...	101
,, 2 p.m. ...	100	28th, 3 p.m. ...	106
18th, 2 p.m. ...	108	29th, 2 p.m. ...	112

30th, at 6 a.m,, 88° ; very sultry all last night, with T at intervals. 7 a.m., 80°, heavy T, with R and wind for about half-an-hour. Looking now likely for cooler weather.

THE MONSOON.

THE present month may be called the turning-point of the season in India, whose agricultural prospects are, humanly speaking, assured by the news which has reached us from Bombay of the bursting of the monsoon. This phenomenon, on whose regular occurrence the fate of the whole of India may be said to hang, is one which excites the awe of those who witness it for the first time, and arrests the attention of all who have an interest in our Great Empire in the East. Even by Anglo-Indians at home the intelligence of the bursting of the monsoon is anxiously looked for as every succeeding June comes round. The moment at which the rain-laden clouds actually burst, after having been rolled up in dense volumes by the steady wind which at the end of April or beginning of May begins to blow across the continent from the Indian Ocean, is one of supreme grandeur. The sudden advent of a summer thunderstorm in this country, after the dark masses of cloud have been slowly brought overhead, when the lightning flash seems to rend the heavens in twain, and the reverberating thunder to shake earth and sky alike, is but a small presentment of what happens among the hills of India. There, after perhaps days of close, sultry weather, during which the dark blue sky has become hidden amid dense volumes of vapour, the cloud assumes a deep fiery hue, apparently reflecting the heat which is felt on all sides. Then, instead of a lull in the regular movement of the air, a sudden squall springs up, followed almost immediately by vivid flashes and sheets of lightning, amid the play of which the rain begins to fall, first in heavy drops and then in torrents, that appear likely to carry all before them. The parched earth eagerly drinks in the moisture; the heaviness of the storm passes off, the atmosphere becomes cool and quiet, and then, in the next valley and amid the adjoining hills, the same impressive sight is witnessed, till gradually the whole country from south to north is visited, and the "rainy season," bringing fertility to the soil, is safely ushered in.—*The Colonies and India.*

A WET APRIL.

RAINFALL REGISTERED AT LONG WITTENHAM, BERKS.
Lat. 51°, 39′ N.; Lon. 1°, 13′ W.

IN THE MONTH OF APRIL, 1851—1882 INCLUSIVE.

1851...	·95	.....	1862...	2·51	.....	1873...	·79
1852...	·54	.....	1863...	1·37	.....	1874...	1·04
1853...	1·93	.....	1864...	1·71	.....	1875...	1·21
1854...	·59	.....	1865...	·93	.....	1876...	2·74
1855...	·38	.....	1866...	1·76	.....	1877...	2·69
1856...	2·56	.....	1867...	2·40	.....	1878...	2·75
1857...	1·74	.....	1868...	1·65	.....	1879...	2·32
1858...	2·11	.....	1869...	1·65	.....	1880...	2·76
1859...	1·98	.....	1870...	·63	.....	1881...	·79
1860...	·84	.....	1871 ..	2·05	.....	1882...	3·84
1861...	1·04	.....	1872...	2·18	.....		

J. CLUTTERBUCK.

[The fall in 1882 was, therefore, more than double the average (1·70 in.), and about 40 per cent. greater than in any one of the previous 31 years.]—ED.

SUPPLEMENTARY TABLE OF RAINFALL, MAY, 1882.

[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	1·35	XI.	Castle Malgwyn	2·24
,,	Margate, Birchington...	1·37	,,	Rhayader, Nantgwillt..	2·43
,,	Littlehampton	1·06	,,	Carno, Tybritle	2·51
,,	St. Leonards	1·96	,,	Corwen, Rhug	2·33
,,	Hailsham	1·18	,,	Port Madoc	2·18
,,	I. of W., St. Lawrence.	1·00	,,	I. of Man, Douglas	1·07
,,	Alton, Ashdell.....	1·92	XII.	Carsphairn	2·28
III.	Great Missenden.....	2·15	,,	Melrose, Abbey Gate...	2·53
,,	Winslow, Addington ...	2·10	XIII.	N. Esk Res. [Penicuick]	2·65
,,	Oxford, Magdalen Col...	1·66	XIV.	Ayr, Cassillis House ..	1·51
,,	Northampton	1·87	,,	Glasgow, Queen's Park.	2·41
,,	Cambridge, Beech Ho...	1·45	XV.	Islay, Gruinart School..	1·73
IV.	Southend	1·08	XVI.	Cupar, Kemback.....	2·70
,,	Harlow, Sheering	1·20	,,	Aberfeldy H.R.S.	2·04
,,	Diss	1·45	,,	Dalnaspidal	4·69
,,	Swaffham	1·71	XVII.	Tomintoul.....	1·69
,,	Hindringham	2·01	,,	Keith H.R.S.	1·93
V.	Salisbury, Alderbury...	2·10	XVIII.	Forres H.R.S.	1·58
,,	Calne, Compton Bassett	1·78	,,	Strome Ferry H.R.S....	3·26
,,	Beaminster Vicarage ...	1·78	,,	Lochbroom	2·66
,,	Ashburton, Holne Vic..	2·48	,,	Tain, Springfield.....	1·78
,,	Torrington, Langtree W.	2·99	,,	Loch Shiel, Glenaladale	5·29
,,	Lynmouth, Glenthorne.	2·07	XIX.	Lairg H.R.S.	·52
,,	St. Austell, Cosgarne...	...	,,	Forsinard H.R.S.	1·68
,,	Taunton, Fullands	1·68	,,	Watten H.R.S.	1·54
VI.	Bristol, Clifton	1·93	XX.	Fermoy, Glenville	3·04
,,	Ross	2·01	,,	Tralee, Castlemorris ...	2·68
,,	Wem, Sansaw Hall.....	1·68	,,	Cahir, Tubrid	3·12
,,	Cheadle, The Heath Ho.	2·89	,,	Newcastle West	1·95
,,	Worcester, Diglis Lock	1·79	,,	Kilrush	...
,,	Coventry, Coundon	1·57	,,	Corofin	2·18
VII.	Melton, Coston	2·04	XXI.	Kilkenny, Butler House	...
,,	Ketton Hall [Stamford]	1·34	,,	Carlow, Browne's Hill..	4·10
,,	Horncastle, Bucknall ...	2·38	,,	Navan, Balrath	3·09
VIII.	Macclesfield, The Park	1·65	,,	Athlone, Twyford	4·03
,,	Walton-on-the-Hill... .	1·26	XXII.	Mullingar, Belvedere ...	3·18
,,	Broughton-in-Furness ..	3·30	,,	Ballinasloe	3·31
IX.	Wakefield, Stanley Vic.	·94	,,	Clifden, Kylemore	3·09
,,	Ripon, Mickley	1·33	,,	Crossmolina, Enniscoe..	3·24
,,	Scarborough.....	1·21	XXIII.	Carrick-on-Shannon ...	1·87
,,	East Layton [Darlington]	1·55	,,	Dowra	1·96
,,	Middleton, Mickleton ..	1·90	,,	Rockcorry..... ..	3·30
X.	Haltwhistle, Unthank..	1·55	,,	Warrenpoint	3·04
,,	Shap, Copy Hill	3·15	,,	Newtownards	1·57
XI.	Llanfrechfa Grange	2·42	,,	Belfast, New Barnsley..	2·28
,,	Llandovery	2·50	,,	Bushmills	2·15
,,	Solva	·77	,,	Buncrana	2·32

MAY, 1882.

Div		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches	in.								
I.	ENGLAND.	London (Camden Square) ...	1·20	— ·72	·41	5	11	74·2	29	37·3	16	0	
II.		Maidstone (Hunton Court)...	1·07	— ·95	·23	25	8	...	...	...	...	...	...
,,		Strathfield Turgiss	1·32	— ·36	·47	5	8	71·4	29	33·1	17	0	8
III.		Hitchin	1·26	— ·73	·39	5	9	70·0	22	30·0	16	3	...
,,		Banbury	2·13	·00	·87	22	14	70·0	30	30·0	17	1	...
IV.		Bury St. Edmunds (Culford)	1·67	— ·23	·53	25	9	74·0	28	31·0	15*d*	3	..
,,		Norwich (Cossey)	1·61	— ·20	·55	24	8	74·0	23	33·0	18	0	...
V.		Bridport	...	...	...	...	...	..	..	...	...	...	...
,,		Barnstaple.....	1·92	— ·18	·43	25	9	72·0	31	39·0	1, 17	0	...
,,		Bodmin	1·83	— 1·01	·39	25	11	72·0	31	38·0	16	0	0
VI.		Cirencester	2·09	— ·09	·67	25	10	...	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	2·26	— ·13	·41	3	15	68·5	10	34·0	16	0	0
,,		Tenbury (Orleton)	2·87	+ ·44	·54	25	13	70·7	30	30·8	16	2	6
VII.		Leicester	2·41	...	·82	7	14	72·6	22	35·0	17	0	...
,,		Boston	1·72	— ·05	·69	25	9	73·0	23	37·0	16	0	...
,,		Grimsby.....	2·04	+ ·39	·42	3	12	68·0	29	35·0	16	0	...
,,		Mansfield	...	...	...	...	...	...	...	...	...	...	...
VIII.		Manchester (Ardwick).....	2·14	— ·09	·44	5	14	70·0	11*a*	38·0	1	0	...
IX.		Wetherby (Ribstone Hall) ...	1·86	+ ·04	·52	4	8	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·44	+ ·32	·66	25	12	75·0	18	32·0	16	...	...
X.		North Shields	2·40	+ ·55	·72	7	14	70·5	28	33·0	17	0	2
,,		Borrowdale (Seathwaite).....	8·48	+ 1·50	4·51	24	13	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely).....	2·26	— ·34	·59	25	13	...	...	...	...	...	...
,,		Haverfordwest	·83	— 1·86	·36	23	8	69·0	22	32·3	4	0	6
,,		Plinlimmon (Cwmsymlog) ...	2·76	...	·86	23	14	...	...	...	...	...	...
,,		Llandudno.....	1·03	— ·59	·41	23	10	65·5	23*b*	33·8	4	0	...
XII.		Cargen [Dumfries]	1·37	— 1·16	·36	1	12	73·6	18	33·6	16	0	...
,,		Hawick	1·49	— ·65	·30	8, 23	11	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	2·31	— ·03	·58	1	14	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	3·22	+ ·46	·62	26	15	...	...	32·0	3, 5	2	...
,,		Appin (Airds)	3·07	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	4·61	...	·80	1	14	...	...	...	...	...	.
XVI.		Loch Leven Sluices	2·70	+ ·41	·90	8	12	...	...	...	...	...	...
,,		Arbroath	2·21	+ ·44	·61	7	11	66·0	28	36·0	16	0	...
XVII.		Braemar	2·51	+ ·09	·47	1	16	71·0	17	28·0	16	4	19
,,		Aberdeen	1·44	...	·39	11	10	68·0	29	34·0	16	0	...
XVIII		Skye (Sligachan)	7·22	...	1·92	9	14	...	...	...	...	..	...
,,		Culloden	·86	— ·92	...	...	...	74·0	19	31·0	16	2	14
XIX.		Dunrobin	1·57	...	·68	11	10	65·0	19	38·0	12	0	...
,,		Orkney (Sandwick)..... ..	1·37	— ·50	·27	11	14	63·2	27	35·6	8	0	5
XX.	IRELAND.	Cork (Blackrock)	2·52	+ ·36	·54	24	15	80·0	30	33·0	16	0	...
,,		Dromore Castle	2·65	...	·50	2	11	68·0	18	34·0	3, 16	0	...
,,		Waterford (Brook Lodge) ...	2·90	...	·94	23	11	70·0	31	33·0	4	0	...
,,		Killaloe	2·65	...	·56	24	13	81·0	30	31·0	5	2	...
XXI.		Portarlington	4·01	+ 2·16	·71	23	19	71·0	18	31·0	16	1	...
,,		Dublin (Monkstown)	1·79	...	·54	24	15	...	...	...	...	...	...
XXII.		Galway (Queen's College) ...	2·43	— ·24	·50	2	14	...	...	...	...	...	...
XXIII.		Waringstown	2·09	— ·02	·28	24	15	77·0	29*c*	33·0	4	0	...
,,		Londonderry...	.	...	...	...	...	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·33	— ·02	·44	24	16	70·0	18	30·0	4	3	...

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

a And 22. *b* And 29. *c* And 31. *d* And 17.

METEOROLOGICAL NOTES ON MAY.

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 was very favourable to the growing crops; the temp. high during the day, and the nights warm; lunar rainbow at 11 p.m., on 26th; hawthorn and ox-eye daisy in flower on 1st, dog-rose on 16th, fox-glove on 19th, blackberry on 22nd, first swift seen on 5th, wheat in ear on 29th.

BANBURY.—Mean temp. 52°·3; TSS on 3rd and 22nd, and T and L on 7th, 23rd, and 28th; high wind on 19th, 20th, and 24th, H on 2nd and 22nd.

CULFORD.—A fine but rather dry month with cold nights; cereals forward and looking well; L on 3rd, T on 21st, H on 7th.

COSSEY.—A dry month with many bright days and cold nights; distant TS on 7th with local heavy showers.

BODMIN.—A warm genial month with beneficial rains from 21st to 28th; mean temp. 56°·0.

CIRENCESTER.—On the whole a favourable month for the crops, but the prospect for fruit damaged by strong winds.

WOOLSTASTON.—Mean temp. of the month 51°·9; a severe S from 3 to 3.45 p.m. on 3rd.

ORLETON.—The first week of the month was warm and rainy with a S wind; the weather then became fine and dry with frosty nights and a steady wind from N. and E., on the 22nd the wind changed again to the S. with violent TSS and heavy R for a week; the last four days of the month were again fine and dry. Mean temp. about 1°·2 above the average of 20 years; T was heard on 5 days and L seen on 4 days. A violent storm of L, T, and H, passed over on 3rd, when many of the H stones were more than 1 inch in length; the fall of H lasted about 9 minutes, and in that time the R gauge registered about ·50 in.; great but short storms of L, T, and R, occurred also on the 22nd and 23rd, many trees in the neighbourhood being struck by the L.

LEICESTER.—The month was a very genial one; grass abundant, corn promising well; a very heavy TS occurred on the 7th with ·82 in. of R, the greater part of which fell in one hour, and a short TS at 3.30 p.m. on 23rd.

KILLINGHOLME.—Very dry in the middle of the month followed by some very acceptable rains from 22nd to 28th; close of the month very fine; T and L at night on 7th, T at mid-day on 24th and 27th.

ARDWICK.—The month opened in a somewhat unpromising manner, but as it advanced became fine; cold E. winds prevailed from about the middle to the 22nd, but on that day beneficial rains commenced. Temp. of the month rather low.

ARNCLIFFE.—Thunder daily from 1st to 4th, and on 7th.

NORTH SHIELDS.—TSS on 3rd and 26th, T on 27th and 29th.

WALES.

HAVERFORDWEST.—One of the driest Mays recorded; it commenced with high wind and R, but after the 3rd the days were fine and bright, and the nights frosty; some R fell on the 9th, but with that exception there was an absolute drought from the 2nd till the 22nd; that day and the four following days were wet and warmer, the warmth continuing to the close of the month.

LLANDUDNO.—A bright and dry month, perhaps too dry for the farmer and gardener, but most enjoyable for health and pleasure seekers; measurable quantities of R fell on 10 days but the amounts were small except on the 23rd, on which day a TS occurred between 4 and 5 p.m. Mean temp. 52°·4, as nearly as possible the average; mean degree of humidity 75; the winds were moderate in force and about half polar and half equatorial; duration of bright sunshine 380 hours.

SCOTLAND.

CARGEN.—A bright warm month, duration of sunshine about 50 hours above the average, R much needed; mean temp. 52°·3, 1°·4 above the average; T on 7th, 11th, and 26th.

HAWICK.—The month was free from anything of a wintry character, and the country is looking beautiful.

ARBROATH.—A violent whirlwind occurred on the 27th at 5 p.m., and lasted ten minutes.

BRAEMAR.—The early part of the month was cold with frosts at night, the latter part fine and warm; T at 5 p.m. on 27th.

ABERDEEN.—Very fine growing weather, vegetation made rapid progress but the rainfall was somewhat deficient, being about half an inch below the average; fresh N.W. gale on 12th, and squally on 11th.

CULLODEN.—Weather very dry, partial showers only occurring, very fine, particularly between 12th and 26th.

SANDWICK.—The weather was fine, and generally favourable to vegetation.

IRELAND.

DROMORE CASTLE.—A fine genial month, all crops promising; mean temp. 52°.

WATERFORD.—T on 7th, 10th, 23rd, and 26th, L on 26th also; strawberries ripe on 25th, oak in leaf some days before the ash.

KILLALOE.—A very fine month; very little frost, abundant brilliant sunshine, and sufficient R to make vegetation vigorous; T and L for several hours on 23rd.

EDENFEL.—A very favourable month for vegetation, very little night frost, and more than the average amount of sunshine, but the bloom of all kinds of fruit, and of thorn, laburnum, &c., conspicuously absent.

ERRATA IN THE *METEOROLOGICAL MAGAZINE* FOR 1881.

IN discussing the annual returns of Rainfall for 1881, the following errors have been detected in the tables printed in the last volume of the *Meteorological Magazine*. R denotes Regular Table; S, Supplementary:—

R.	January.....	Boston	should be.....		·81
S.	,, ...	Port Madoc.....	,, ...		1·40
S.	,, ...	Melrose	,, ...		1·93
S.	April	St. Lawrence.....	,, ...		1·13
R.	May	Portarlington	,, ...		2·24
S.	November.....	Dowra	,, ...		3·72
S.	December	Taunton	,, ...		2·26

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RESUMPTION OF THE BEN NEVIS METEOROLOGICAL OBSERVATIONS, 1882.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S.

Under the auspices of the Scottish Meteorological Society.

MAY 25th.—Arrived at Fort William from Edinburgh.

May 26th.—Engaged making arrangements for workmen, &c. In evening erected Stevenson's thermometer screen, at Achintore, in the same field as last year, by the Loch beach, and about 28 ft. above the sea.

Subsequently hung the low level barometer, a fine Board of Trade by Adie, London, its greatest error being but 0·003 in., and compared with it the mercurial barometer that is to be used at a new fixed and fully equipped station I had arranged with the Scottish Meteorological Society to establish at the Lake (1840 ft.)

May 27th.—Started off four men and a mason betimes for the Lake. I followed, accompanied by Mr. Livingston of Public Schools, Fort William, and Mr. J. B. Simpson of Edinburgh University. Away nine hours, and engaged with the men building a cairn for the barometer near the water's edge, 1,840ft. above sea. Had great trouble in getting the stone, collected granite from the quagmire adjacent and the water's side, where it lies and "crops up" in some quantity. Had to battle with pitiless hail squalls and heavy weather in the afternoon; men could not make rapid progress, and cairn not completed, by some 4ft. However, fixed the box to contain the barometer inside.

May 28th.—Sunday's rest—engaged, however, examining instruments, and fixing those at Achintore, Fort William.

May 29th.—A heavy day's work. Men left Fort William at 7 a.m., returning about 9 p.m. Two men and mason engaged at the Lake, I superintending. The barometer cairn there finished, and the Stevenson's thermometer screen fixed. These are situated by the edge of the tarn, at the N.E. end. Twelve men and joiner engaged on summit of Ben Nevis, I superintending there in afternoon.

Snow covered the entire plateau of the summit to a depth of from 3 to 5 ft. Engaged "digging out" the barometer cairn, which was surrounded by snow 3 ft. 6 in. deep, thermometer cage and hut, and in excavating an area, 18 ft. in diameter, where another thermometer screen was fixed (some ten paces E. from the other). This is to contain a self-recording hygrometer, acting by clockwork, to record the temperature of the air, and that of evaporation at 9 p.m. on the Ben. Messrs. Negretti and Zambra are the makers of this invaluable apparatus, and have most kindly placed it at my disposal, for use on Ben Nevis. The snow walls of this area averaged $3\frac{1}{2}$ ft. high, and presented a most singular appearance. It will be remembered that the barometer was securely built-up last October in its cairn. Great labour was expended to-day, before the north side of the cairn was reopened; the stones were so hard frozen that a crowbar had to be used to remove them. To my delight, I found the instrument in excellent order—nothing the worse for its winter's "rest." Snow had deeply accumulated inside thermometer cage. The reading of the minimum thermometer that has been on the Ben all winter was 11°·0, and this occurred since January, when Mr. Livingston, of the Public Schools. Fort William, made an ascent.

May 30th.—Engaged at Achintore Observatory on sundry matters —sowing grass-seed around thermometer box, and placing post for new solar radiation thermometer.

May 31st.—A most important day. Fixed all the instruments for the commencement of my work on the morrow. Up at 5 a.m.; examined the thermometers, to ascertain their index errors; then packed up those for the new "Lake" station and Ben Nevis. Set out at 8 a.m., I carrying barometer for the Lake, accompanied by Mr. Mackenzie, of the Inland Revenue, Fort William, and Mr. J. B. Simpson, Edinburgh University, carrying the thermometers. The Lake Observatory, fully equipped by 3 p.m., and barometer safely hanging in its cairn; then set out for the Ben. By 8.15 p.m. all instruments were fixed in position on the summit of Ben Nevis, including Negretti and Zambra's clockwork hygrometer, and a new tarpaulin was placed over the hut. Arrived at Achintore, Fort William, about 11 p.m.; afterwards re-fixed instruments at the sea level station, and being satisfied that all was correct got to bed about 1 a.m., very tired. Up again by 5 a.m., June 1st, and commenced work, taking observations on the outward and homeward journeys, and five sets of readings on Ben Nevis.

The work this year is much heavier than that of last season, and the following is the plan that has hitherto been, is being, and will be, adhered to till the end of the season:—Outward to Ben Nevis (fixed stations), observations at Achintore, Fort William, are taken at 5 a.m.; on the Peat Moss, about 30 ft. above sea, and two miles N.N.E. from Fort William at 5.30; at "The Boulder," about 840 ft. above sea, 6.15 a.m.; at the new fully-equipped observatory at "The Lake," 1,840 ft., at 7 a.m. (Here are barometer, and dry

and wet bulbs, maximum and minimum thermometers in cairn and Stevenson's screen respectively; rain gauge; tubes for earth temperature and ozone tests); at Brown's Well, about 2,200 ft., at 7.30; at the Red Burn Crossing, about 2,700 ft., at 7.55 to 8 a.m.; and at Buchan's Well, about 3,575 ft., at 8.30. On the summit of Ben Nevis, 4,406 ft., the observations are taken at 9, 9.30, 10, 10.30, and 11 a.m.; and consist of atmospheric pressure, by mercurial standard and aneroid barometers, temperature and extremes of ditto, hygrometrical conditions, ozone, rainfall, solar and terrestrial radiation, wind, force, cloud, amount of ditto, movements of the various strata, hydrometeors, &c., and temperature of "Wragge's Well," about 25 ft. from summit; Negretti & Zambra's clockwork hygrometer, registers at 9 p.m.

From June 15th ozone observations are taken half-hourly, and three more rain gauges will be examined at 9 a.m. at different points, from the centre of the plateau to the precipice, to ascertain if, and to what extent, the rainfall varies with different winds. Dr. Angus Smith, F.R.S., of Manchester, has kindly undertaken to supply apparatus for the measurement of the actinism of the sun's rays and of daylight. Browning's Rainband spectroscope is also used.

Homewards from Ben Nevis, the observations are at Buchan's Well, at 11.30, at the Red Burn Crossing at noon, at Brown's Well at 0.30, at "The Lake" at 1, at "The Boulder" at 1.45, on the Peat Moss at 2.30, and at Fort William at 3 p.m.

At all intermediate stations a "travelling" hygrometer is used (dry and wet bulbs), and the observations consist of pressure by aneroid, temperature of air (of Lake), wells, and burns, moisture, wind, force, cloud and amount, &c.

Simultaneous observations are taken in direct connection with the foregoing at the low-level observatory at Achintore, Fort William, about 28 ft. above sea, and the hours of observation there are 5 a.m., 5.30, 6.15, 7, 7.30, 8, 8.30, 9, 9.30, 10, 10.30, 11, 11.30, and noon, also 0.30 p.m., 1, 1.45, 2.30, 3, and at 6 and 9 p.m., and the elements of observation are precisely the same. Lest reading half-hourly at the low-level station should, by the heat of the observer's person, cause vitiation of readings of the self-registering thermometers, these instruments have been placed at 30 ft. distant from the hygrometer and other thermometer screen, in a new special screen. I am fortunate in having an able assistant, whom I have myself trained, and who relieves me when occasion requires in the ascent of Ben Nevis, and who takes the low-level observations. Mr. J. B. Simpson has also assisted, and my best thanks are due to him. I have also other assistants in training, so that any emergency may be met. The work is very heavy, but well under control, and punctuality and method will carry it through. The weather during the last few days on the Ben has been bitterly cold, and much new snow has fallen. The barometer cairn and thermometer cages on the 15th instant, were entirely frozen up, and

great difficulty was experienced in opening them. A supply of fuel is very necessary, for one's hands get so dead with the cold that writing and handling keys, instruments, &c., are difficult matters—hence the necessity for an observatory house. Temperature has been between 23° and 30°, with biting N.E. winds, and maximum below 32° Fah.

One of the greatest difficulties I have to contend with is the getting the horse (on which I ride to and from the Lake) over the ruts and swamps. The latter are so very treacherous and deep, that the poor animal has a trying time of it. By keeping the work well in hand, I can keep time punctually at the intermediate stations, and so secure the simultaneous, or nearly simultaneous, observations, that I trust will be of the greatest value. The hardest climb is from Buchan's Well to the summit in the half-hour. Earth temperature will be added to the observations on July 1st, and systematic observations of the rainband by Browning's spectroscope will be by then an important feature in the work. CLEMENT L. WRAGGE.

Fort William, N.B., June 16th, 1882.

P.S.—The great value of the intermediate observations is, that they enable disturbances in the varied stratum of atmosphere between Ben Nevis and Fort William to be localised and examined in discussion. We hope largely to increase the value of forecasts.

SUBSEQUENT NOTE. *July 1st,* 1882.

Stevenson's screens, somewhat smaller than the usual size, are now fixed at all intermediate stations (from July 1st) between Fort William and Ben Nevis (at the Lake the large "Stevenson" is used), and in these are exposed neat and small "sling" thermometers with small bulbs fitted as "dry" and "wet." The labour of swinging is thus done away with, punctuality ensured, and accuracy also. The entire observing system goes like clockwork.

There are now 4 rain gauges, 15 paces apart on the plateau of the summit of Ben Nevis, read daily 9 a.m.—*viz.*, A in centre of plateau, D on edge of great precipice, and B and C intermediate. There is a gauge at the Lake 1840 ft. (also on Peat Moss at base of mountain) read weekly; and gauge at Achintore, Fort William, read 9 a.m. 9 p.m. CLEMENT L. WRAGGE.

THE METEOROLOGICAL SOCIETY.

THE closing meeting of this society for the present session was held on the 21st inst. at the Institution of Civil Engineers, Mr. J. K. Laughton, F.R.A.S, president, in the chair.

The following papers were read:

I. "A New Metal Screen for Thermometers," by the Rev. F. W. Stow, M.A., F.M.S. This screen differs from the ordinary Stevenson in the following respects:—(1.) It is somewhat larger; (2) it has a single set of double zinc louvres; (3) it is partially closed at

the bottom to cut off radiation from the ground. The advantages claimed for the use of zinc louvres are—(1) The conductivity of metal causes the heat derived from the sun's rays to be distributed over every part of the louvres; (2) the louvres being much thinner than those of wood, the circulation of air through the screen is not only much greater absolutely, but much greater also in proportion to the bulk of the louvres; (3) the zinc louvres, therefore, are much more sensitive to changes of temperature than wooden ones. Comparative readings of thermometers in this screen, along with those in an ordinary Stevenson screen, were made during the summer of 1881. From these the author is of opinion that the Stevenson becomes unduly heated when the sun shines, but this may be as much due to its small size as to the material of which the louvres are made. The thermometers in it are only 3 to 5 inches from the louvres at the back of the screen, against 7 to 8 inches in the zinc screen. The roof, too, is single, and the box is open at the bottom. The author also says that there is no need to condemn all wooden screens; but there does seem to be some reason to think that screens with metal louvres might be better.

In the discussion it was pointed out that the differences were not very large, but that it was important that no change should be made in the pattern or materials of Stevenson's screens until after mature consideration, as strict uniformity was more necessary even than a theoretically perfect stand.

II. "On the effect of different kinds of Thermometer Cribs, and of different exposures in estimating the diurnal range of temperature at the Royal Observatory, Cape of Good Hope." By David Gill, LL.D., F.R.A.S. Meteorological observations were commenced at the Cape Observatory in 1841, when the thermometers were placed in a well-ventilated crib, before a south window, through which they could be read. The buildings were unfortunately burnt in 1852. A small wooden house, with double roof, and affording a free passage of air, was then erected on the site of the old Meteorological Observatory. The instruments were placed in the middle of this building, and observations were recommenced on the same plan as before, and continued until the end of August, 1858. On September 1st the thermometers were transferred to a crib erected in front of the south-west window of the transit circle room. This crib is well ventilated, except on the side next the transit room window, but the great mass of solid masonry in the immediate neighbourhood of the thermometers appears seriously to affect the range of temperature. For many years a Glaisher stand has been in use, and at the end of 1880 the author caused a Stevenson screen to be erected in its immediate neighbourhood. In this paper the author gives results of observations made in the window, Stevenson and Glaisher screens, during the year 1881; from which it is evident that the exposure of the thermometers in the window crib gives a distinctly smaller, and

on the Glaisher stand a larger, daily range of temperature than in the Stevenson screen.

III. "Some account of a Cyclone in the Mozambique Channel, January 14th–19th, 1880."—By C. S. Hudson.

IV. "Rainfall of Frere Town, Mombassa, East Coast of Africa, 1875-1881." By R. H. Twigg, M.Inst.C.E., F.M.S.

THE GALE OF APRIL 29TH AND SEA-SPRAY IN LONDON.

To the Editor of the Meteorological Magazine.

SIR,—The gale you mention (*Met. Mag.*, Vol. XVII., p. 65), in which salt was found on the windows at Leeds was, I have no doubt, that of January 6th (Epiphany Sunday night), 1839.

My house near Bowness, Windermere, was stripped of every slate, on the weather side, and very extensive damage was done. No doubt you have some record of it.—Yours faithfully,

T. SABINE PASLEY.

Moorhill, Shedfield, Botley, Hants, June 16, 1882.

REVIEWS.

Results of Meteorological Observations made in New South Wales during 1875, *under the direction of* H. C. RUSSELL, B.A., F.R.A.S., Government Astronomer of New South Wales. Sydney: Thomas Richards, Government Printer, 8vo, 1880.

THIS is the general summary, not merely of the results from the observatory, but also from all the stations (about 50) in the colony.

The relation of the temperature and rainfall of 1875 to the average is summed up in the following paragraph :—

"The general average temperature for all stations is only 0°·4 higher than it was in 1874, and is again, as it was in 1874, 3° below the temperature of Sydney. The general average rainfall for 1875 is less by 4½ in. than that of 1874; but if the stations are divided by the Blue Mountains into two sets, Eastern or coast stations, and Western or inland stations, it appears that the coast stations had 3 in. less rain than they had in 1874, and the inland stations 5½ in. less."

Underground temperature observations are somewhat rare in Australia, and as this report contains a long series, we epitomize the results :—

There are five thermometers, the bulbs being respectively, 1 in., 2½ ft., 5 ft., 10 ft. and 19 ft. below the ground. Each thermometer is enclosed in a wooden tube 3 in. square, and so protected they were all placed vertically in a well 4 ft. in diameter, which had been dug 20 ft. deep through the following strata :—

5 ft. red clay, with a few stones.
7 ft. bands of red clay and iron sandstone.
8 ft. solid sandstone.

Mean Monthly Temperature of the Earth at Sydney, New South Wales

	Shade Temp.	At Depth of				
		1 in.	2½ ft.	5 ft.	10 ft.	19 ft.
	°	°	°	°	°	°
January	**72·7**	**73·3**	**72·7**	**69·7**	66·7	63·6
February	69·7	69·8	70·6	69·5	67·2	64·5
March	69·6	69·6	70·1	69·1	**67·3**	65·1
April	65·0	65·5	67·5	67·8	66·6	**65 2**
May	57·0	57·1	61·1	63·5	64·3	64·6
June	55·6	54·5	57·6	59·8	61·4	63·6
July	52·5	51·3	54·7	57·3	59·0	62·2
August	57·3	54·8	56·4	57·2	58·3	61·0
September	57·4	56·7	58·7	58·7	58·8	60·7
October	64·5	63·7	63·4	61·7	60·6	61·1
November	68·1	67·0	66·8	64·6	62·7	61·7
December	70·7	70·1	70·1	67·5	65·0	62·9
1875	63·4	62·8	64·1	63·9	63·2	63·0
1874	63·0	62·7	63·7	63·3	62·7	62·7
1873	63·0	62·8	63·9	63·7	63·0	63·0
1872	62·6	62·5	64·1	64·0	63·4	63·2
1871	62·4	62·7	63·9	63·4	62·8	62·8
1870	62·8	63·0	64·2	63·9	63·3	63·2
Mean	62·9	62·8	64·0	63·7	63·1	63·0

Max. figures printed thus, **72·7**; Min. figures thus, 52·5.

It is curious, if true, that the mean annual temperature should be about 1° higher at depths of 2½ ft. and 5 ft. than it is either at greater or less depths.

It will be seen that the retardation of the epoch of extreme temperatures is much the same as in this country, the max. falling two months late at 10 ft. and three months late at 19 ft. Similarly, the min., which, of course, occurs in the air in July, is one month late at 5 ft. and 10 ft., and two months late at 19 ft.

So, again, with respect to the extreme range between the absolute max. and absolute min., at each depth they are much the same as in England :—

	Shade.	1 in.	2½ ft.	5 ft.	10 ft.	19 ft.	
Extreme range in year	58°·6	29°·7	20°·7	14°·2	10°·8	5°·0	..... Sydney, 1875.
	73°·5	34°·0	25°·0	17°·5	12°·0	5°·5	..... Greenwich, 1874
Ratios	100	52	35	24	18	9	..... Sydney.
	100	47	34	24	16	8	..... Greenwich.

Which, being interpreted, shows that of the total range, scarcely half penetrates 1 in. deep, only a quarter penetrates 5 ft. deep and at 19 ft. the entire range between winter and summer is only about 5°, or less than one tenth of the range in the air in perfect shade.

Bulletin mensuel de l'Observatoire Météorologique de l'Université d'Upsal. Vol. xiii. 1881. Par Dr. H. HILDEBRAND-HILDEBRANDSSON. 4-to. Upsal: E. Berling, Imprimeur de l'Université.

IN noticing this volume, we have the pleasure of congratulating Dr. Hildebrandsson on recovery from long illness, and upon the resumption of directorial functions at the Observatory.

We think that it would be well to devote two or three pages in each part to a brief description of the instruments used, and of their position. At present there is not a single word upon the subject. Hourly values of pressure, temperature, humidity, and wind are given, and copious notes of clouds and occasional phenomena. At the end there are two pages of summaries of the results, from which we select a few.

Mean barometric pressure at 32°, 29·782 in.*
„ temperature 37°·6.
„ humidity, 82.
„ amount of cloud, 6·4.
Total depth of rain, 16·79 in.

This portion of the work requires development, *e.g.*, the extremes of temperature, pressure, &c., should be stated, and it would be very desirable to give also the differences between the values for the year in question, and the averages for previous years.

Now that Dr. Hildebrandsson has resumed control, we hope to see these needs supplied.

Meteorologiska Iakttagelser I Sverige, utgifna af Kongl. Sevenska Vetenskaps Akademien, Nittonde Bandet, 1877. *4to, Stockholm, Kongl. Boktryckeriet*, P. A. Norstedt & Söner, 1881.

OUR readers will remember that while the observations made at the Observatory at Upsala are carried on and published at the cost of the University, the records from all other parts of Sweden, and an abstract of the Upsala values, are collected, discussed, and published at Stockholm, at the Swedish Central Meteorological Institute, which is under the control of Dr. Rubenson.

The volume before us complies very nearly, if not absolutely, with the conditions laid down by the International Congresses, and is by that statement sufficiently described—except as regards extent. The records from 18 second order stations are printed *in extenso*, and abstracts are given from the whole system, viz., 34 stations.

The hours of observation are 8 a.m., 2 p.m., and 9 p.m. The chief instrumental deficiency appears to be that of self-registering maximum and minimum thermometers.

We have compiled the following abstract, converting the observations into Fahrenheit degrees and English measures, believing that,

* There is nothing to show whether this is at sea-level, or, if not, at what altitude the barometer is.

though referring to only one year, they will be of general interest. The stations follow in geographical order from S. to N., the last, Jockmock, being within the Arctic circle.

Abstract of Returns from Sweden, 1877.

	Lat. N.	Lon. E.	Alt.	TEMPERATURE.			Mean Humidity.	Mean Cloud.	Total Rain.
				Max.	Min.	Mean.			
	° ′	° ′	ft.	°	°	°		0—10.	in.
Wexiö	56 53	14 48	551	83·8	— 4·9	41·0	77	7·0	25·14
Westervik ...	57 46	16 38	43	87·8	— 8·5	41·4	—	6·8	22·11
Jönköping ...	57 47	12 11	321	86·9	— 9·4	41·0	80	7·1	20·23
Skara	58 23	13 27	371	86·7	—16·6	40·5	87	6·0	21·66
Askersund ...	58 53	14 54	315	81·5	—12·1	39·2	84	6·3	33·35
Örebro	59 16	15 13	101	—	—24·7	39·2	81	6·4	26·58
Stockholm ...	59 20	18 4	145	85·8	— 9·9	40·3	80	6·6	19·63
Nora	59 31	15 3	—	85·3	—27·4	38·5	79	6·7	30·20
Westerås	59 37	16 32	59	88·7	—14·8	39·7	80	7·6	21·42
Upsala	59 52	17 38	79	84·4	—15·0	38·6	83	6·7	24·45
Falun	60 36	15 37	380	86·0	—25·6	37·4	80	6·5	25·07
Gefle	60 40	17 9	43	89·6	—13·0	38·2	79	6·0	21·95
Östersund.....	63 11	14 42	1082	82·4	—19·8	32·8	—	6·1	18·93
Haparanda ...	65 51	24 11	30	80·6	—27·4	31·3	84	6·1	21·97
Jockmock.....	66 36	19 50	926	—	—	27·9	—	4·5	11·91

We are sorry not to find in this volume any references to the relation of these values to those for previous years, and we also consider, that although the latitudes and longitudes of the stations are given, yet the addition of a map would be an improvement.

This reminds us of the desirability of mentioning that in the corresponding volume for 1875, a most interesting map was given by Dr. Rubenson in illustration of the exceptional cold on the morning of January 24th, 1875. The temperature at upwards of a dozen stations fell to or below—40°C, which oddly enough is identical with—40°F; and at two stations near Lake Siljan it went down to —45°C, or—49°F. And this excessive temperature was not in the extreme north of the country, but over a tract about 200 miles long by 100 miles wide, near the centre of the country. The observer at Östersund reports "Qvicksilfret gätt ned under skalan" (mercury gone down under the scale) and well it might, for few would prepare for such temperatures in the latitude of the Faroe Isles.

———

Weather Report for the Month of April, 1882; (*From the Jamaica Gazette*). Published by Authority. Government Printing Establishment, Kingston. Folio, 1882.

In his paper on "The Climate of the various British Colonies," the following was Mr. Symons's epitome of the meteorological data which he was able to collect respecting Jamaica :—

"No regular observations have been established in the colony (except those made by the Army Medical Department) and no papers upon the subject have been published. About 20 rain gauges have been in more or less regular use for three years, and indicate a rainfall, varying from about 37 in. at Kingston, to upwards of 100 in. at the Cinchona plantations in the parish of St. Andrew."

Shortly afterwards, a paper was contributed to the Meteorological Society by Mr. Cox,* in which he summarised the fragmentary rainfall records 1870-76 and therein showed that while the above figures were very nearly correct, the rainfall was greatest at Bath in the parish of St. Thomas, nearly at the eastern extremity of the Island.

We call attention to the monthly report described at the head of this note because it shows the marked advance which has taken place in the attention devoted to the subject since it has passed under the control of Mr. Maxwell Hall.

In the first place, we have a summary of a complete series of Meteorological Observations taken at Kingston, which perhaps we may as well reprint as describe.

METEOROLOGICAL RESULTS FOR APRIL, 1882. KINGSTON.

Mean Pressure	30·020 in.
,, Temperature	77°·9
,, Maximum Temp.	84°·7
,, Minimum Temp.	70°·1
,, Minimum Temp. on Grass ...	64°·5
,, Range of Temp.	14°·6
,, Direction of the Wind ...	S.E. by S.
,, Velocity of the Wind	4·5 Miles per Hour
,, Temp. of the Dew-point ...	69°·4
,, Humidity	76
,, Amount of Cloud	2·6
Total Rainfall in inches	0·15

Average Weather :—Fair, with strong sea breezes.

The highest temperature was 89°·6 recorded on the 18th ; the lowest was 66°·8 recorded on the 24th ; the extreme range was, therefore, 22°·8. The lowest temperature on the grass was 60°·2, recorded on the 24th.

This is followed by returns of total rainfall at 168 stations—then is given the mean fall at those stations for which it has been possible to obtain averages, so as to show the relation of the fall to the average for separate districts and for the whole island. Some general remarks follow, and also a comparison of identical elements observed at Kingston (50 ft.) and the Cinchona Plantation, 5,100 ft. above sea level. Temperature observations are also given for several localities ; we add three sets of values :—

Station	Kingston.	Cinchona Plantation.	New Haven Gap.	Worthy Park.	King's House.
Altitude	50	5100	...	...	...
Mean Max.	84·7	67·1	69·6	81·0	91·0
,, Min.	70·1	57·3	50·8	60·0	65·7
,, Daily Range ...	14·6	9·8	18·8	21·0	25·3

* Quart : Jour : Met. Soc. Vol. iv. p. 15.

It would be unfair to the Island to omit the last two lines of Mr. Maxwell Hall's report :—"Kingston was very healthy during April, the death-rate being only 17·7 per thousand."

Observations upon the Temperature, Pressure, and Rainfall of the past Winter. Privately printed.

IN this paper, which like many previous ones has been printed by Mr. C. L. Prince, F.R.A.S., for private distribution, he gives the details for 1882 and some previous years as recorded at the Observatory, Crowborough, Sussex, and also the values (corrected for elevation), from his long series of observations at Uckfield. The first paragraph is in many respects so truthful that we reprint it verbatim.

"There appears to be a general impression that the temperature of the past winter has been many degrees above the average. It may therefore be interesting to know, from the statistics of temperature, that such has not been the fact. The following table will show that there have been nine instances of warmer winter temperature within the last forty years. It is remarkable how soon our recollection, as regards date, of any particular weather passes away; otherwise, the majority of persons would not have forgotten the warm winters of 1868-69 and 1876-77, both of which far exceeded the past winter in warmth. It is also remarkable that of the ten instances, which I quote, the winter of 1881-82 has been the coldest. In order to render my observations at Crowborough comparable with those previously taken at Uckfield, I have applied an approximate correction for the difference of elevation above sea-level."

THE COMING SUMMER.

To the Editor of the Meteorological Magazine.

SIR,—In the March number of your magazine there appeared a letter from Mr. Brumham, in which he predicted that "a very high maximum temperature for so early in the season" would occur about the end of May, or in the first ten days in June, unless "the very abnormal conditions" then prevailing should interfere with the rule. It is to be regretted that Mr. Brumham did not say what were "the very abnormal conditions" to which he referred. But if a prediction of this kind is worth publishing, it should be worth verifying, and I simply write to point out that no such high maximum temperature as that predicted has occurred. According to the official weekly weather reports, the absolute maximum for the last week of May was 73°, and for the first ten days of June only 71° even in the south of England—a quite exceptionally low maximum for the time of year. In the same letter, Mr. Brumham predicts "a warm summer and a good harvest," the prediction in this particular instance not being qualified by any saving clause. I am not going to follow Mr. Brumham's example by prophesying when I do not know; but as regards the first month of this summer, the prediction has certainly not been fulfilled, as the temperature in June was everywhere below the average, and rainfall nearly everywhere in excess. The total here reached the high figure of 6·27 inches. G. T. RYVES.

Tean Vicarage, Stoke-on-Trent, July 3rd, 1882.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEB., 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute.				Average.				Absolute.		TotalRain.		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp.	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	56·2	26	24·6	2	48·2	36·3	37·8	84	95·4	19·4	1·30	8	7·7
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	84·6	11	70·0	19	82·3	74·4	70·0	77	...	...	8·28	23	6·6
Calcutta	88·5	1	51·6	6,9	81·7	58·9	59·2	69	147·6	40·9	3·42	5	1·8
Bombay	94·3	25	63·2	18	83·6	68·5	63·9	66	150·4	52·3	·04	1	·4
Ceylon	90·6	21	69·3	21	87·5	73·4	70·8	72	157·0	62·0	3·58	9	5·9
Melbourne	105·1	26	46·1	24	79·3	55·2	50·9	60	158·0	38·0	·29	2	4·3
Adelaide	103·5	21	50·0	1,28	89·1	61·3	51·1	43	158·5	40·8	·00	0	1·3
Wellington	72·5	16	47·0	23	67·5	54·1	...	...	142·0	42·0	1·60	5	...
Auckland	78·0	8	51·0	9	72·8	57·7	55·5	71	131·5	45·4	1·90	11	6·6
Falkland Isles	62·7	13	36·4	28	56·0	44·3	45·5	82	127·0	30·0	2·38	12	8·5
Jamaica	88·6	17	61·5	6	84·0	66·6	66·0	78	...	57·1	·28	5	2·5
Barbados	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	50·3	13,15	9·6	18	37·4	23·1	25·3	78	117·0	6·5	1·72	14	6·7
New Brunswick, S. John	41·0	14	—6·0	4	27·5	12·2	20·0	90	...	...	7·47	13	5·5
Cape Breton, Sydney	44·4	14	—6·1	5	27·4	8·0	18·2	89	...	...	5·22	13	5·6
Newfoundlnd, S. John's	43·0	14	—3·0	2	25·5	14·8	20·0	...	105·0	—0·0	6·50	15	7·3
Manitoba, Winnipeg	40·7	28	—31·5	17	19·2	4·8	11·0	93	...	...	1·79	11	4·9

REMARKS, FEBRUARY, 1882.

Mauritius.—Rainfall, 1·29 in. above the average; pressure slightly below it. Mean hourly velocity of wind, 12·4 miles; extremes, 27·7 miles and 1·9 miles; prevailing direction, E.S.E. to E. by N. T and L on seven days.

C. MELDRUM, F.R.S.

CEYLON.—TSS occurred on six days, and L was seen on five other days.

J. STODDART.

Melbourne.—Mean pressure, temp., and humidity all about the average; mean temp. of dew point, amount of cloud, and total rainfall below it. Prevailing winds, S. and S.W.; strong breezes occurring on six days.

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

Adelaide.—Mean temp. (75°·2) 1° above the average; the max. reaching 90° on 15 days, five days more than the average. No R fell in this colony up to lat. 30° or along the route of the overland telegraph, S. of lat. 19°, except one slight T shower at the S. end of the Flinders range and one at Charlotte Waters; but about 600 miles E. of the latter place, viz.:—Gooyea, in Queensland, 6·72 in. fell on 11 days. In the tropics the fall was below the average.

C. TODD.

Wellington.—Generally fine pleasant weather throughout the month. Mean pressure, average; temp. 2° below average; rainfall less than half the average. Prevailing wind, N.W.; stormy at times. T on 21st, and L on 11th; earthquakes on 1st, 20th and 21st.

R. B. GORE.

Auckland.—Weather mostly fine; temp. below the average. Mean pressure, 29·837 in. (rather low). Wind mostly W. and S.W. Rainfall small till the last day, then heavy with light N.E. wind; very close and sultry.

E. B. DICKSON.

NEWFOUNDLAND.—The month throughout was very severe. Several wrecks occurred along the coast, attended by loss of life. Depth of S 64 in. Coast and harbour blocked up with ice during the last 14 days.

J. DELANEY.

SUPPLEMENTARY TABLE OF RAINFALL, JUNE, 1882.

[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	2·46	XI.	Castle Malgwyn	3·70
,,	Margate, Birchington...	2·03	,,	Rhayader, Nantgwillt..	5·99
,,	Littlehampton	1·97	,,	Carno, Tybritle	5·99
,,	St. Leonards	2·15	,,	Corwen, Rhug	3·99
,,	Hailsham	2·08	,,	Port Madoc	7·04
,,	I. of W., St. Lawrence.	2·28	,,	I. of Man, Douglas	3·55
,,	Alton, Ashdell.....	3·31	XII.	Carsphairn	4·31
III.	Great Missenden.....	3·44	,,	Melrose, Abbey Gate...	4·92
,,	Winslow, Addington ...	3·12	XIII.	N. Esk Res. [Penicuick]	4·45
,,	Oxford, Magdalen Col...	3·08	XIV.	Ayr, Cassillis House ...	4·09
,,	Northampton	2·72	,,	Glasgow, Queen's Park.	3·32
,,	Cambridge, Beech Ho...	1·72	XV.	Islay, Gruinart School..	3·94
IV.	Southend	1·94	XVI.	Cupar, Kemback.....	2·47
,,	Harlow, Sheering	2·50	,,	Aberfeldy H.R.S.	3·01
,,	Diss	2·85	,,	Dalnaspidal	6·11
,,	Swaffham	4·98	XVII.	Tomintoul.....	...
,,	Hindringham	3·38	,,	Keith H.R.S.	3·98
V.	Salisbury, Alderbury...	3·74	XVIII.	Forres H.R.S.	2·25
,,	Calne, Compton Bassett	4·03	,,	Strome Ferry H.R.S....	4·48
,,	Beaminster Vicarage ...	4·34	,,	Lochbroom	3·93
,,	Ashburton, Holne Vic..	5·46	,,	Tain, Springfield.....	3·39
,,	Torrington, Langtree W.	4·66	,,	Loch Shiel, Glenaladale	6·98
,,	Lynmouth, Glenthorne.	2·93	XIX.	Lairg H.R.S.	...
,,	St. Austell, Cosgarne...	...	,,	Forsinard H.R.S.	4·91
,,	Taunton, Fullands	3·38	,,	Watten H.R.S.	4·71
VI.	Bristol, Clifton	3·37	XX.	Fermoy, Glenville	3·46
,,	Ross	2·51	,,	Tralee, Castlemorris ...	2·88
,,	Wem, Sansaw Hall.....	3·38	,,	Cahir, Tubrid	2·53
,,	Cheadle, The Heath Ho.	5·87	,,	Newcastle West	2·90
,,	Worcester, Diglis Lock	2·71	,,	Kilrush	4·19
,,	Coventry, Coundon	4·03	,,	Corofin	5·42
VII.	Melton, Coston	3·68	XXI.	Kilkenny, Butler House	...
,,	Ketton Hall [Stamford]	3·15	,,	Carlow, Browne's Hill..	3·00
,,	Horncastle, Bucknall ...	3·72	,,	Navan, Balrath	2·82
VIII.	Macclesfield, The Park.	7·24	,,	Athlone, Twyford	3·20
,,	Walton-on-the-Hill.....	4·30	XXII.	Mullingar, Belvedere ...	3·28
,,	Broughton-in-Furness ..	6·36	,,	Ballinasloe	2·81
IX.	Wakefield, Stanley Vic.	4·58	,,	Clifden, Kylemore	5·44
,,	Ripon, Mickley	3·45	,,	Crossmolina, Enniscoe..	4·31
,,	Scarborough.....	3·36	XXIII.	Carrick-on-Shannon ...	4·34
,,	East Layton [Darlington]	...	,,	Dowra	5·36
,,	Middleton, Mickleton ..	4·56	,,	Rockcorry.....	4·70
X.	Haltwhistle, Unthank..	6·71	,,	Warrenpoint	4·02
,,	Shap, Copy Hill	4·25	,,	Newtownards	3·14
XI.	Llanfrechfa Grange	5·32	,,	Belfast, New Barnsley .	4·83
,,	Llandovery	5·02	,,	Bushmills	3·80
,,	Solva	2·94	,,	Buncrana	...

JUNE, 1882.

Div		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·30	— ·37	·41	9	18	74·3	27*a*	41·5	13	0	0
II.		Maidstone (Hunton Court)...	2·50	+ ·43	·72	24	20	...	...	...	...	...	...
,,		Strathfield Turgiss	1·99	— ·11	·44	8	15	73·2	27	36·6	17	0	2
III.		Hitchin	2·93	+ ·80	·66	26	18	70·0	29	40·0	12	0	..
,,		Banbury	5·42	+ 2·98	2·04	22	22	72·5	29	37·0	17	0	...
IV.		Bury St. Edmunds (Culford)	2·71	+ ·44	·52	24	20	75·0	29	39·0	12	0	...
,,		Norwich (Cossey)	2·87	+ ·65	·58	9	14	72·0	24*a*	41·0	1	0	0
V.		Bridport	3·94	...	·85	5	16	..	..	...	...	...	...
,,		Barnstaple.....	3·23	+ ·51	·72	5	23	73·5	30	47·0	13	0	...
,,		Bodmin	5·24	+ 2·03	1·07	5	22	69·0	30	42·0	17	0	0
VI.		Cirencester	3·80	+ 1·31	·57	5	18	...	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	4·13	+ 1·26	·78	4	20	73·5	30	40·5	13	0	...
,,		Tenbury (Orleton)	4·77	+ 2·03	1·08	4	19	76·0	30	37·2	13	0	0
VII.		Leicester	4·11	...	1·09	22	21	73·2	30	41·0	13	0	0
,,		Boston	3·01	+ ·76	·40	22	19	75·0	25	42·0	13	0	...
,,		Grimsby.....	3·39	+ 1·02	·48	5	22	...	...	...	...	...	...
,,		Mansfield	...	...	...	...	...	...	...	...	...	...	...
VIII.		Manchester (Ardwick).....	6·75	+ 3·59	1·08	4	21	69·0	25*b*	42·0	13	0	...
IX.		Wetherby (Ribstone Hall) ...	4·36	+ 1·49	1·47	24	11	...	...	...	...	...	...
,,		Skipton (Arncliffe)	6·64	+ 2·82	1·01	4	21	75·0	30	35·0	16	0	...
X.		North Shields	3·88	+ 1·85	·90	3	16	71·0	4	36·5	13	0	0
,,		Borrowdale (Seathwaite).....	13·66	+ 5·85	2·40	17	21	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely).....	4·02	+ ·96	·82	5	20	...	...	...	...	...	...
,,		Haverfordwest	5·80	+ 2·77	1·00	17	16	73·2	30	37·5	16	0	1
,,		Plinlimmon (Cwmsymlog) ...	6·05	...	1·20	4	23	...	...	...	...	...	...
,,		Llandudno.....	2·98	+ ·98	·72	13	20	68·5	28	43·2	10*e*	0	...
XII.		Cargen [Dumfries]	3·46	+ ·29	·64	18	18	74·6	30	39·0	12	0	...
,,		Hawick	4·96	+ 2·45	·84	21	16	...	...	..	...	...	.
XIV.		Douglas Castle (Newmains)	3·92	+ ·91	1·08	29	19	...	...	...	...	..	...
XV.		Lochgilphead (Kilmory).....	4·21	+ ·37	·74	8	17	...	...	34·0	16	0	...
,,		Appin (Airds)	4·47	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	4·82	...	·91	17	17	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·10	+ ·33	·50	18	15	...	...	...	...	...	...
,,		Arbroath	3·24	+ ·63	·57	3	12	67·0	27*c*	39·0	12*f*	0	...
XVII.		Braemar	4·61	+ 1·52	·75	14	25	71·2	30	34·4	17	0	7
,,		Aberdeen	3·41	...	·85	22	20	68·0	26	37·0	13	0	0
XVIII		Skye (Sligachan)	6·50	...	1·05	6	17	...	...	...	...	..	...
,,		Culloden	2·15	— ·10	·50	5	13	70·0	2	37·3	11	0	2
XIX.		Dunrobin	3·61	...	·46	22	21	67·0	2	37·8	11	0	0
,,		Orkney (Sandwick)..... ..	3·43	+ 1·63	·42	3	22	62·6	2	40·1	14	0	1
XX.	IRELAND.	Cork (Blackrock)	3·67	+ ·12	·58	2	20	85·0	30	37·0	12	0	
,,		Dromore Castle	4·92	...	·80	20	23	70·0	29	41·0	12*g*	0	...
,,		Waterford (Brook Lodge) ...	3·11	...	·48	17*h*	19	75·0	30	37·0	15	0	...
,,		Killaloe	4·50	...	·64	4	24	82·0	30	37·0	13	0	...
XXI.		Portarlington	2·68	+ ·25	·31	17	24	75·0	29	37·0	15	0	...
,,		Dublin (Monkstown)	...	...	...	...	...	...	...	...	...	...	...
XXII.		Galway (Queen's College) ...	...	...	...	...	...	...	...	...	...	...	...
XXIII.		Waringstown	3·60	+ ·94	·57	28	18	79·0	27*d*	39·0	11	0	0
,,		Londonderry...	..	...	...	...	...	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·78	+ 1·73	·90	8	24	73·0	30	36·0	15	0	...

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

a And 29. *b* And 27. *c* And 28. *d* And 30. *e* And 11. *f* And 13. *g* And 18, 21. *h* And 24.

METEOROLOGICAL NOTES ON JUNE.

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 hay crop promised to be heavy, and cutting became general about the 18th, but the variable weather has caused much anxiety. H on 12th, larkspur and guelder rose in flower on 9th, privet in blossom on 23rd.

HITCHEN.—The coldest June since observations were commenced here.

BANBURY.—High wind on 3 days; T and L on 10th, 12th, and 26th.

CULFORD.—A very unsettled month, frequent T and heavy showers; heavy H storm on 14th; last few days of the month very fine and warm.

COSSEY.—A cold month, temp. rose to 70° on 8 days only; wheat not fully in ear before the 21st.

BODMIN.—A very wet ungenial month; mean temp. 58°·3.

CIRENCESTER.—Large crops of hay, but bad weather for making it until the end of the month, the number of wet days being large.

ORLETON.—The weather till the 25th was generally very cold and cloudy, with much R and little sunshine; on the 4th a sudden storm of L, T and R occurred at 1 p.m., followed by frequent heavy showers of R till the 6th, and after that date by very cold rough winds and showers for two weeks. On the 24th another sudden storm of L, T and heavy R occurred at noon, and was succeeded by warmer weather, and after another TS on the 26th, the last four days were very fine. The mean temp. was 2¼° below the average of 20 years, and was lower only in 1862, 71, and 79; wheat generally in blossom about the 27th.

LEICESTER.—Rain fell daily from 3rd to 15th, and during that time the nights were cold, with occasional signs of frost; the second half of the month was milder, and towards the end sometimes very hot. Hay crops good, but dry weather much needed at the close of the month.

BOSTON.—Mean temp. 2°·5 below the average, which, coupled with the wet weather, retarded the crops very much; strawberries ripe on 9th; wheat generally in ear on 20th; hay cutting commenced about the 26th; crop heavy and good.

KILLINGHOLME.—The month with the exception of the last few days was very wet and unsettled; splendid crops of grass and clover; apples and pears a failure.

MANCHESTER.—The month was a very unsatisfactory one, comparatively cold and very wet; there were but a few seasonable days; the rainfall was heavy and all but continuous, except during the last few days of the month, which were warm and bright; hay crop heavy, but fine weather much wanted to secure it.

NORTH SHIELDS.—Thunderstorms on 4th, 7th, and 23rd, and T on 3rd and 24th.

SEATHWAITE.—Wet and cold, with occasional T; S on mountains on 11th, heavy H on 14th; six falls of R exceeding 1 in. in 24 hours.

WALES.

HAVERFORDWEST.—The month was as a whole cold, unsettled, and wet, very trying for the hay harvest; the temp. only once reached anything like summer heat, and on the 16th the grass min. registered 31°, the nights about that date being very cold; followed up to the 27th by very broken weather, with heavy falls of R at night; great electrical disturbance with enormous H during night of 23rd, and L and T on 26th.

LLANDUDNO.—June was very unsettled as to temp. : it began and ended fine, but from the 8th to the 19th an unusually cold wave passed over the British Isles, which I attribute in part to the enormous quantity of ice which was seen about this time floating in mid-Atlantic. The mean temp. of the month was about 2° below the average ; the amount of bright sunshine was low (except in the last 9 days), and the mean degree of humidity was considerably in excess ; altogether the month was cold, wet, and ungenial.

SCOTLAND.

CARGEN.—Mean temp. 1° below the average ; partial TSS frequent ; last four days of the month close and sultry.

HAWICK.—A very warm and genial month, with heavy T showers on 18th, 19th, 24th, and 26th ; scarcely a wasp to be seen.

QUINISH.—From the 3rd to the 22nd the weather was very cold and ungenial, but from the 22nd to the end of the month was warm and beautiful.

ABERDEEN.—On the whole the month was unsettled and rainy, but towards the end it was very fine with bright sunshine ; T, L and H on 6th ; fresh gale from 10th to 12th.

SLIGACHAN.—The first half of the month was cold and unseasonable, the latter half very fine and warm, particularly towards the end, the temp. in shade rising to 87° on the 25th ; severe TS on the 24th. All crops looking well, and stock in good condition. S on hill tops on 12th.

CULLODEN.—The weather during the month was very favourable for growing crops, which are well advanced, and promise abundance ; distant T on several days.

SANDWICK.—June was a wet month the rainfall being greatly in excess of the average. H on 11th, sleet on 12th, fog daily from 26th to 29th.

IRELAND.

DROMORE.—Cold rains in the early part of the month checked vegetation, but the latter part, especially the last week, was warm and genial, hay crop heavy, but green crops greatly injured by slugs. Potato blight appeared in several places on the coast early in the month, but the spots affected were very limited in extent, and the disease did not spread, so that the crop on the whole is promising.

WATERFORD.—Strong wind on 5th, 8th, 13th, 14th, and 25th ; H on 18th, 24th, and 25th ; L on 18th ; potato blight appeared on 19th ; hay making only commenced with the last few days of the month, which were fine and bright.

KILLALOE.—Cold unseasonable weather until the 25th, after which date the temp. rose considerably, the max. temp. in shade being registered on the last day ; some heavy but partial H showers about the 20th.

EDENFEL.—The early promise of an abundant year has been much clouded by the weather of the past month, which, in amount of rainfall and lowness of temp., was almost identical with June, 1879. A violent H shower occurred on the 22nd ; it covered a space not more than a mile in diameter, leaving it white with H stones of irregular shape, many being $\frac{3}{4}$ of an inch long. The shower lasted 40 minutes, and was attended by T and L, the rain gauge yielding ·25 in., the greater part of which fell in 15 minutes.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CXCIX.] AUGUST, 1882. [PRICE FOURPENCE, or 5s. per ann. post free.

THE COPENHAGEN MEETING OF THE INTERNATIONAL METEOROLOGICAL COMMITTEE.

IT may be remembered that when the representatives of Official Meteorology were assembled at Rome, they elected nine of their own body as a permanent committee to watch over and as far as possible harmonize the work of the Government meteorological establishments in each country.

We may as well prevent the possibility of misconstruction by stating that the words official meteorology are introduced solely as the shortest term whereby to indicate that these various International meetings do not represent anything except the views of the heads of the various government establishments. No one would deny that it would be difficult, probably impossible, to collect a more distinguished group of meteorologists than the members of the Congress at Rome, all that we want to point out is that after all the word International is and must be qualified by the word Official. For instance, there was no separate vote representing the Meteorological Societies of England, France, Scotland, or Austria; none to represent the observatories of Greenwich, Oxford, or Stonyhurst; none for Montsouris; none for the vast meteorological system of India; none for the system which covers nearly 100° of longitude in the dominion of Canada; none for the observatories and systems of our various Australian colonies and Mauritius; none for the Mexican system or many others.

If we have spoken in high terms of the whole of the Congress at Rome, it will only be necessary to report the members selected therefrom for the International Committee to support our proposition. The original members were:—MM. Buys Ballot, Cantoni, de Brito Capello, Hann, Mascart, Mohn, Neumayer, Scott, and Wild.

This body has just been holding its second meeting, and we have been favoured with the following epitome of its proceedings:—

The second meeting of the International Meteorological Committee took place at Copenhagen, August 1–5 inclusive. All the Members were present, except Professor Cantoni, who has resigned his seat

on the Committee on account of health. Professor Tacchini was unanimously elected in his place. The following brief account of the more important of their proceedings is in the numerical order in which the respective subjects were discussed :—

It was resolved—

(*a*) To organize an exhibition in connection with the International Fisheries Exhibition, London, of the methods and apparatus used in different countries for giving weather intelligence and storm warnings to the coasts, and of the instruments, &c., used in the study of Ocean Meteorology.

(*b*) To issue a circular to all existing organizations, requesting them to supply data as to their condition and operations up to the end of the current year.

(*c*) To request the several institutions to be more precise in the information published by them as to the hour of occurrence of rain and other phenomena.

(*d*) To request all institutions to append to their Daily Bulletins, Monthly Sheets giving the mean results for the month, in the same way as the London Office has done since 1880.

(*e*) To request all institutions to furnish particulars of any stations which may exist in distant localities, especially in the Torrid Zone, South America, and the Islands of the Pacific, at least during the period of the International Polar Observations, and to publish the names of such stations in the Polar Bulletin issued by Professor Wild.

(*f*) To express approval of the plan proposed by Capt. Hoffmeyer and Dr. Neumayer, to publish daily synoptic charts of the Atlantic Ocean, with an explanatory text, at the cost of the respective institutions of Copenhagen and Hamburg, and to recommend other institutions to contribute materials for the work if they can.

(*g*) M. Tietgens, Chairman of the Great Northern Telegraph Company, submitted to the Committee a plan for a cable to connect Iceland and the Faroes with Europe, the expense to be met by the receipts from Meteorological telegrams. The Committee, while recognizing the very great importance which information coming from Iceland and the Faroes must possess in relation to the issue of Storm Warnings and Forecasts in Europe, felt that they were not in a position to express an opinion on the practical execution of the project.

(*h*) The Sub-Committee nominated at Berne (MM. Mascart and Wild) submitted specimens of their proposed International Reduction Tables. It was resolved to print a full page of each of these tables, with explanations, and

submit them to Meteorologists for their opinion, with the view of subsequently publishing the tables by means of subscriptions from the different institutes.

(*i*) M. van Rysselberghe's proposal to communicate by wire the indications of his instruments at out stations to central offices was considered, and that gentleman was requested to draw up and publish a detailed scheme for its execution.

(*j*) A Committee was nominated, consisting of M. de Brito Capello, Rev. Clement Ley, and Professor Hildebrandsson, to draw up a scheme of instructions for the observations of "cirrus" clouds.

(*k*) It was resolved that the prospects of the preparation of a general catalogue of Meteorological Bibliography were not favourable to its execution, and that the only action for the Committee to take was to invite the heads of the different institutes to prepare catalogues of the meteorological literature of their respective countries.

It only remains to say that the Members of the Committee were most hospitably entertained during their stay in Copenhagen, they were honoured with an invitation to dine with the King on the 5th inst., and on the following day an excursion was organized for them by the Marine Ministry to Friederichsborg and Elsinore; which was fortunately favoured with fine weather.

ROBERT H. SCOTT,
Secretary.

REVIEW.

Les Courants atmosphériques d'après les Nuages au point de vue de la Prévision du temps. Par André Poëy, Fondateur et ancien directeur de l'Observatoire physique et météorologique de la Havanne. 8vo.—PARIS: Gauthier-Villars, 1882.

IT is somewhat refreshing to receive a work upon Meteorology with ten times as many pages of letter-press as there are of tables. While at Havannah Prof. Poëy was certainly among the largest contributors to the "millions of observations," of which we so often hear, and even in the present work we find a reference to the 214,471 observations of the barometer made at Havannah in the one year 1862, but in the present book almost the only tabular matter is in an appendix of 8 pages.

By way at once of introducing the subject and of giving an idea of the style of the work, we append a rough translation of the first section of Chapter I.

"We endeavoured in our previous volume to sketch the Genesis of clouds from a study of the evolution of water in its forms of vapour, snow and ice, and under the influence of the concomitant meteorological-manifestations. We proved that the form of clouds is due

to their integral structure, which is inseparable from the physical constitution of the various layers of the atmosphere, where the action of weight, pressure, heat and humidity undergo constant changes indicated by the presence of special formations of clouds; that there are but two characteristic types of cloud, the Cirrus formed of frozen particles, and the Cumulus formed of watery ones; all other forms are evolved from these two types; that there exists in the evolution of the clouds a scale of complication or increasing speciality, from the upper region of the Cirrus down to the Fracto-cumulus near the surface; that one may regard the atmosphere in a vertical sense as divided into two great regions, each having physical characteristics and meteorological products quite distinct; that usually the Pallio fractus forms the boundary between these two layers. It is at this intermediate layer where the watery particles are changing into snow or ice that the meteorological manifestations are developed.

"In the region below this are produced thunder storms, rain, snow, hail, the easterly trades, surface winds, and optical phenomena dependent on reflection, such as rainbows and coronæ. The general movements of the atmosphere have their origin in the upper regions, as have also equatorial storms, the westerly trades, and optical phenomena dependent on refraction such as halos, parheliæ and paraselenæ. Accordingly, heat and moisture prevail in the lower regions, cold and dryness in the upper, and hence the formation and structure of the clouds.

"In the upper region the vapour of water is precipitated in the form of ice needles and in the formation of cirrus; in the middle region in that of snow crystals and cirro cumulus, and in the lowest region in that of watery particles, and of cumulus. The forms of the clouds are modified by the physical properties of the surrounding media.

"The atmosphere may therefore be regarded as consisting of a series of concentric beds of constantly varying properties and in which the clouds are modified from the cirrus or cumulus to an extent corresponding with their altitude. From the altitude alone it is therefore possible to determine the physical constitution of the stratum and the characteristic form of cloud, and *vice versâ*. The elements are all intimately related and the knowledge of any one enables us to deduce the others. When observers are thoroughly persuaded of the truth of these facts they will have a powerful guide in their observations of clouds, they will recognize the importance of employing a nomenclature in harmony with the present state of the science, and perhaps they will adopt that which we have proposed.

"Our object in this volume is to show that in the circulation of the atmosphere there exist two antagonistic currents, horizontal and vertical, ascending and descending, and that their dynamic energy or potential is intimately related to the barometric gradient."

Could there be a greater contrast than that exhibited by comparing

the views above suggested with the intensely heavy and uninteresting information given by nearly all the official publications of the present day—few of which tell us more than the number of tenths of the sky covered by cloud, and of which the better ones arrive at some such interesting statement as—"Amount of cloud 6, ci-cu; cu-str."

If we may not say that Prof. Poëy's heart is in the clouds, at any rate no one can read this work without being impressed by the extent of his reading, the justice of many of his remarks, and the vigour with which he shows how little the various International congresses and conferences have done towards the improvement and development of cloud observations, the latter being emphasized by contrast with the attention given to the subject by Clement Ley, and Hildebrandsson.

In order to give a general idea of the work we take from the table of contents a few of the headings, some for one reason some for another.

"Upper currents as indicated by Cirri—The official world has done almost nothing—The three primary sources, Clement Ley, Hildebrandsson and Poëy—Cirrus as a wind vane."

"Universality of Solar meteorology—Terrestrial meteorology depends on that of the sun—Meteorology is cosmopolitan—Its phenomena extend from Pole to Pole."

"Confirmation of the Anti-Trades—The movements of cirri confirm the theory established by Halley and Hadley."

"The clouds and the Official World—Five Conferences and Congresses have done almost nothing—At Leipzig, out of 61 savants, only 6 replied to Question 16—Amount of cloud. At Vienna, out of 32 delegates, 11 took part in discussing the subject of cloud observations, but nearly all the time was spent in discussing modes of recording total space covered—At the London Maritime Congress the result was similar—At the Paris Congress the subject was not discussed, the only reference to clouds being unimportant ones by Silbermann and G. Tissandier—At Rome 16 subjects were selected as of special interest, but 'the clouds' was not one of them."

"Cloud observations have been misunderstood—The question remains nearly where it was left by the Brussels Conference 26 years since—Nearly all atmospheric disturbances have their origin in the upper regions of the atmosphere—All cirrus observers have independently arrived at this conclusion, and it is and has been shared by Buys Ballot, Ferrel, Dove, Faye and Biot."

Our selections from the contents have taken much space, but we believe that they will be useful, both as showing how much is traceable to cloud study, and in suggesting that future writers on atmospheric movements must not omit to examine Professor Poëy's statements, especially since in this, as in most of his works, he is careful to give complete bibliographical information in support of his

quotations. In fact, it may be well to mention, that there are 130 separate notes of authors quoted in the work.

One parting suggestion. Is it possible that the reason that shepherds and fishermen are such good weather-prophets is that they do study the form and character of the clouds, and that in their rough way they get a truer insight than do those excellent observers who determine that the mean amount of cloud at 9 a.m. is 6·7 and at 9 p.m. 7·1? Interesting facts, no doubt, but surely not all that we ought to learn from the ever varying aspects of cloudland.

REFLECTED RAINBOWS.

BY W. STANLEY JEVONS, LL.D., F.R.S.

SOME years ago considerable discussion arose upon the question whether it is possible to see a reflected rainbow. Artists having been in the habit of inserting beautiful reflected bows in their landscapes, it was denied by some persons that such reflection could be seen, apparently on the ground that each person sees his own rainbow. It might easily be proved, indeed, from the laws of optics, that there is nothing to prevent the reflection of a rainbow, though it is true that the bow as seen reflected is not precisely that seen by direct vision. The sun's rays which have been refracted in the rain-drops may be reflected again and again from any suitable surfaces, and may still reach the eye of some observer.

But though a reflected rainbow is to be seen, there are comparatively few people, I imagine, who have seen one. I have all my life looked out for any curious phenomenon of the sort, and have, on several occasions, seen beautiful lunar rainbows, which are considered rare appearances. Only two years ago did I for the first time notice a reflected solar rainbow. The rarity of the occurrence is no doubt due to the fact that it needs the combination of three independent conditions to allow of the observation. In the first place there must be a bright bow, which is not seen many times in the year; secondly, he who sees the bow must happen to be in the neighbourhood of a piece of water suitable in extent and position to reflect the bow; thirdly, the water must be tranquil enough to allow of reflection. The last condition will usually be wanting, because rain-clouds will, in most cases, be accompanied by wind.

About two years ago, however, I saw a bright reflected rainbow, and what struck me much was that it assumed a form and character which I could not possibly have foreseen. I was on a steamboat, steaming up one of the lower and broader reaches of the lovely Hardanger Fyord. The water happened to be almost perfectly tranquil, and yet at the same time a brilliant bow appeared upon a heavy shower of rain, which was falling at the further side of the fyord. The brilliant colours of the bow were finely contrasted against the darkness of the cloud and of the surrounding fyelds, and as the boat advanced through the glassy water it was easy, from the head of the vessel, to see a bright reflection. Instead, however, of the perfect segment of a circle, with all the seven colours clearly distinguished, I was surprised to see something entirely different, namely, a broad and nearly straight streak of confused whitish light, extending from the base of one side of the bow, to within ten or twenty yards of the steamer, where the light rather suddenly curved off in an awkward sickle-like

form, and was soon abruptly lost. The fact is that the water, although so placid and glassy, was affected by a ripple almost imperceptible except by its disfiguring effect upon the bow. Now, as we see in the case of the sun or moon setting over a placid sea, the effect of such a ripple is to spread out the reflection into a long streak, each wave, within certain limits of distance, having some part of its surface disposed at a suitable angle to produce reflection. A complete rainbow springs perpendicularly at the sides, and approaches the horizontal at the summit. If we imagine the bow cut up into nearly square segments, it follows that many of these segments in the legs of the bow will be reflected into streaks, and these streaks will be superimposed upon each other. Thus the full light of the bow will there be seen reflected undiminished by the scattering effect of the ripple, and as different coloured rays, derived from different parts of the bow, will be mixed together, they will, in accordance with the Newtonian theory of light, be fused together into white light. As regards the summit of the bow, however, there would be no superposition of reflected streaks, and the one thickness of the bow would give insufficient light to be perceptible.

Without in the least denying that a person may casually, and still more probably by intention, witness a rainbow reflected in all its beauty of form and colour, I have no hesitation in saying that nine times out of ten the reflected bow will be no bow at all, but only a whitish streak. Artists will doubtless continue to paint reflected rainbows as they are seldom or never seen, rather than as they are seen.

It should be added that since I began to write this little article, I have happened to see a rainbow almost perfectly reflected, both as regards form and colour, upon the flat wet sands of the sea-shore. The watery surface, being unaffected by the moderate breeze which was blowing, acted as a nearly perfect mirror. Although persons walking upon flat wet sands see the clouds fully reflected therein, I cannot call to mind that I ever saw this effect represented in landscape paintings. I am, of course, far from denying that it may have been often so represented.—*The Field Naturalist, August*, 1882.

FORESTS AND METEOROLOGY.

An important paper in *Polybiblion* on this subject gives the results of observations made during the last six years under trees, and not far from the edge of a forest, and also in the plain, and far from all trees.

1. Forests increase the quantity of meteoric waters which fall on the ground, and thus favour the growth of springs and of underground waters.

2. In a forest region the ground receives under cover of the trees as much water as, or more, than the uncovered ground of regions with little or no wood.

3. The cover of the trees of a forest diminishes to a large degree the evaporation of the water received by the ground, and thus contributes to the maintenance of the moisture of the latter, and to the regularity of the flow of springs.

4. The temperature in a forest is much less variable than in the open, although, on the whole, it may be a little lower; but the *minima* are there constantly higher, and the *maxima* lower than in regions not covered with wood.

These observations have been made in the neighbourhood of Nancy, and by the pupils of the School of Forestry of that city, under the direction of M. Mathieu, sub-director of the school.

M. Fautrat, when sub-inspector of forests at Senlis, made during four years, but on a different method, observations on forestial meteorology, which fully and completely corroborate in certain respects those of M. Mathieu. The laws which seem to follow from the figures given by M. Fautrat, as well as an inspection of the curves which graphically represent them, are as follow:—

1. It rains more abundantly, under identical circumstances, over forests than over non-wooded ground, and most abundantly over forests with trees in a green condition.

2. The degree of saturation of the air by moisture is greater above forests than over non-wooded ground, and much greater over masses of *Pinus sylvestris* than over masses of leaved species.

3. The leafage and branches of leafed trees intercept one-third, and those of resinous trees the half of the rain water, which afterwards returns 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 evaportion is nearly four times less under a mass of leafed forest than in the open, and two and one-third times only under a mass of pines.

4. The laws of the change of temperature out of and under wood are similar to those which result from the observations of M. Mathieu.

SUNSPOTS, MAGNETIC STORM AND AURORA AUSTRALIS.

[Our readers may remember an article with the above title in the June number of this Magazine, in which the simultaneity of the appearance on April 16th, 1882, of a huge sun spot, and of a magnetic storm and aurora Australis was dwelt upon. In the last number (August) of *The Observatory* there is an account of the Aurora Borealis seen in the United States on that day, which is in many respects so excellent as to demand that it be laid before all our readers.—ED. *M. M.*]

SOLAR OUTBURST AND AURORAL DISPLAY.

[FROM *The Observatory*, AUGUST 1, 1882.]

SIR,—After having read in the *Observatory* several accounts of the outburst on the Sun in April, which fail to mention the grand aurora following, I conclude that it was not seen in England, and send you a note relating its appearance here. Sunday, April 16th, 1882, will pass into the history of astronomy as an eventful day. The Sun was in violent agitation throughout the day; and colossal centres of cyclonic activity were clearly seen in my telescope—a 6 in. Clark equatoreal. There were seen during the day 111 spots,

the largest being 67,000 miles in length and 48,000 miles in width. These were arranged in 10 clusters, none being far from the equator of the Sun. The largest number of spots seen in any cluster was 34, each aggregation having two or more very large, the remainder varying in size from medium to small.

The great spot was seen at this observatory at 8 a.m., April 15th, already advanced on the eastern edge of the sun 15°. Throughout the 15th it did not display unusual turbulence; but during the night activity set in, for on the 16th its internal structure had materially changed. It was cut into four portions by "bridges," but these did not maintain the same position an hour. They were widening, contracting, or bending into ever-changing forms, displacement being detected at half-hour intervals. At 9 a.m. two tongues of fire were pointing toward each other from opposite sides of the abyss, and at 0.30 p.m. passed, leaving quite a space between. Shortly after, they began to show curvature, and at 2 p.m. formed a circle—clearly a case of solar cyclone. Every large spot had bridges, complete or in the process of formation. In the large chasm, at about 4.30 p.m., one of the bridges split lengthwise, the separation requiring two hours to become complete, while the ends of several jets were tufted and tasselled with filaments of white-hot matter, which, nearly coinciding with the centre of one of the largest divisions, presented the appearance of the whirlpool rapids below Niagara, as they would be seen were that frenzy of water instantly rendered motionless. There were three clusters of faculæ also on the Sun—brilliant places much brighter than the general surface. The terrestrial atmosphere being in fine condition for telescopic definition, the "rice-grains," granulations, and "pores" all over the sun could be distinctly seen. We watched the solar orb the entire day, and when it vanished, wished the day might be longer; but night brought still other wonders in the heavens.

At 9 p.m., while viewing Wells's comet, it waned and disappeared. Looking out to learn the cause, its obscuration was found to come from the arc of an advancing aurora. The apparition presented a yellowish-green arc of a circle, whose altitude was 18°, the ends resting on the eastern and western horizons. The breadth of the band of light was 5°, clear sky revealing the stars in Cassiopeia, which were between it and the northern horizon. The centre of the auroral arc did not appear to be on a line below Polaris; and on measuring the displacement we found the eastern termination of the arc to be 15° north of the equator, while the western was 25° north, the centre being 10° east of the pole. For nearly an hour the phenomenon developed no sign of coming grandeur; but at 10 p.m., three pillars of crimson light shot up to an altitude of 40° from the western extremity of the arc, a few yellower streamers ascending in the east. These seemed to be a preconcerted signal with the celestial pyrotechnists, for within two minutes the whole arc flashed and trembled, and then expanding, ascended 8°, when a halt was made. This did not last more than a minute, when two flashes in rapid succession were seen throughout the widened arc, now 20° broad. A mighty upheaval followed, the apex of the band at once rose to Polaris, filling the northern heavens with light brilliant enough to read by. The altitude of the pole at this observatory is 41° 13′; and as there was still open sky under the band 10° in breadth, the belt of light was 30° wide.

The great Aurora reserved its forces a few moments and then discharged simultaneously hundreds of columns of scarlet, violet, and light yellow streamers, instantly converging at the zenith.

This display waned only to make way for another more magnificent, and so the whole night passed, outbursts succeeding each other in rapid movement. From midnight to 1 a.m. April 17th the phenomenon was at its height, the whole northern heavens from the horizon to the equator being striped and banded with varying streams flashing incessantly. A wave of light would appear in the northern horizon, and instantly rush to the zenith, producing curvature in the straight columns, which at once resumed their original position when the wave passed, only to be wrought again in a few seconds.

The whole northern hemisphere quaked with the rapidity of lightning without cessation during the hour following midnight, each upheaval impelling light-emitting matter to the zenith, where it was no longer agitated, but floated slowly south. Much of this actually descended as far as Scorpio, 30° south declination, so that nearly the entire celestial vault was filled with the coruscations. This unparallelled display of auroral activity was still in motion at 4.30 a.m., 17th, when the solar rays obscured the scene.

The sun-spot turbulence, the aurora, and a magnetic storm occurring all at one time, seem to indicate a bond of union between solar and terrestrial energy, the secret of which yet eludes research. The perpetual flashing of the heavens was the most marked feature of the aurora, giving rise to a scene of appalling grandeur and sublimity.

EDGAR L. LARKIN.

Observatory, New Windsor, Ill., U. S. A., June 17th, 1882.

THUNDERSTORM, JULY 8TH.

To the Editor of the Meteorological Magazine.

SIR,—We had a thunderstorm here on Saturday, July 8th, with the most tremendous rain I ever witnessed. The thunder began about 1 p.m., and from 2 to 4 there was a perfect deluge of rain with fierce lightning and very loud thunder. There was a short sharp hailstorm about 3. Thinking my rain gauge would overflow, I took off 2 inches of water about 4 o'clock, and on Sunday morning there was 0·20 more, making 2·20 inches in the 24 hours. I have, I believe, never measured as much as 2 inches before. The little river in the valley before the house rose over its banks, and filled the valley, which I think is nearly 100 yards wide. A good deal of hay lying cut has been washed away, and there are furrows in my gardenwalks, a foot deep. I picked up with my own hands a live trout, of a quarter of a pound weight, stranded in a small gutter, to which place it must have been washed by the overflow of a pond 50 or 60 yards off.

Yours very sincerely,

EDWARD COODE.

Polapit Tamar, Launceston, July 10th, 1882.

EXCESSIVE RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—Between the hours of 8.45 a.m. July 11th, and 8.45 a.m. July 12th, the rainfall was 2·25 in., the greater part of which fell

between 4.30 and 7 p.m. on Tuesday, 11th. This has been the greatest recorded in this neighbourhood, in 24 hours, for more than 13 years, with the exception of July 14th. 1875, when 3·11 in. fell, but on July 14th, 1880, 2·11 in. fell in the same number of hours (1·14 in. of which was registered after a thunderstorm lasting half an hour).

Yours truly,

RICHARD GORTON.

Cirencester, July 18th, 1882.

MULTIPLE RAINBOWS.

To the Editor of the Norfolk Chronicle. [*Reprint.*]

SIR,—Some of your readers may be interested in the description of a phenomenon I witnessed on July 5th, and which does not seem to have been widely observed. At about 6.15 p.m. my attention was attracted to a very brilliant rainbow, the whole arch being traceable from base to base; below it and contiguous were two fanit reflections of the bow, then about 10° above it was another faint bow, and about 10° higher still, two more faint reflections of the prismatic colours, making six in all. I was told we should have nine days' rain after this, and we have certainly had many showers every day since, as yet.

Yours faithfully,

J. ALFRED LAURENCE.

Dilham Vicarage, Norfolk, July 11th, 1882.

A WET JULY.

To the Editor of the Meteorological Magazine.

SIR,—The month of July is nearly always a very rainy one in this district, but this year it has exceeded any month since I first began to keep a register, in 1867.

Rain fell on 22 days, and the total amount was 9·15 in.—that on the 7th was 2·37.

We had an occasional bright day, which was generally followed by a very wet one, greatly to the annoyance of the farmers and the injury of their hay. Other crops have also suffered to some extent from excessive wet and deficient sunshine. We have had as yet very little summerly weather.—Yours truly,

C. WILSON.

Calder Mount, Garstang, North Lancashire, August 3rd, 1882.

SNOW IN JUNE.—On Sunday, 18th June, 1882, snow and sleet fell at South Kilvington, near Thirsk—an occurrence which has not happened in the middle of June in the district for many years.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	63·9	20	28·5	4	55·5	38·1	41·1	84	128·7	25·2	1·35	11	5·1
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	83·4	1	69·0	16	80·7	73·8	70·2	80	...	...	17·53	26	7·8
Calcutta	99·0	24	63·2	5	93·0	69·8	68·1	68	156·7	51·5	·52	1	1·6
Bombay	93·4	27	66·1	4	86·8	73·7	69·4	69	148·1	53·3	·02	1	1·4
Ceylon	92·2	14	71·8	7	89·3	75·8	73·1	74	154·0	67·0	2·36	10	4·5
Melbourne	102·1	10	45·3	27	78·0	54·7	51·1	64	155·7	36·2	·94	8	5·3
Adelaide	100·0	7	50·5	20	83·4	61·7	51·5	48	157·0	39·6	·49	7	4·2
Wellington	78·0	16	47·9	25	68·3	56·5	...	...	135·0	42·0	3·65	12	...
Auckland	80·0	7	45·1	25	72·5	61·2	59·3	77	131·6	44·0	4·39	14	7·4
Falkland Isles	62·2	14	28·9	22	51·8	39·3	41·5	81	122·2	20·2	2·76	25	7·3
Jamaica	87·5	18	64·9	12	84·1	67·6	67·4	79	...	58·4	1·23	...	3·1
Barbados	80·0	var.	66·0	30	79·0	70·0	68·9	79	149·0	...	2·02	8	6·0
Toronto	56·2	27	15·4	31	38·3	25·4	25·8	75	119·0	8·0	2·12	16	7·3
New Brunswick, S. John	45·0	2	8·0	16,25	33·2	20·7	25·5	87	...	...	6·16	15	5·9
Cape Breton, Sydney	45·8	28	−12·8	16	31·3	12·9	20·4	84	...	...	6·01	15	6·5
Newfoundlnd, S. John's	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	38·3	26	−24·3	24	24·2	−0·5	14·0	90	...	...	2·48	11	5·7

REMARKS, MARCH, 1882.

Mauritius.—Rainfall, 10·59 in. above the average; mean pressure (corr. and red.) 29·934 in. Mean hourly velocity of wind, 12·1 miles; extremes, 32·5 miles on 13th, and 0·0 mile on 20th; prevailing direction, E.S.E. to E. T and L on seven days. C. MELDRUM, F.R.S.

CEYLON.—TSS occurred on 14 days, and L was seen on 4 other days. J. STODDART.

Melbourne.—Mean pressure, humidity and amount of cloud below the average; mean temp. 0°·4 above, and rainfall, 1·06 in. below it. Prevailing direction of wind, S. and S.E.; strong breezes occurring on 9 days; greatest hourly velocity, 24 miles on 14th. Heavy dew on 7 days, dense fog on 9th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. (72°·5) nearly 2° above the average, the max. reaching 90° on 11 days, 3 days more than the average number. A most severe water famine was experienced throughout this Colony and Victoria during this and the preceding month, but towards the end of March a few slight showers fell, and the long continuance of hot weather appeared to be breaking up. C. TODD.

Wellington.—Dull wet weather prevailed up to the 7th, followed by pleasant weather till 16th; from 17th to 25th windy and showery, and the remainder of the month fine and generally cool. Prevailing winds, S.E. and N.W. Mean pressure and temp. both slightly above the average; rainfall, ·81 in. above it. R. B. GORE.

BARBADOS.—Mean pressure, ·16 in. below the average of 17 years; mean temp. 73°·9, also slightly below it. Prevailing direction of wind, N.E.; average velocity, 13·5 miles per hour, 30 per cent. above the average of 10 years; extremes, 20·2 miles and 8·2 miles. Rainfall 6 per cent. above the average of 25 years, and evaporation 8 per cent. below it. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, JULY, 1882.

[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	3·01	XI.	Castle Malgwyn	5·60
,,	Margate, Birchington...	2·13	,,	Rhayader, Nantgwillt..	7·45
,,	Littlehampton	2·57	,,	Carno, Tybritle	5·08
,,	St. Leonards	2·47	,,	Corwen, Rhug	4·64
,,	Hailsham	...	,,	Port Madoc	7·24
,,	I. of W., St. Lawrence.	2·83	,,	I. of Man, Douglas	5·42
,,	Alton, Ashdell.....	3·30	XII.	Carsphairn	8·61
III.	Great Missenden.....	2·71	,,	Melrose, Abbey Gate...	3·78
,,	Winslow, Addington ...	3·06	XIII.	N. Esk Res. [Penicuick]	4·70
,,	Oxford, Magdalen Col...	3·56	XIV.	Ayr, Cassillis House ...	5·39
,,	Northampton	3·18	,,	Glasgow, Queen's Park.	4·03
,,	Cambridge, Beech Ho...	2·04	XV.	Islay, Gruinart School..	4·38
IV.	Southend	1·71	XVI.	Cupar, Kemback.....	...
,,	Harlow, Sheering	1·78	,,	Aberfeldy H.R.S.	4·26
,,	Diss	2·83	,,	Dalnaspidal	5·45
,,	Swaffham	3·04	XVII.	Tomintoul.....	...
,,	Hindringham	2·12	,,	Keith H.R.S.	4·14
V.	Salisbury, Alderbury...	...	XVIII.	Forres H.R.S.	2·19
,,	Calne, Compton Bassett	3·76	,,	Strome Ferry H.R.S....	6·60
,,	Beaminster Vicarage ...	4·88	,,	Lochbroom	4·94
,,	Ashburton, Holne Vic..	7·46	,,	Tain, Springfield.....	3·58
,,	Torrington, Langtree W.	..	,,	Loch Shiel, Glenaladale	9·33
,,	Lynmouth, Glenthorne.	5·17	XIX.	Lairg H.R.S.	...
,,	St. Austell, Cosgarne...	...	,,	Forsinard H.R.S.	5·26
,,	Taunton, Fullands	2·51	,,	Watten H.R.S.	2·98
VI.	Bristol, Clifton	...	XX.	Fermoy, Glenville	6·76
,,	Ross	4·63	,,	Tralee, Castlemorris ...	6·59
,,	Wem, Sansaw Hall.....	3·95	,,	Cahir, Tubrid	6·18
,,	Cheadle, The Heath Ho.	3·86	,,	Newcastle West	3·98
,,	Worcester, Diglis Lock	4·21	,,	Kilrush	4·20
,,	Coventry, Coundon	3·93	,,	Corofin	6·00
VII.	Melton, Coston	2·86	XXI.	Kilkenny, Butler House	...
,,	Ketton Hall [Stamford]	3·25	,,	Carlow, Browne's Hill..	5·83
,,	Horncastle, Bucknall ...	2·32	,,	Navan, Balrath	6·37
VIII.	Macclesfield, The Park.	5·27	,,	Athlone, Twyford	7·41
,,	Walton-on-the-Hill.....	4·80	XXII.	Mullingar, Belvedere ...	5·31
,,	Broughton-in-Furness ..	8·65	,,	Ballinasloe	6·38
IX.	Wakefield, Stanley Vic.	2·89	,,	Clifden, Kylemore	9·27
,,	Ripon, Mickley	3·92	,,	Crossmolina, Enniscoe..	6·58
,,	Scarborough.....	2·74	XXIII.	Carrick-on-Shannon ...	5·18
,,	East Layton [Darlington]	3·98	,,	Dowra	4·46
,,	Middleton, Mickleton ..	3·93	,,	Rockcorry.....	5·71
X.	Haltwhistle, Unthank..	4·60	,,	Warrenpoint	6·33
,,	Carlisle, St. James Rd...	4·84	,,	Newtownards	4·17
,,	Shap, Copy Hill	8·69	,,	Belfast, New Barnsley .	5·99
XI.	Llanfrechfa Grange	5·15	,,	Bushmills	6·68
,,	Llandovery	8·24	,,	Buncrana	5·64
,,	Solva	4·01			

JULY, 1882.

Div		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·95	+ ·48	·95	10	18	77·8	30	46·0	1	0	0
II.		Maidstone (Hunton Court)...	2·94	+ ·90	·72	15	19	...	...	...	...	...	...
,,		Strathfield Turgiss	1·60	— ·70	·24	24	16	77·2	30	42·7	27	0	0
III.		Hitchin	2·65	— ·05	·75	11	21	73·0	3	46·0	9*a*	0	0
,,		Banbury	4·29	+ 1·31	·85	8	24	75·0	2, 3	45·0	8	0	...
IV.		Bury St. Edmunds (Culford)	1·88	— 1·09	·44	11	22	75·0	29	39·0	26	0	...
,,		Norwich (Cossey)	2·74	— ·01	·79	11	18	77·0	29	41·5	27	0	...
V.		Bridport	3·64	...	·57	14	14	..	..	...	...	...	...
,,		Barnstaple.....	5·03	+ 1·48	·75	6	21	77·0	29	47·0	31	0	...
,,		Bodmin	6·31	+ 2·87	1·35	10	22	71·0	14	47·0	27	0	0
VI.		Cirencester	5·89	+ 2·88	2·20	11	20	...	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	4·09	+ 1·06	·70	11	25	74·0	1	47·0	10*a*	0	0
,,		Tenbury (Orleton)	3·50	+ ·59	1·32	11	23	77·0	2	41·6	10	0	0
VII.		Leicester	3·36	..	·97	11	25	74·3	2	46·8	10	0	0
,,		Boston	2·42	— ·11	·59	9	17	78·0	29	47·0	27*c*	0	...
,,		Grimsby.....	2·73	— ·05	·76	8	22	72·0	3, 4	46·0	27	0	...
,,		Mansfield	...	...	...	...	...	...	...	...	...	...	...
VIII.		Manchester (Ardwick).....	5·56	+ 1·75	1·57	17	25	75·0	2, 3	50·0	25	0	...
IX.		Wetherby (Ribstone Hall) ...	2·75	+ ·14	·64	28	12	...	...	...	...	...	...
,,		Skipton (Arncliffe)	9·64	+ 4·69	1·11	6	27	76·0	1	39·0	26	0	...
X.		North Shields	3·80	+ 1·25	·73	10	21	75·0	2	43·0	27	0	0
,,		Borrowdale (Seathwaite).....	21·04	+12·27	3·29	13	29	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely).....	5·18	+ 1·37	·75	6	25	...	...	...	...	...	...
,,		Haverfordwest	7·02	+ 3·09	1·23	13	21	71·0	1	41·5	26	0	...
,,		Plinlimmon (Cwmsymlog) ...	7·85	...	·91	31	26	...	...	...	..	...	...
,,		Llandudno.....	2·55	— ·16	·48	6	18	70·0	2, 3	49·2	27	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	6·37	+ 3·24	1·68	14	28	70·4	1, 12	46·2	27	0	...
,,		Hawick	4·06	+ ·94	·65	25	23	...	...	..	...	...	.
XIV.		Douglas Castle (Newmains)	5·17	+ 1·88	·86	14	27	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	8·33	+[illegible]3·79	1·77	23	24	...	...	42·0	8*d*	0	...
,,		Appin (Airds)	7·09	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	5·26	...	1·08	3	24	...	...	...	...	...	...
XVI.		Loch Leven Sluices	4·00	+ ·95	·90	15	21	...	...	...	...	...	...
,,		Arbroath	3·54	+ ·90	·47	14	21	70·0	2, 29	45·0	26	0	...
XVII.		Braemar	4·39	+ 1·53	·87	1	26	72·8	28	41·0	23	0	0
,,		Aberdeen	3·32	...	·62	2	18	71·0	14	45·0	25	0	0
XVIII		Skye (Sligachan)	9·42	...	1·30	19	24	...	...	...	...	..	...
,,		Culloden	1·97	— ·81	·32	6	16	71·0	2	45·5	21	0	0
XIX.		Dunrobin	4·25	...	·70	8	21	71·0	29	45·0	21*e*	0	...
,,		Orkney (Sandwick)	2·44	— ·22	·63	3	20	65·4	22	47·4	5	0	0
XX.	IRELAND.	Cork (Blackrock)	5·24	+ 2·40	·76	7	23	85·0	1	43·0	25	0	...
,,		Dromore Castle	8·86	...	·72	26	24	69·0	2	43·0	25	0	...
,,		Waterford (Brook Lodge) ...	5·41	...	·88	12	19	76·0	1	44·0	26	0	...
,,		Killaloe	6·24	...	·74	13	26	78·0	10	41·0	26	0	...
XXI.		Portarlington	5·84	+ 3·16	·64	9	28	77·0	2	45·0	8	0	...
,,		Dublin (Monkstown)	...	...	...	...	...	...	...	...	...	...	...
XXII.		Galway (Queen's College) ...	...	...	...	...	...	...	...	...	...	...	...
XXIII.		Waringstown	4·40	+ ·82	·43	20	24	77·0	2, 11	45·0	25	0	0
,,		Londonderry...	...	...	...	...	...	...	...	...	...	...	...
,,		Omagh (Edenfel)	7·04	+ 3·79	·80	6	30	67·0	26	42·0	25	0	0

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

a And 25. *c* And 31. *d* And 11, 26. *e* And 26. *f* And 27.

METEOROLOGICAL NOTES ON JULY.

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.—An unsettled month; harvest commenced on the 19th.

BANBURY.—The showery weather during the month interfered greatly with the gathering of the hay, many fields being uncut at the end of the month. Mean temp. 60°·6. TS with H on 8th; T and L on 2nd; L on 20th.

CULFORD.—The month was very unsettled, and although the total rainfall is small, the number of wet days is unusually great; a good deal of T and L with occasional H, which in some parts of the county was very heavy.

COSSEY.—A cool month, with sunshine and showers, favourable for growing crops; the temp. rose above 70° only on twelve days, and fell below 50° on 5 nights; TS on 7th, two cottages at Ringland struck by L and burnt; heavy shower on 17th, ·39 in. of R fell in half an hour.

BODMIN.—A wet, cold, and very ungenial month, often more like October than July; mean temp. 61°·0.

CIRENCESTER.—A month of excessive R. with low temp.; one of the worst hay-making seasons ever known.

WOOLSTASTON.—A cold, wet, and dreary month; six days only without R; much of the hay crop quite ruined.

ORLETON.—The first three days were fine and warm with a few spots of R each day. The remainder of the month was very showery with a low temp. and rough wind almost every day. Distant T was heard on 1st, 2nd, 3rd, 13th, 24th, and 27th, and a smart storm of L and T occurred on the 10th, followed by a very heavy rainfall on the 11th. The grass was a heavy crop, but much of it was damaged by the daily R. Mean temp. of the month more than 2° below the average of 20 years.

LEICESTER.—The month was very unsettled, R falling on 25 days; the hay crop, which is very abundant, has been for the most part secured, though not in good condition. TSS on 2nd and 24th.

BOSTON.—An unfavourable month for farm crops; although the rainfall was not above the average, the frequency of the showers rendered hay-making a tedious process. The mean temp. was 1°·5 below the average, which, with the many dull gloomy days and frequent low temp. at night, was detrimental to the wheat and other corn crops.

KILLINGHOLME.—Crop of grass enormous, of corn moderate, of roots very good; the corn harvest is likely to be late. T and L on 8th, 10th, 12th, 19th, and 25th; T on 7th, 9th and 24th.

MANCHESTER.—A very unseasonable month; very little sunshine and almost constant R; the temp., too, was comparatively low. A few TSS occurred, one on the 16th being very heavy.

ARNCLIFFE.—An unusually heavy rainfall, disastrous to the hay harvest, and frequent TSS.

NORTH SHIELDS.—TSS on 10th and 12th, and T on three other days.

WALES.

LLANDUDNO.—In 13 years out of 21, July here is the warmest summer month, but this year it is to be hoped will prove an exception, for the mean temp. (57°·9) of the month which has just expired was nearly 4° below the average. Altogether July was not a genial month, but owing to the considerable amount of bright sunshine (164·2 hours), most of the hay was fairly well secured, and the grain crops are more promising than was anticipated.

HAVERFORDWEST.—The temp. was low throughout the month, the max. reaching 70° on four days only, but the nights were warm. It was the wettest July since 1861, when 8·13 in. of R fell on 13 days.

SCOTLAND.

CARGEN.—The wettest July since observations were commenced here (23 years) ; it rained more or less every day, although on three days the fall did not amount to ·01 in., but notwithstanding the heavy rainfall, the duration of sunshine (244 hours) was about the average. The weather was bad for securing the hay, but all other crops are luxuriant. Mean temp. of the month 59°·2 half a degree below the average. S. winds prevailed on 26 days.

HAWICK.—The month was chiefly remarkable for TSS, but the heavy rains produced a grand crop of hay.

BRAEMAR.—A wet, dark, but mild month. T and L on 7 days.

ABERDEEN.—Very thundery wet weather, rainfall considerably above the average ; on only one day did the max. temp. exceed 69°.

SLIGACHAN.—Only six days on which no R fell, but crops and stock look well. Nothing but sunshine and dry weather is wanted to secure the heaviest crop of hay for 20 years.

CULLODEN.—Temperature of the month below the average ; TSS very general ; frequent R, but no heavy falls.

SANDWICK.—The weather in July was pleasantly warm, with sufficient R for the crops which are very promising ; T on 19th and 24th ; a sleet shower on 29th.

IRELAND.

DROMORE CASTLE.—The wettest July on record ; hay, a heavy crop, but saved with difficulty and deficient in quality, many meadows being left uncut till overripe in consequence of the continuous R. Potatoes injured by storms and blight, but not extensively so beyond the sea-coast ; corn crops very good and promising.

WATERFORD.—The wettest July of the last eight ; rainfall nearly double the average ; weather wild and uncertain during the whole month.

KILLALOE.—A deplorable month, the rainfall has only once been exceeded in amount in the same month during 36 years (viz. in July, 1861, 6·51 in.) Hay crop spoiled to a great extent.

WARINGSTOWN.—Wet but not cold ; some damage to wheat and potatoes and early hay, but crops generally good.

EDENFEL.—With the exception of December, 1876, the past month was the wettest in 20 years, hopelessly damaging to potatoes and some hay.

GREAT HAILSTORM NEAR BRISTOL.

A Bristol correspondent sends us the following note relative to a great hailstorm near Bristol :—"On the evening of the 25th ult., this neighbourhood was visited by one of the most extraordinary hail-storms ever witnessed, the ground being covered with hail, which remained in many places the whole of the night, for on Wednesday morning we measured some where it had rolled into a heap 5½ inches deep at seven o'clock. We have not a flower left outside, and I fear tender plants such as Alternantheras and Coleus are permanently injured, as they were covered up for some time in hailstones, and now they have the appearance of having been frozen. Everything is more or less damaged, Beet especially so."—*Journal of Horticulture.*

SYMONS'S

MONTHLY

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THE BRITISH ASSOCIATION AT SOUTHAMPTON.

ALTHOUGH no one can deny that the Southampton people did their best to make the meeting of the British Association a success, we are doubtful if it can be maintained that the results of recent meetings have been worth the time and trouble and money expended upon them, both by the local associates and by the members themselves.

Disguise it as we may, the fact remains that the state of science now differs so enormously from what it was half a century since, that it is *prima facie* improbable that an organization suitable to 1831 should be equally suitable to 1882.

And we doubt the expediency of the localities recently selected, or rather of their recent selection. It used to be a rule, or at any rate a frequent practice, to choose alternately large and small centres of population, so that if one meeting was small, it would be followed by one at say Liverpool, Manchester, or Edinburgh, which would restore both the prestige and the exchequer. But we have had Swansea, York, Southampton, and are promised Southport and Montreal. York, helped on by the éclat of a so-called jubilee (which it was not) had a good meeting, but both Swansea and Southampton were poor, especially the former, the attendance not half what it was at several towns under the genial guidance of Professor Phillips. Southport proposes to combine Liverpool and Manchester, but it can hardly flatter itself that it will have a meeting of 6,000 members and associates. As for Montreal, that is at present too uncertain for us to consider it.

We have incidentally referred to the geniality of Prof. Phillips, and revert to the topic, because we are sure that the Association is losing much by the diminution of that element. We will give two instances, neither very important, and neither matters in which the writer was the acting party.

A movement was set on foot, having for its twin objects (1) the establishment of closer relations between the British Association and the hundreds of Natural History Societies which have been established in various parts of the country, and (2) the representa-

tion of those societies on the General Committee, in accordance with one of the oldest rules of the British Association.

The Council of the British Association seem hitherto to have failed to perceive the very great local support which this movement would have ensured in nearly all parts of the country, and instead of assisting the movement have apparently regarded it solely as an attempt at unduly increasing the General Committee, and have resisted it accordingly.

The other still smaller matter (but a straw will show a current) is the Meteorological Breakfast, an arrangement intended to promote the personal acquaintance of those devoted to that branch of Science —and one which to our knowledge has drawn members to meetings which they would otherwise have neglected. This also has met with no favour at the hands of the authorities, and this year the new secretary, when applied to by one of the leaders of modern meteorology, refused to allow the posting of the usual notice of where the breakfast would be held. On arriving at Southampton, and learning what had occurred, remembering also that somewhat similar courtesy had been manifested before, a consultation of several meteorologists was held, and although they knew that if they chose to proceed, no action of the British Association could stop them, they decided that after this repetition of discouragement, they would drop that which had been originally designed chiefly as an incentive to attendance at the British Association meetings.

That there would have been a fair attendance at the breakfast may be inferred from the following list of meteorologists present at Southampton—no one being placed on the list unless either a Fellow of the Meteorological Society or an observer at the present time :—

Adams, Prof. J. C., F.R.S.	Cambridge.
Armstrong, Sir W. G., F.R.S.	Newcastle-on-Tyne.
Barrow, B.	Ryde.
Bateman, J. F., C.E., F.R.S.	London.
Baumhauer, Dr. G. H. Von	Haarlem.
Brett, A. T., M.D.	Watford.
Casella, L. P.	London.
Chapman, E.	Oxford.
Colman, J. J., M.P.	Norwich.
Crowley, F.	Alton.
Cushing, T.	Lambeth.
Davies, Rev. R. P.	Fairford.
Dines, G.	Hersham.
Edmonds, F. B.	London.
Evans, J., D.C.L., F.R.S.	Hemelhempstead.
Everett, Prof. J. D., F.R.S.	Belfast.
Fordham, H. G.	Royston.
Garrett, Rev. H.	Southampton.
Glaisher, J., F.R.S.	Blackheath.
Hankinson, R. C.	Southampton.
Harrison, J. P.	London.
Hawksley, T., C.E., F.R.S.	London.
Howlett, Rev. F.	Alton.
Lawton, W.	Hull.

Livesay, J. G.	Ventnor.
Mackeson, H. B.	Hythe.
Mann, R. J., M.D.	Wandsworth.
Mylne, R. W., C.E., F.R.S.	London.
Pengelly, W., F.R.S.	Torquay.
Pleydell, J. C. Mansell	Blandford.
Rawson, Sir Rawson W., C.B.	London.
Roberts, I.	Liverpool.
Shaw, Prof. H. S. Hele	Bristol.
Siemens, C. W., D.C.L., F.R.S.	London.
Smelt, Rev. M. A.	Cheltenham.
Smith, Basil Woodd	Hampstead.
Smith, Prof. H. J. S., F.R.S.	Oxford.
Stanley, W. F.	South Norwood.
Stewart, Prof. Balfour, F.R.S.	Manchester.
Symons, G. J., F.R.S.	London.
Vivian, E.	Torquay.
Walker, C. V., F.R.S.	Tunbridge Wells.
Westlake, T.	Fordingbridge.

The following is we believe, a complete list of all Meteorological papers :—

A. T. Aitcheson	*Report of Wind Pressure Committee.*
Prof. J. Crafts	*On the comparison of the Mercury and Air Thermometer.*
C. E. De Rance	*Report on the circulation of the Underground Waters in the Permeable Formations of England.*
Prof. Everett	(1) *Report of Committee on Underground Temperature;* (2) *Synopsis of all previous reports of this Committee.*
Litton Forbes, M.D.	*The Geography and Meteorology of Western Kansas.*
A. Mallock	*On a mechanical Self-registering Anemometer.*
Prof. Lord Rayleigh	*On the effect of Wind on the draught of Chimneys.*
Prof. Lord Rayleigh	*On the tension of Mercury vapour at Common Temperatures.*
Prof. Rücker	*Report of the Committee on the methods employed in the calibration of Mercurial Thermometers.*
Hon. F. A. R. Russell	*On Cirrus and Cirro-cumulus.*
Prof. Schuster	*Report of Committee on Meteoric Dust.*
Prof. Schwedoff	*On the origin of Hail.*
Prof. Balfour Stewart	*On a comparison of Magnetical and Meteorological Weather.*
Prof. Balfour Stewart	*On a supposed connexion between the heights of Rivers and the number of Spots on the Sun.*
Prof. S. P. Thompson	*On Schwedoff's Theory of Hail.*

UNDERGROUND TEMPERATURE.

The Fifteenth Report of the Committee, consisting of Prof. Everett, Prof. Sir Wm. Thomson, Mr. G. J. Symons, Sir A. C. Ramsay, Prof. Geikie, Mr. J. Glaisher, Mr. Pengelly, Prof. Edward Hull, Dr. C. E. Le Neve Foster, Prof. A. S. Herschel, Prof. G. A. Lebour, Mr. A. B. Wynne, Mr. Galloway, Mr. Joseph Dickinson, Mr. G. F. Deacon, *and* Mr. A. Strahan, *appointed for the purpose of investigating the Rate of Increase of Underground Temperature downwards in various Localities of Dry Land and under Water, embodying a Summary of the previous fourteen reports. Drawn up by* Prof. Everett *(Secretary).*

The results were classified as follows :—

A. Instruments. B. Methods of observation. C. Questions affecting cor-

rectness of observations. D. Questions affecting deductions from observations. E. Comparison of results. F. Mean rate of increase of temperature with depth, and mean upward flow of heat.

A. INSTRUMENTS.—Under this head we have—

1. Instruments for observing temperature. 2. Subsidiary apparatus.

1. The thermometers which the Committee have employed have been of two kinds—slow-action thermometers and maximum thermometers. The present pattern of slow-action thermometer consists of a thermometer having its bulb surrounded by stearine or tallow, the whole instrument being hermetically sealed within a glass jacket, and had its origin in a conference between the Secretary and Dr. Stapff in the St. Gothard tunnel. Other slow-action methods described in the reports are—Ångstrom's thermometer in bottle of water, large spirit thermometer, and Symons' thermometer in a thick casing of felt.

Our present patterns of maximum thermometer are two—the Phillips, and the Inverted Negretti—both being hermetically sealed in strong glass jackets to prevent the bulbs from receiving pressure when lowered to a great depth in water.

Both instruments are used in a vertical position, and it is necessary that they register truly in spite of jolts in hauling up. The Phillips pattern was used first, and there were continual complaints of the detached column shaking down, till it was pointed out by Prof. Phillips himself, that the fault arose from the bore not being small enough. This defect was remedied, and the instrument has since worked perfectly, but it requires good light and sharp eyes to read it.

The Inverted Negretti was contrived by the Secretary with the view of overcoming the error from jolts, but the contrivance had been anticipated many years before by Messrs. Negretti and Zambra themselves. It is easily read and managed, but it has a theoretical defect in requiring a slight correction for the difference between the temperature at the time of taking the reading and the maximum temperature recorded.

References to some other kinds of maximum thermometers will be found in some of the reports—namely, to Walferdin's, Lubimoff's, and Magnus', all these being overflow thermometers.

References to Becquerel's thermo-electric method of observing underground temperature were made in three of the reports, and some laboratory experiments were subsequently carried out by the Secretary, which led to the conclusion that the method could not be relied on to yield sufficiently accurate results. It may be mentioned that Becquerel's observations are only carried to the depth of 100 feet, whereas we require observations at the depth of 1,000 or 2,000 feet.

As regards subsidiary (non-thermometric) apparatus, Mr. Symons' arrange ment for lowering and raising thermometers to and from any required depth in a deep well (1,000 feet deep in this case), is described with an illustration in II.*

Plugs for preventing convection-currents in a bore or well, are suggested in the first report. Herr Dunker's two forms of plug successfully employed by him at Sperenberg are described in IX., and Professor Lebour's umbrella-like plug in IX., X., XII. In its final form it appears to be very convenient,

* This and all similar Roman numerals refer to the number of the report.

as it requires only one wire, XII. It remains collapsed as long as the wire is taut, but opens out and plugs the hole when it becomes slack.

B. METHODS OF OBSERVATION. These have chiefly been of two kinds.

1. Observations in holes bored to the depth of a few feet in newly opened rock, either in the workings of a mine or of a tunnel, or in a shaft during the sinking. The rock should not have been exposed for more than a week when the hole is bored, and a day may be allowed to elapse for the heat generated by boring to escape before the thermometer is inserted. Very complete plugging is necessary to exclude the influence of the external air. It is desirable to use about two feet of plugging, of which the outer part should be made air tight with plastic clay or greased rag. After the lapse of a few days, the thermometer is to be drawn out by means of a string attached to the handle of its copper case, and the reading taken. The slow-action thermometer above described is employed for this purpose, and there is time to read it with sufficient deliberation before any appreciable change occurs in its indication. It is recommended that the thermometer be then re-inserted and plugged as before, and a second reading taken after the lapse of a week. The majority of our successful observations have been made by this method.

2. Observations in deep bores of small diameter.

Report I. contained a successful application of this method to a bore about 350 feet deep, near Glasgow, which gave very regular results in a series of observations at every 60th foot of depth; but in the majority of instances in which it has since been applied, there have been marked irregularities, due apparently to the influx of water from springs at particular points. One of the most valuable of our results was obtained by the application of the method to a bore 863 feet deep, executed at the bottom of a coal mine 1,066 feet deep, giving a total depth of 1,929 feet. The bore in this case was dry at the time of its execution, though full of water at the time of the observation. It was in South Hetton Colliery, Durham, and the observer was Mr. J. B. Atkinson. The instrument generally employed in the observations of this class was a maximum thermometer of either the Phillips or the Inverted Negretti construction, as described above.

The larger the diameter of the bore, the more uncertain does this mode of observation become. The South Hetton bore had a diameter of $2\frac{1}{2}$ inches. The Kentish Town well, 1,000 feet deep, in which Mr. Symons' observations were made, had a diameter of 8 inches, and the well 2,165 feet deep at La Chapelle, in the north of Paris, had a diameter of $4\frac{1}{2}$ feet. The temperatures in this last were proved to be largely affected by convection, the water at the top being too warm, and that at the bottom not warm enough. The observations of Herr Dunker, in the bore at Sperenberg, near Berlin, with a depth of 3,390 feet and a diameter of 12 inches, proved a similar disturbance, amounting at the top, and especially at the bottom, to several degrees. As regards the bottom, the proof consisted in showing that when a thermometer at the bottom was protected by a light plug from the influence of the water above, its indications were higher by $6\frac{3}{4}^{\circ}$ F. than when this precaution was not employed.

3. Where a shaft contains only a few feet of water at the bottom, a thermometer lowered to the bottom of this water may be assumed to give pretty nearly the normal temperature of the soil at this depth, and a few of our observations have been taken in this way. No observations of any value for

our purpose can be made in the portion of a shaft or well occupied by air, as the temperature of such air is largely influenced by that of the air at the surface. This is clearly proved by Mr. Symons' observation in 200 feet of air at Kentish Town.

C. QUESTIONS AFFECTING THE CORRECTNESS OF THE OBSERVATIONS.

This might theoretically include questions as to the correct working of the instruments employed, and as to the personal reliability of observers; but the latter topic has not come into discussion, and the former has not arisen since our present patterns of instrument came into use. The questions for discussion are thus confined to those which relate to possible differences between the temperature of the point at which the thermometer was placed, and the normal temperature at the same depth in its vicinity.

1. The heat generated by the action of the boring tool will vitiate the observation if sufficient time is not allowed for its escape.

A very full discussion on this subject in connection with the great artesian well at La Chapelle will be found in reports V., VI., and VII., clearly establishing the fact that the temperature at the bottom both on the third and the sixth day after the cessation of boring operations, was $7\frac{1}{4}$° F. higher than after the lapse of four months, though the water had been left to itself during this interval. Further evidence showing that the temperature in the lower part of a bore full of water may thus be raised several degrees, is furnished by the Sub-Wealden bore.

2. The generation of heat by local chemical action is well known to be a powerful disturbing cause when pyrites is present. In report X., the observers in the mines of Schemnitz say, "Pyrites and also decaying timber were avoided as being known to generate heat." In report IX., the observations in the coal mines of Anzin show a temperature of $70\frac{3}{4}$° F. in a very dry shaft at the depth of less than 70 ft. This must be about 15° F. above the normal temperature.

At Talargoch lead mine in Flintshire (XIII. XIV.), the discrepancies between the temperatures at the six observing stations are suggestive of local chemical action.

3. Convection of heat has proved a very troublesome disturbing cause.

As to convection of heat by air in a shaft or well not filled with water, evidence will be found in report II., both in the case of Mr. Hunter's observations in the shafts of two salt mines at Carrickfergus, having the depths of 570 and 770 feet respectively, and in the case of Mr. Symons' observations at Kentish Town, where the first 210 ft. of the well are occupied with air. At the depth of 150 ft. the temperature was 52°·1 in January, and 54·7 F. in July.

Convection of heat by water in old shafts which have been allowed to become flooded, is very manifest in some of the observations communicated by Mr. Burns in reports II. and IV. In Allendale shaft (Northumberland), 300 ft. deep, with about 150 ft. of water, the temperature was practically the same at all depths in the water, and this was also the case at Breckon Hill shaft, where the observations extended from the depth of 42 ft. to that of 350 ft. A similar state of things was found in a shaft at Ashburton (Devon), by Mr. Amery, who observed at every fiftieth foot of depth down to 350 ft.

Convection by water in the great well at La Chapelle, 2,165 ft. deep, and 4 ft. 5 in. in diameter at the bottom, appears probable from the following comparisons.

Very concordant observations (communicated by M. Walferdin to *Comptes Rendus* for 1838) at three different wells in the Paris basin, of the respective depths of 863 ft., 1,312 ft., and 1,968 ft., show by comparison with one another and with the constant temperature in the caves of the Paris Observatory, a rate of increase of 1° F. in 56 or 57 ft. These data would give at the depth of 328 ft. a temperature of 57°, and at the depth of 2,165 ft. a temperature of 90°; whereas the temperatures actually observed at those depths in the well at La Chapelle in October, 1873, when the water had been undisturbed for a year and four months, were 59°·5 and 76°. It thus appears probable that the upper part of the well is warmed, and the lower part cooled, by convection. Further light may be expected to be thrown on this point when the well reaches the springs, and the water spouts above the surface as it does at the *puits de Grenelle*. A letter received by the Secretary in July, 1882, states that engineering difficulties have prevented any deepening of the well since the above observations, but that arrangements for this purpose have now been made.

More certain and precise information as to the effect of convection in deep bores is furnished by the experiments of Herr Dunker at Sperenberg. The principal bore at Sperenberg has a depth of 4,172 English feet, and is, with the exception of the first 283 ft., entirely in rock salt. Observations were first taken at numerous depths, from 100 ft. to the bottom, and showed a fairly regular increase of temperature downwards. The temperature at 700 ft. was 68°·2 F., and at 3,390 ft. 108°·7 F. Plugs were then contrived which could be fixed tight in the bore at any depth with the thermometer between them, or could be fixed above the thermometer for observing at the bottom. Convection was thus prevented, and a difference of two to four degrees was found in the temperatures at most of the depths: at 700 feet the temperature was now 70°·4 F., and at 3,390 ft. 113°·3 F. We have thus direct evidence that convection had made the temperature at 3,390 ft. 4°·6 F. too low; and this, as Herr Dunker remarks, is an under estimate of the error, inasmuch as convection had been exerting its equalising action for a long time, and its effect could not be completely destroyed in the comparatively short time that the plugs were in position. Again as regards the effect of convection on the upper part of the bore, the temperature, 56°·7 F., was observed at the depth of 100 ft. in the principal bore when no plugs were employed, while a second bore only 100 ft. deep in its immediate vicinity showed a temperature, 52°·2 F., at the bottom. This is direct evidence that the water near the top of the great bore had been warmed 4½° F. by convection.

Suggestions for observations in filled up bores will be found in report XI., but they have not yet taken a practical shape.

D. Questions affecting Deductions from Observations.

1. In many instances the observations of temperature have been confined to considerable depths, and in order to deduce the mean rate of increase from the surface downwards, it has been necessary to *assume* the mean temperature of the surface. To do this correctly is all the more difficult, because there seems to be a sensible difference between the mean temperature of the surface and that of the air a few feet above it.

In Report III. some information on this point is given, based on observations of thermometers 22 in. deep at some of the stations of the Scottish Meteorological Society, and of thermometers 3 (French) feet deep at Greenwich and at Edinburgh. These observations point to an excess of surface temperature

above air temperature, ranging from half a degree to nearly two degrees, and having an average value of about one degree.

Dr. Schwartz, Professor of Physics in the Imperial School of Mines at Schemnitz, in sending his observations made in the mines at that place, remarks on this point :—

"Observations in various localities show that in sandy soils the excess in question amounts, on the average, to about 1° F. In this locality the surface is a compact rock, which is highly heated by the sun in summer, and is protected from radiation by a covering of snow in winter; and the conformation of the hills in the neighbourhood is such as to give protection against the prevailing winds. Hence the excess is probably greater here than in most places, and may fairly be assumed to be double the above average."

Some excellent observations of underground temperature at small depths were made at the Botanic Gardens, Regent's Park, London, for the six years 1871–76, along with observations of air temperature, and have been reduced by Mr. Symons. They are at depths of 3, 6, 12, 24, and 48 in. beneath a surface of grass, and their joint mean derived from readings at 9 a.m. and 9 p.m. for the six years is 49°·9 F., the mean for the 48-in. thermometer being 50°·05 F. The mean air temperature derived in the same way from the readings of the dry bulb thermometer is 49°·6 F. Hence it appears that the excess of soil above air is in this case about 0°·4 F.

Quetelet's observations for three years at Brussels (page 48 of his '*Mémoire*') make the earth, at depths of less than 1½ foot, colder than the air, and at greater depths warmer than the air.

Caldecott's observations for three years at Trevandrum, in India, make the ground at the depth of three feet warmer than the air by 5°·7 F.

Dr. Stapff, in his elaborate publications on the temperature of the St. Gothard tunnel, arrives at the conclusion that the mean temperature of the soil on the surface of the mountain above the tunnel is some degrees higher than that of the air, the excess increasing with the height of the surface and ranging from 4° F. near the ends of the tunnel to 9° or 11° F. in the neighbourhood of the central ridge.

Connected with this is the question—

2. Whether the mean annual temperature of the soil increases downwards from the surface itself, or whether, as is sometimes asserted, the increase only begins where annual range ceases to be sensible—say at a depth of 50 or 60 feet.

The general answer is obvious from the nature of conduction. Starting with the fact that the temperature increases downwards at depths where the annual range is insensible, it follows that heat is travelling upwards, because heat will always pass from a hotter to a colder stratum. This heat must make its way to the surface and escape there. But it could not make its way to the surface unless the mean temperature diminished in approaching the surface; for if two superposed layers had the same mean temperature, just as much heat would pass from the upper to the lower as from the lower to the upper, and there would not be that excess of upward flow which is necessary to carry off the perennial supply from below.

This reasoning is rigorously true if the conductivity at a given depth be independent of the temperature, and be the same all the year round. By "conductivity" we are to understand the "flux of heat" divided by the

"temperature-gradient;" where by the "flux of heat" is meant the quantity of heat which flows in one second across unit area at the depth considered, and by the "temperature-gradient" is meant the difference of temperature per foot of descent at the depth and time considered.

Convection of heat by the percolation of water is here to be regarded as included in conduction. If the conductivity as thus defined were the same all the year round, the increase of mean temperature per foot of depth would be independent of the annual range, and would be the same as if this range did not exist.

As a matter of fact, out of six stations at which first-class underground thermometers have been observed, five show an increase downwards and one a decrease. The following are the results obtained for the depths of 3, 12, and 24 French feet :—

	3 feet.	12 feet.	24 feet.
Brussels, three years	51·85	53·69	53·71
Edinburgh (Craigleith) five years	45·88	45·92	46·07
,, (Gardens), five years	46·13	46·76	47·09
,, (Observatory), seventeen years	46·27	46·92	47·18
Trevandrum, India, three years	85·71	86·12	—
Greenwich, fourteen years	50·92	50·61	50·28

In calculating the mean temperature at 12 feet for Trevandrum, we have assumed the temperature of May, which is wanting, to be the same as that of April.

Omitting Trevandrum, and taking the mean values at 3 and 24 French feet, we find an increase of 1° for about 34 English feet.

3. Another question which it has sometimes been necessary to discuss is the influence which the form of the surface exerts on the rate of increase of temperature with depth.

The practical inference is that the distance between the isotherms (in other words, the number of feet for 1° of increase), is greatest under mountain crests and ridges, and is least under bowl-shaped or trough-shaped hollows.

The observations in the Mont Cenis tunnel, and the much more complete observations made by Dr. Stapff in the St. Gothard tunnel, fully bear out these predictions from theory.

As regards the St. Gothard tunnel, Dr. Stapff reports :—"The mean rate of increase downwards in the whole length of the tunnel is, measured from the surface directly over, 1° F. for 88 feet. Where the surface is a steep ridge the increase is less rapid than this average; where the surface is a valley or plain the increase is more rapid."

4. The question whether the rate of increase downwards is upon the whole the same at all depths, was raised by Professor Mohr in his comments upon the Sperenberg observations, and is discussed, so far as these observations bear upon it, in reports IX. and XI. Observations in different localities give different results, but from a theoretical point of view, in places where there is no local generation of heat by chemical action, the case stands thus :—

The flow of heat upwards must be the same at all depths, and this flow is equal to the rate of increase downwards multiplied by the conductivity, using the word "conductivity" (as above explained) in such a sense as to include convection. The rate of increase downwards must, therefore, be the same at all depths at which this conductivity is the same.

This reasoning applies to superposed strata at the sa me place, and assumes

them to be sufficiently regular in their arrangement to ensure that the flow of heat shall be in parallel lines, not in converging or diverging lines.

Clauses 5 and 6 deal with the conductivity through various geological formations, and at various angles, and seem to show that the effects of these two conditions are not very great.

Section E. deals with a comparison of the results, and occupies many pages, we must therefore refer our readers to the report for the details, and content ourselves with reprinting the synoptical table.

Collecting together the foregoing results, and arranging them mainly in the order of their rates of increase, but also with some reference to locality, we have the following list:—

	Depth feet		Feet for 1° F.
Bootle Waterworks (Liverpool)	1,392	...	130
Przibram Mines (Bohemia)	1,900	...	126
St. Gothard Tunnel	5,578	...	82
Mont Cenis Tunnel	5,280	...	79
Talargoch Lead Mine (Flint)	1,041	...	80
Nook Pit Colliery	1,050	...	79
Bredbury ,, (East Manchester Coal Field.)	1,020	...	78½
Ashton Moss ,, (East Manchester Coal Field.)	2,790	...	77
Denton ,, (East Manchester Coal Field.)	1,317	...	77
Astley Pit, Dukinfield (East Manchester Coal Field.)	2,700	...	72
Schemnitz Mines (Hungary)	1,368	...	74
Scarle Boring (Lincoln)	2,000	...	69
Manegaon Boring (India)	310	...	68
Pontypridd Colliery (S. Wales)	855	...	76
Kingswood Colliery (Bristol)	1,769	...	68
Radstock Colliery (Bath)	620	...	62
Paris Artesian Well, Grenelle	1,312	...	57
,, ,, St André	830	...	56
,, ,, Military School	568	...	56
London ,, Kentish Town	1,100	...	55
Rosebridge Colliery (Wigan)	2,445	...	54
Yakoutsk, frozen ground (Siberia)	540	...	52
Sperenberg, boring in salt (Berlin)	3,492	...	51⅛
Seraing Collieries (Belgium)	1,657	...	50
Monkwearmouth Collieries (Durham)	1,584	...	70
South Hetton ,, ,,	1,929	...	57½
Boldon ,, ,,	1,514	...	49
Whitehaven ,, (Cumberland)	1,250	...	45
Kirkland Neuk Bore (Glasgow)	354	...	53
Blythswood ,, ,,	347	...	50
South Balgray ,, ,,	525	...	41
Anzin Collieries (North of France)	658	...	47
St. Petersburg, well (Russia)	656	...	44
Carrickfergus, shaft of salt mine (Ireland)	770	...	43
,, ,, ,,	570	...	40
Slitt Mine, Weardale (Northumberland)	660	...	34

In deducing a mean from these very various results, it is better to operate not upon the number of feet per degree, but upon its reciprocal—the increase of temperature per foot. Assigning to the results in the foregoing list weights proportional to the depths, the mean increase of temperature per foot is found to be ·01563, or about $\frac{1}{64}$ of a degree per foot—that is, 1° F. in 64 feet.

[It may be well to point out that, accepting this value of 1° F. for 64 ft., we should have for the temperature under London :—

Depth. Feet.	Miles.		Temperature. Degrees F.
0	0	.....	50·0
1000	0·2	.....	65·6
5280	1·0	.....	132·5
10368	1·9	.....	212·0

So that the usual temperature of boiling water exists constantly at less than two miles below the surface ; while according to the observations made at Kentish Town the temperature of 212°, would be found at the depth of 8,910 feet, or about $1\frac{3}{4}$ miles.]

DIFFERENCE IN RAIN GAUGES.

To the Editor of the Meteorological Magazine.

SIR,—On measuring the rain gauges this morning, I found such a remarkable difference between that in the gauges near the ground and in the one at 11 ft., that I cannot refrain from publishing it, and shall be interested to know if any other observer remembers the like.

I may mention that the gauge 11 ft. above ground is 63 ft. from the one 2 ft., and still further from the other two ; the former is placed in an exposed position, and the piping is enclosed in a wooden case and out of the reach of anybody, and so constructed that the water (if any) running down the outside could not possibly enter the receiving bottle.

The bottle itself holds nearly an inch and half of rain, and as it happened I examined it last evening when it was raining fast. I took the bottle and measured the contents, fearing it might overflow, when I registered 1 in., and instead of putting it back again, kept it to be added to the fall during the night.

The rain that fell during the first part of the day was of a drizzling nature, but the principal part fell from about 6 p.m. and during the night.

All the gauges are 8 in. in diameter, consequently I need only one glass for measurement, and I flatter myself on being correct in noting the quantity before throwing the water away.

The gauges at the respective heights, viz. 6 in., 1 ft., and 11 ft., are registered every morning at 8.45, beginning at the one nearest the ground, but the one at 2 ft. I generally register once every week, though in this instance I measured it at the same time for comparison, and put the water back into the receiving bottle, so as not to interfere with the weekly measurement.

6 in.	1 ft.	2 ft.	11 ft.
0·72	0·74	0·71	1·45

Yours truly,

RICHARD GORTON.

Cirencester, Sept. 2nd, 1882.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0–10
England, London	65·5	21	32·6	16	58·2	40·8	41·1	78	116·6	27·4	2·83	14	6·4
Cape of Good Hope	82·8	4	47·2	22	72·4	56·3	56·4	82	...	...	1·99	9	5·5
Mauritius	82·3	18	70·3	26	81·0	73·0	68·0	75	...	...	1·46	13	4·3
Calcutta	101·5	26	67·4	18	95·5	73·9	70·6	67	161·7	60·5	·25	3	3·7
Bombay	91·4	17	74·9	23	88·5	76·7	73·2	72	151·1	63·6	·08	2	0·6
Ceylon	92·5	...	72·8	11	89·6	75·8	73·0	73	156·0	69·5	2·62	11	6·1
Melbourne	85·1	10	42·0	8	66·9	49·4	47·4	71	134·0	34·5	2·31	14	6·8
Adelaide	86·2	9	49·5	13	71·7	55·5	48·5	58	150·0	41·5	2·06	12	6·3
Wellington	67·0	16	45·0	23	63·3	53·4	...	...	123·0	40·0	6·58	15	...
Auckland	75·0	1, 3	48·6	24	69·6	56·5	55·9	78	131·5	46·0	4·84	14	5·6
Falkland Isles	55·2	23	27·2	8	45·2	35·2	37·2	87	105·3	21·2	3·03	23	7·1
Jamaica	89·6	18	66·8	24	84·7	70·1	69·4	76	...	60·2	·15	3	2·6
Barbados	83·0	26,27	69·0	5,6,7,8	80·7	72·0	69·7	75	150·0	...	1·80	9	6·0
Toronto	65·0	4	21·9	10	48·3	32·0	29·7	65	128·0	17·0	1·02	10	5·7
New Brunswick, S. John	49·0	17	6·0	1	38·7	26·8	28·6	82	...	...	4·16	14	6·6
Cape Breton, Sydney	50·0	30	4·6	6	37·2	21·9	25·3	80	...	...	2·86	11	6·1
Newfoundlnd, S. John's	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	58·0	24	−9·3	4	46·1	22·0	28·1	74	...	...	·47	2	4·5

REMARKS, APRIL, 1882.

Mauritius.—Rainfall 4·49 in. below average; mean bar. 29·998 in.; mean hourly velocity of wind 10·5 miles, prevailing direction E. by S.—C. MELDRUM, F.R.S.

CEYLON.—TSS on 9 days, and L was seen on 8 other days. J. SYMONDS.

Melbourne.—Mean pressure, temp., humidity and rainfall all below the average, amount of cloud above it; prevailing winds N. and S.E., strong breezes occurring on 7 days; heavy dew on 8 days; L on 3rd, and T and L on 23rd. Aurora Australis on 17th and 20th. R. L. J. ELLERY, F.R.S.

Adelaide.—Though there were some showers at many of the coast stations during the first half of the month, the amount was hardly of consequence; but on the 21st a splendid fall commenced, which extended over all the settled districts of South Australia, south of lat. 30° and on the 23rd reached lat. 27°. Rainy weather prevailed throughout the remainder of the month, the fall being exceptionally heavy in the N. of the colony on the 27th. Mean temp. 1° below the average; and rainfall ·48 in. above it. C. TODD.

Wellington.—On the whole showery unpleasant weather, though at times fine and bright; 2·21 in. of R fell on 28th; prevailing wind N.W., moderate except on 26th when it blew hard from that quarter; T and L on 29th and 30th, H on 29th; earthquakes on 6th and 16th. Brilliant auroræ on 16th, 17th and 20th. R. B. GORE.

Auckland.—Weather very broken and unsettled, with occasional very heavy falls of R, that of 28th accompanied by very low bar.; wind moderate, mostly W. and N.W.; magnificent aurora on 18th. E. B. DICKSON.

Falkland Isles.—Heavy gale on 6th, 7th and 8th, with snow squalls.—F. E. COBB.

BARBADOS.—Mean pressure below, and mean temp. (75°·6) a trifle higher than the average. Wind N.E., and averaged 13·8 miles per hour. Rainfall 37 per cent. and evaporation 10 per cent. below average. R. BOWIE WALCOTT.

SYDNEY.—On the 27th, horses still crossing the harbour on the ice.

SUPPLEMENTARY TABLE OF RAINFALL, AUGUST, 1882.

[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	1·21	XI.	Solva	4·27
,,	Margate, Birchington...	1·14	,,	Castle Malgwyn	...
,,	Littlehampton	1·61	,,	Rhayader, Nantgwillt..	5·82
,,	St. Leonards	2·49	,,	Carno, Tybritle	5·17
,,	Hailsham	3·46	,,	Corwen, Rhug	3·20
,,	I. of W., St. Lawrence.	2·01	,,	Port Madoc	5·75
,,	Alton, Ashdell.....	1·85	,,	I. of Man, Douglas	...
III.	Great Missenden.....	1·50	XII.	Carsphairn	5·08
,,	Winslow, Addington ...	2·03	,,	Melrose, Abbey Gate ...	...
,,	Oxford, Magdalen Col...	1·36	XIII.	N. Esk Res. [Penicuick]	2·50
,,	Northampton	1·47	XIV.	Ayr, Cassillis House ...	4·44
,,	Cambridge, Beech Ho...	1·50	,,	Glasgow, Queen's Park.	1·82
IV.	Southend	1·02	XV.	Islay, Gruinart School..	2·85
,,	Harlow, Sheering	1·37	XVI.	St.Andrews,NewtonBk.	2·40
,,	Diss	2·44	,,	Aberfeldy H.R.S.	...
,,	Swaffham	2·37	,,	Dalnaspidal	...
,,	Hindringham	2·15	XVII.	Tomintoul.....	...
V.	Salisbury, Alderbury...	1·47	,,	Keith H.R.S.	3·00
,,	Calne, Compton Bassett	2·62	XVIII.	Forres H.R.S.	3·07
,,	Beaminster Vicarage ...	2·99	,,	Strome Ferry H.R.S....	3·81
,,	Ashburton, Holne Vic..	4·87	,,	Lochbroom	5·14
,,	Torrington, Langtree W.	5·74	,,	Tain, Springfield.....	1·54
,,	Lynmouth, Glenthorne.	5·51	,,	Loch Shiel, Glenaladale	6·24
,,	St. Austell, Cosgarne...	...	XIX.	Lairg H.R.S.	...
,,	Taunton, Fullands	2·51	,,	Forsinard H.R.S.	3·00
VI.	Bristol, Clifton	5·18	,,	Watten H.R.S.	2·80
,,	Ross	2·37	XX.	Fermoy, Glenville	3·18
,,	Wem, Sansaw Hall.....	2·25	,,	Tralee, Castlemorris ...	2·90
,,	Cheadle, The Heath Ho.	2·68	,,	Cahir, Tubrid	3·42
,,	Worcester, Diglis Lock	2·04	,,	Newcastle West	4·21
,,	Coventry, Coundon	2·09	,,	Kilrush	...
VII.	Melton, Coston	2·72	,,	Corofin	3·59
,,	Ketton Hall [Stamford]	1·87	XXI.	Kilkenny, Butler House	...
,,	Horncastle, Bucknall ...	3·59	,,	Carlow, Browne's Hill..	2·40
VIII.	Macclesfield, The Park.	4·68	,,	Navan, Balrath	2·91
,,	Walton-on-the-Hill.....	2·99	,,	Athlone, Twyford	5·58
,,	Broughton-in-Furness ..	6·70	XXII.	Mullingar, Belvedere ...	...
IX.	Wakefield, Stanley Vic.	1·42	,,	Clifden, Kylemore	6·41
,,	Ripon, Mickley	2·11	,,	Crossmolina, Enniscoe..	6·40
,,	Scarborough.....	1·67	XXIII.	Carrick-on-Shannon ...	4·04
,,	East Layton [Darlington]	1·88	,,	Dowra	...
,,	Middleton, Mickleton ..	1·82	,,	Rockcorry.....	3·86
X.	Haltwhistle, Unthank..	2·96	,,	Warrenpoint	3·70
,,	Carlisle, St. James Rd...	3·09	,,	Newtownards	2·89
,,	Shap, Copy Hill	3·42	,,	Belfast, New Barnsley..	4·30
XI.	Llanfrechfa Grange	3·50	,,	Bushmills	2·90
,,	Llandovery	6·16	,,	Buncrana	3·21

AUGUST, 1882.

Div		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·48	— 1·26	·39	22	12	80·8	6	45·0	31	0	0
II.		Maidstone (Hunton Court)...	1·25	— ·99	·24	15	14	...	...	...	...	...	...
,,		Strathfield Turgiss	1·61	— ·81	·43	31	13	83·7	6	44·0	31	0	0
III.		Hitchin	1·87	— ·41	·81	15	13	73·0	12	42·0	8	0	0
,,		Banbury	2·26	— ·44	·50	15	16	76·5	6	41·0	31	0	...
IV.		Bury St. Edmunds (Culford)	2·21	+ ·04	·57	22	15	77·0	6	40·0	30	0	...
,,		Norwich (Cossey)	1·73	— ·89	·38	25	16	80·8	12	43·0	11	0	...
V.		Bridport	3·13	...	1·13	31	17	..	..	...	...	...	...
,,		Barnstaple.....	5·86	+ 1·76	1·08	13	17	82·0	13	36·0	8	0	...
,,		Bodmin	4·14	— ·70	·76	24	19	73·0	9	50·0	26	0	0
VI.		Cirencester	3·24	— ·42	·80	15	15	...	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	2·64	— 1·44	·55	22	17	74·5	6	46·0	16*c*	0	0
,,		Tenbury (Orleton)	2·55	— 1·17	·43	22	17	80·2	6	41·0	11	0	0
VII.		Leicester	2·22	...	·44	25	15	79·0	12	42·0	11	0	0
,,		Boston	2·25	— ·36	·78	16	14	81·0	11	46·0	16	0	...
,,		Grimsby.....	3·97	+ 1·05	·75	25	19	76·0	11	40·5	31	0	...
,,		Hesley Hall [Tickhill].....	1·93	...	·39	23	17	80·0	13	41·0	31	0	...
VIII.		Manchester (Ardwick).....	2·94	— ·98	·44	29	16	77·0	13	47·0	24	0	...
IX.		Wetherby (Ribstone Hall) ...	...	...	...	...	...	...	...	...	...	...	...
,,		Skipton (Arncliffe)	4·27	— 1·53	·82	28	20	80·0	9, 10	40·0	30	0	...
X.		North Shields	4·42	+ 1·33	2·04	22	16	79·0	11	42·5	4	0	
,,		Borrowdale (Seathwaite).....	9·05	— 1·99	1·46	20	21	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely).....	7·26	+ 1·93	1·12	15*e*	12	...	...	...	...	...	...
,,		Haverfordwest	5·59	+ ·62	1·10	31	16	75·0	7, 11	40·0	28	0	...
,,		Plinlimmon (Cwmsymlog) ...	6·90	...	1·15	22	21	...	...	...	...	...	...
,,		Llandudno.....	3·15	— ·04	·53	28	15	70·6	10*a*	49·8	23	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·54	— 1·73	1·19	22	11	...	...	...	...	...	...
,,		Hawick	1·96	— 1·94	·60	22	11	...	...	..	...	...	.
XIV.		Douglas Castle (Newmains)	3·70	— ·60	·59	15	17	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	4·05	— 1·17	1·25	14	18	...	...	36·0	31	0	...
,,		Appin (Airds)	3·69	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	3·10	...	·41	20	23	...	...	...	...	...	...
XVI.		Loch Leven Sluices	2·40	— 1·68	·40	15	9	...	...	...	...	...	...
,,		Arbroath	1·30	— 2·03	·39	31	11	73·0	7*b*	40·0	31	0	...
XVII.		Braemar	1·53	— 2·90	·46	28	15	77·8	10	37·0	24	0	3
,,		Aberdeen	1·68	...	·25	16*f*	19	81·0	11	44·0	8, 19	0	...
XVIII		Skye (Sligachan)	...	...	...	...	...	...	...	...	...	...	...
,,		Culloden	1·51	— 1·49	·48	29	...	77·5	11	40·0	24	0	1
XIX.		Dunrobin	2·15	...	·54	28	12	78·8	11	43·0	4	0	...
,,		Orkney (Sandwick)..... ..	2·59	— ·31	·41	1	18	68·2	13	45·6	31	0	0
XX.	IRELAND.	Cork (Blackrock)	3 49	— ·34	·85	13	11	89·0	6	42·0	16	0	...
,,		Dromore Castle	4·23	...	1·12	22	14	80·0	8, 10	47·0	3*d*	0	...
,,		Waterford (Brook Lodge) ...	...	...	...	...	...	...	...	...	..	...	...
,,		Killaloe	3·80	...	·68	15	17	83·0	10	40·0	17	0	...
XXI.		Portarlington	2·29	— ·78	·58	31	23	77·0	8	44·5	16	0	...
,,		Dublin (Monkstown)	...	...	...	...	...	...	...	...	...	...	...
XXII.		Ballinasloe	...	...	...	...	...	...	...	...	...	...	...
XXIII.		Waringstown	3·20	— ·24	1·40	22	16	84·0	10	44·0	29	0	...
,,		Londonderry...	...	...	...	...	...	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·09	— ·56	·55	31	19	78·0	10	43·0	28	0	...

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

a And 13. *b* And 10, 11. *c* And 23, 24. *d* And 17, 29. *e* And 24. *f* And 31.

METEOROLOGICAL NOTES ON AUGUST.

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.—First fortnight very fine and dry, latter half of the month showery and unpropitious for harvest work; TS on 29th.

BANBURY.—First half of the month fine, latter part showery. Mean. temp. 58°·6; frequent T with a little L on evening of 25th, wind changing from S.W. by N. and E. to S.; high wind on 20th, 22nd and 23rd.

CULFORD.—The weather during the month was somewhat fickle and unsettled. T on 15th; high wind on 22nd and 23rd. Harvest progressing slowly.

COSSEY.—A fine harvest month until the 24th, after which date some rain fell every day, and delayed the carting; wheat secured in good order, but nearly half the barley was in the fields at the close of the month. Westerly gale on 23rd; the 12th was the only day during the summer on which the temp. reached 80°.

BODMIN.—Mean temp. 62°·0; the almost daily R after the 12th was most disastrous for the harvest.

CIRENCESTER.—Rainfall not so great as in June or July, but, although below the average, it was so distributed as to be unfavourable for getting in the corn crops.

WOOLSTASTON.—Early part of month fine and warm, but after the 13th it was cold with constant R; T and L on 12th. Harvest prospect very gloomy. Mean temp. 58°·4.

ORLETON.—The temp. was rather above the average, and the weather fine and dry till the night of the 12th when L and T occurred; the remainder of the month was very showery, with scarcely a dry day; very unfavourable for the wheat harvest; after the 18th the air was generally cold. Mean temp. 1°·5 below the average of 20 years; aurora on the night of the 30th.

BOSTON.—The cutting of the corn began generally in this neighbourhood on the 14th, but owing to the continuous showers and wet weather, very little was stacked before the end of the month.

NORTH SHIELDS.—There were two very remarkable falls of R during the month; on 26th ·66 in. fell in one hour from 11 a.m. to noon; no R fell at Newcastle, eight miles distant. From 2 a.m. to 11 a.m. on 23rd, nine hours, the fall was 2·24 in.; 2·04 in. was measured at 9 a.m. on the 23rd, and when the R ceased at 11 a.m., ·20 in. more had fallen; it began gently about 10 minutes to 2 in the morning, and fell without any high wind. T on 13th.

WALES.

HAVERFORDWEST.—The month opened fine with a rising temp.; after the 3rd it fell for a few days with a northerly wind; it was then fine but hazy, with great heat, until the evening of the 12th, when frequent flashes of L were seen, and at 2 a.m. (13th) a violent TS broke; from that hour till 4.15 a.m. the T and L were incessant, forked and sheet with torrents of R; this storm broke up the weather, and to the end of the month constant R prevailed, with some very tempestuous weather between the 21st and 29th, and again on 31st, when there was a heavy storm of R and wind from S.E., with an unusually high tide.

LLANDUDNO.—The first half of the month was, on the whole, fine and seasonable; a TS occurred on the morning of the 13th, after which the weather became unsettled, and the last ten days of the month were both wet and cold. Mean temp. 58°·6, 2°·5 below the average; sky cloudy, especially after the 18th, only 131·3 hours of bright sunshine. On only two days did the temp. exceed 70°, range for the month 20°·8, mean daily range 9°·2. The greater part of the grain was cut by the end of the month, though but little was carried owing to the wet state of the weather.

SCOTLAND.

CARGEN.—The fine weather which prevailed during the first half of the month ripened the crops rapidly, and harvest was general toward the end of the month; mean temp. 58°·5, 0°·4 below the average; T on 13th.

HAWICK.—The weather during the first half of the month was most beautiful,
BRAEMAR.—T and L on 13th.

ABERDEEN.—Rainfall only half the average; the early part of the month was characterised by dry warm weather and bright sunshine, but after a TS on the 13th, the weather became showery and unsettled; altogether the conditions were very favourable to the ripening of the crops.

CULLODEN.—Weather very dry up to the middle of the month. Harvest general after the 20th, crops a full average; hay crop safely got in; little appearance of potato blight; turnip crop greatly improved by the rainfall at the close of the month.

SANDWICK.—The temp. of August was pleasant, and the rainfall less than the mean of the previous 41 years. The amount of cloud was above the average, and the bar. was generally low. T and L on the night of 13th, T at noon on 14th and on 29th. Crops particularly good, and harvest just beginning at the close of the month.

IRELAND.

BLACKROCK.—T and L on 12th and 13th; gale on night of 22nd.

DROMORE.—First part of month very fine, constant sunshine, and temp. higher than July. Much cold R in the latter part. A heavy hay crop throughout the county, much of it got in without a drop of R. Green crops inferior from want of June heat; oat crop very fine, but rather laid by the rains of the last part of month; early potatoes injured by rains, potatoes on the whole an inferior crop.

KILLALOE.—Beautiful warm weather prevailed up to the 12th, effecting a marked improvement on hay making and harvest prospects generally; shooting stars very frequent during that period. Heavy R at the close of the month.

EDENFEL.—Weather for the first 12 days very fine, and some days very hot; remainder of month generally wet, cool and unsettled. Meadow hay a splendid and well-saved crop; oats abundant, but remaining crops below average.

THE RAIN BAND.

SPECTROSCOPIC PREVISION OF THE WEATHER.

To the Editor of the Scotsman.

SIR,—Last Friday morning, Sept. 1st, the spectroscopic "rain-band" was the blackest and most intense of the season; and your issue of Saturday morning announced destructive floods, from most heavy rainfalls in various parts of Scotland, to have occurred on that day, Friday.

But this morning—Monday, September 4—there is an absence of the "rain-band," and a clearing away of all the watery vapour lines in the spectrum of sky-light, to an extent not equalled during the last two or three months. In a powerful spectroscope, the two solar D lines now stand out clear and clean, in place of being almost lost, as all through last month, in a thicket of terrestrial water-vapour lines. So the farmers may be enabled to gather in their crops at last, dry and in good condition, though, probably, in rather cold and sharp weather.—I am, &c.

C. P. S.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

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METEOROLOGICAL BIBLIOGRAPHY.

I AM glad to be able to state that the compilation of the catalogue which is to be transmitted to the Signal Office of the United States for publication is rapidly approaching completion.

There is, however, one class of assistance which, though invited, has been rendered by very few persons. I am, of course, desirous of making the catalogue as nearly perfect as possible, but if authors who are also readers of this Magazine find that some of their works are not quoted, they will have to be referred to the following paragraphs which I reprint from the February number of this Magazine, and to which *only five replies* have been received!

"I therefore conclude by inviting authors, directors of Meteorological Institutes, and all others who may be willing to help, to send—

(1) Complete lists of Meteorological works published by them. If these are sent in MS., extremely legible (unmistakable) writing is indispensable; but, of course, printing is preferable.

(2) Copies of the papers or books. If any instructions as to the disposal of the works are sent, they shall be obeyed; if none are sent, the books will be added to my own library if a copy of each is not already there, or they will be distributed among the libraries of The Meteorological Society, The United States Signal Office, The Meteorological Office, The Société Météorologique de France, and The Scottish Meteorological Society."

This invitation is now eight months old, and I cannot *detain* the catalogue for chance arrivals; but, as two very important additions have yet to arrive from France, it is certain that it cannot be shipped before the middle of November, and therefore there is still time for any European author to accept the invitation.

G. J. SYMONS.

62, *Camden Square, N. W.*

THE BRITISH ASSOCIATION AT SOUTHAMPTON.

(*Continued from page* 123.)

On the effect of Wind on the draught of Chimneys, by PROF. LORD RAYLEIGH, F.R.S.

The author said that the draught diminished as the direction of the wind was more and more downwards, but did not go backwards until the inclination amounted to about 30 degrees. The maximum up-draught would occur, not, as was often supposed, with a direction of wind vertically upwards, but with one making an angle of about 30 degrees with the vertical. A chimney with a T piece at the top never produced an unfavourable effect on the up-draught, and only in one case failed to produce a favourable one. With a T piece to which was affixed vertical ends, every wind met with would have a favourable effect, and no wind known would have an unfavourable effect.

Professor De Chaumont thought that vertical ends increase the resistance of the up-draught, and described a chimney with a lamp-shade-like top and conical cap, with which it was impossible to get a down-draught.

Comparison of Magnetical and Meteorological Weather, by PROF. BALFOUR STEWART, F.R.S.

The author had compared the fluctuations of the daily range of temperature during 1871 and 1872, with the range of declination as photographically recorded at Kew. The daily ranges of temperature and those of declination were first smoothened by the process described by Mr. J. C. Bloxam, in his *Meteorology of Newport*—"Bloxamized" we may perhaps be permitted to say, and then the smoothened values were compared. The result seems to be that there is a slight similarity in the curves and that the temperature ranges follow the declination ranges at intervals of from 5 to 13 days according to the season.

On a supposed connexion between the heights of Rivers and the number of Spots on the Sun, by PROF. BALFOUR STEWART, F.R.S.

The author gave data respecting several rivers, and called especial attention to the Nile, which he stated reaches its greatest height in years of maximum sunspot prevalence, and taking the present as a maximum year he predicted that it would be a year of great rise of the Nile.

Report of the Committee on Meteoric Dust, read by PROF. SCHUSTER, F.R.S.

It will be remembered that the object of this Committee is, if possible, to collect the dust produced by the ignition and fusion of meteors and shooting stars when passing through the earth's atmosphere, As yet, however, they do not seem to have advanced very far, the principal fact which seems to have been quoted in their report was that M. Tissandier had found in meteoric dust particles of iron in a perfectly spherical form, and some dust from Sahara contained similar particles, which must at some time have been in a state of fusion.

Report of the Committee consisting of Professors Balfour Stewart, Thorpe, and Rücker, appointed at the York Meeting to Report on Methods of Calibrating Mercurial Thermometers, read by PROF. RÜCKER.

Thermometer tubes are in general of unequal bore in different parts, and the

ndications of the instruments will thus be erroneous, unless these irregularities are allowed for. If a short column of mercury broken off from the main mass in the bulb and tube be measured in different parts of the tube, its length will be greater in the narrower, and less in the wider parts. By means of such measurements the correction for the inequalities in the bore can be applied in two different ways distinguished as methods of calibration and correction respectively. In the first the length of the column of mercury is measured in various parts of the tube before the scale is etched on it, and the lengths of the divisions are then so adjusted as to make equal differences of scale readings correspond to equal volumes. In the second the tube is in the first instance furnished with a uniform scale, and a table of corrections is afterwards drawn up, by means of which the same end is attained as before. In either case the measurements have to be made systematically, and a number of different methods of performing the observations and calculations have from time to time been proposed. That used at Kew Observatory, Gay Lussac's, is the simplest of all, while the more elaborate methods have for the most part been proposed by German writers. The report consisted of a minute discussion of the relative merits of these various methods, the chief of which had been applied by the Committee to the same thermometer, so that the results could be readily compared. The measurements for this purpose were made in the Physical Laboratory of the Yorkshire College. The methods chiefly investigated were Gay Lussac's, Hällström's, Thiesen's, Marek's, Rudberg's, and Bessel's, both as modified by von Oettingen, and also with further modifications introduced by Professors Thorpe and Rücker.

Having given the above brief epitome of the subject, we have the pleasure of quoting from the *Chemical News* a full report of Professor Rücker's remarks :—

Report of the Committee on the Calibration of Mercurial Thermometers.

In drawing up the Report the Committee have desired to present it in the form in which it will be most generally useful. It is therefore divided into two parts. The first contains a brief outline of the various methods of calibration hitherto proposed, and a summary of the results arrived at with regard to them by the Committee. This portion, therefore, contains the facts necessary to enable a selection from the various methods to be made by persons intending to undertake the calibration or correction of a thermometer. The second consists of a fully worked-out example of each of the methods, together with critical and other remarks of a detailed character. This part will, it is hoped, be useful in facilitating the calculations required, more especially as references to the subject of calibration in English scientific works are rare and meagre.

The corrections for the inequalities in the bore of a thermometer tube may be applied in two different ways, viz., by *calibration* or *correction*. In the first the tube is studied before the scale is etched on it, and the divisions of the scale are adjusted so as to make equal differences of scale readings correspond to equal tube volumes. In the second the tube is furnished with a uniform scale, and a table of corrections is afterwards prepared by which the same result is attained. A high degree of excellence can be obtained by the former method, which is generally employed by the makers. If, however, great accuracy is desired, all thermometers require correction, and if an instrument has been previously calibrated, this process is rendered very laborious by the

varying lengths of the divisions which have to be allowed for in the calculations. The results, too, are probably, less accurate than they otherwise would be on account of the irregularity of the correction curves produced by the superposition of the errors of the tube and scale. The Committee, therefore, recommend the use of a uniform millimetre scale, and the employment of such tubes only as preliminary tests have shown to be of fairly uniform bore.

As all the methods of calibration and correction described depend upon the measurement of the length of columns of mercury in various parts of the tube, it is important to decide upon the best method of separating these "threads" (as they are called) from the main mass of mercury in the tube and bulb. In general it is in the first place necessary to make the mercury "run" from the bulb into the tube, so that a column of any length can be obtained when the thermometer is at the ordinary temperature. To effect this the instrument should be held in a vertical position with the bulb uppermost, and the lower end of the tube should be cautiously tapped against the table. If the mercury does not run, it is well, as a preliminary, to heat and cool the bulb several times. A change of temperature of a few degrees will generally suffice. The transference of the mercury from the bulb to the tube causes a vacuum bubble to appear in the former. If this is brought to the junction between the tube and bulb it is often possible, in a thermometer with a tolerably wide bore, to effect a disruption of the mercury at this point by a dexterous jerk, and thus to break off a thread of the desired length. It is, however, exceedingly difficult, if not impossible, to apply this method satisfactorily to instruments with narrow bores; and in all the experiments undertaken by the Committee the separation of the thread was effected by heat. Some writers recommend the use of the blowpipe flame, which appears unnecessarily risky. The Committee employed a small flame, about four or five millimetres high, obtained from the gas issuing from a narrow orifice at the extremity of a piece of glass tubing drawn out fine. Into this the thermometer was introduced, care being taken to heat the tube equally all round, and the rupture was effected at the point where the heat was applied. It is easy thus to break off threads to within a millimetre of the length desired. When great accuracy is important it is advisable first to break off a thread longer than that required, and then to separate from it a portion of the desired length. Greater steadiness of the mercurial column while the thermometer is being heated is thus attained. Many dozens of threads have thus been broken off within the experience of members of the Committee without a single breakage of the instruments experimented on.

Methods of calibration and correction may be divided into four classes.

The first class contains what may be called the *step by step* method which is due to Gay-Lussac. In it a thread of mercury is measured in a position A B, then shifted to B C, then to C D, and so on through the whole length of the tube, the corrections being deduced from the variations in length.

FIG. 1.

A B C D E F G

The second class contains *principal point* methods. In these a number of principal points separated by an equal number of scale divisions are selected. The corrections are determined for these by means of threads, the lengths of which are approximately equal to, or multiples of, the distance between two

consecutive principal parts. Several methods are included in this class. Hällström's, as described by Pfaundler, is a modification of Gay-Lussac's, in which an attempt is made to prevent the risk of the cumulation of errors inherent in the use of very short threads. Two threads are used, one twice, the other three times as long as the distance between two principal points. The first is measured in the positions (see Fig. 1) A C, B D, C E, &c., the other in the positions A D and B E only. From these measurements the corrections at A B C, &c., can be found.

In M. Thiesen's method (*Carl's Repertorium*, bd. xv.), the scale being divided into n parts by equidistant principal points, threads equal in length to 1, 2, 3 . . $n-1$ of these intervals are measured with the ends nearest the bulb, coincident in turn with as many of the selected points as possible, and hence the corrections are deduced. Marek (*Ibid.*, bd. xv.) has applied the method of least squares to the calculation of the corrections of a number of selected points.

When by any principal point method the scale has been divided into a number of parts, the relative volume values of which are known, it is of course possible to sub-divide these parts by a number of secondary points. In one method, however (Rudberg's), such sub-division is of the essence of the method, and it therefore constitutes the third class or method of *repeated sub-division*. Thus (see Fig. 1) the tube is first divided into two equal parts by measuring a thread of about half its volume when it occupies approximately the positions A D, D G. These parts are then sub-divided into three by measuring a thread about one-third of the length of the tube in the positions A C, C E, E G, B D, and D F, and the process can then be carried further.

The last class may be called that of *distributed point methods*. Of these there is only one example, viz., Bessel's. In it the threads are measured with the end nearest the bulb coincident in turn with each of a series of selected points, but as the lengths of the threads are, within wide limits, arbitrary, the other ends do not coincide with the principal points, but are distributed more or less unevenly over the scale.

In the modification of this method adopted by A. von Oettingen ("*Ueber die Correction der Thermometer*, Dorpat," 1865) eight or ten threads are used, and the corrections are finally found by a graphic method. The scale divisions being taken as abscissæ, and the corrections to be applied to them as ordinates, each thread furnishes a correction curve. The curve obtained by taking the mean of the ordinates of these is the final correction curve. This method is in the report subjected to full and detailed criticism. It is open to the objection that by it the ends of the tube are less accurately corrected than the centre. This is especially unfortunate. Thermometers are now often made with scales so open that it requires several to cover the whole range of temperature from 0° to 100° C. Each instrument therefore can have at the most but one fixed point, and to determine the value of a scale division in degrees it is necessary that each thermometer should overlap those above and below it, so that they can be compared over a considerable range of temperature. This range is, however, seldom more than one-fourth of that over which the scale of each thermometer extends, and thus any error which occurs in the determination of the relative value of this overlap in two instruments is magnified in its effects upon the absolute readings of each. It is, then, important that the ends of such thermometers shall be corrected with especial care, and Professors

Thorpe and Rücker have introduced some changes into Von Oettingen's method of procedure which diminish this defect. The two methods are fully compared in the Report.

In many methods of calibration and correction one or both ends of the thread are, when it is measured, assumed to occupy certain definite positions on the scale. The condition that both ends should occupy their theoretical position could only be fulfilled in a perfectly uniform tube ; otherwise, if satisfied in one part it would fail elsewhere. It is, however, often inconvenient even to comply with the condition that one end shall occupy a certain position. If the tube is graduated, and the position in question is indicated by a graduation, the breadth of this is often so considerable that the required accuracy of adjustment cannot be attained if the end of the thread is hidden behind it. Hence it is often better merely to bring the thread end to within a small but accurately measured distance of its theorotical position. The error thus committed can then be allowed for either by means of a second approximation, or by the use of a preliminary correction curve obtained by any simple method. The Report contains full details and examples of these two methods of procedure.

Formulæ are given which express the probable error of the correction of a principal point (E) in terms of the probable error of a thread length (e). If $E=m\,e$, the numbers in Table I. give the values of m^2 for ten principal points 4° apart, when the methods referred to are employed to find the corrections at them. These numbers are inversely proportional to the theoretical weights which should be assigned to the correction of a point determined by any method if it is to be combined with a similar correction determined by another method.

Thus in the case of Gay-Lussac's method, the value of the correction of a point is, *cæteris paribus*, proportional to the length of thread used in obtaining it. Rudberg's method corrects the instrument best in the middle—Gay-Lussac's at the ends. Thiesen's method has the advantage that the value of the corrections is uniform throughout the scale ; Hällström's the grave disadvantage that it is very irregular, and that the errors accumulate in an extraordinary way on two of the points.

TABLE I.

Squares of Probable Errors of Principal Points.

Point.	Gay-Lussac. Thread 2° long.	Gay-Lussac. Thread 4° long.	Rudberg.	Hällström.	Thiesen.	Bessel.
0	0·0	0·0	0 0	0·0	0·00	0 00
1	1·8	0·9	1·4	1·1	0·18	0·10
2	3·2	1·6	1·8	0·8	0·18	0·10
3	4·2	2·1	0·7	1·1	0·18	0·10
4	4·8	2·4	0·6	1·2	0·18	0·09
5	5·0	2·5	0·5	2·5	0·18	0·09
6	4 8	2·4	0·6	1·2	0·18	0·09
7	4·2	2·1	0·7	4·3	0·18	0·10
8	3·2	1·6	1 8	0·8	0·18	0·10
9	1 8	0·9	1·4	6·5	0·18	0·10
10	0·0	0·0	0·0	0 0	0·00	0·00

It must be remembered that the numbers in this Table apply only to the case of the determination of ten principal points, and that in calculating them no allowance is made for inaccuracies introduced by assumptions, which are only approximately true, made in the methods themselves.

The experimental work of the Committee has been performed upon twelve thermometers. Two sets of three belonging to Professors Thorpe and Rücker were made by Casella. The other two sets were made in the Kew Observatory and in the Physical Laboratory of the Owens College respectively. The length of a degree in the different instruments varied from 9 to 13 mm., and may therefore, in round numbers, be taken as equal to a centimetre.

The Kew Thermometers were calibrated according to Welsh's (Gay-Lussac's) method, a good dividing engine being employed. After the scale was etched, the same instrument was employed to make all the measurements necessary for the application of Bessel's method to the thermometer. The result of this severe test was reported to Section A last year, viz., that the maximum error barely exceeded 0·01°, and in two of the thermometers fell much below this amount.

The Committee have also tested the various methods by applying them all to the same thermometer, an instrument reading from 98° C to 142° C. The measurements were made in the Physical Laboratory of the Yorkshire College, partly by Professor Rücker, partly by Mr. W. Heaton, Demonstrator in the Clarendon Laboratory of the University of Oxford, who spent some time in Leeds for the purpose of assisting in this rather laborious task. Gay-Lussac's method was applied three times, the thread lengths being 1·6°, 2·0°, and 4·0° respectively. The curve obtained by means of the thread 2·0° long was used as above explained as a preliminary curve to allow for the errors introduced in the other methods by the fact that the thread ends did not always occupy their theoretical positions.

The instrument employed was that devised by Mr. F. D. Brown, and described by him in a recent number of the *Philosophical Magazine* (June, 1882). Readings could be made on the vernier to 0·1 mm., and by estimation to 0·02 or 0·03 mm. The probable error of the measures made for the application of Bessel's method, 138 in number, was 0·25 mm. The Committee thought it well to employ this instrument, as if satisfactory results were obtained its comparative simplicity and cheapness would enable many persons to correct their thermometers who had not the opportunity of using the dividing engine. The result of the investigation showed that it is capable of giving very good results. The following table gives in thousandths of a degree the corrections obtained for the principal points by the methods indicated. Rudberg's method cannot be directly compared with the others, as it was used to find the corrections at 12 points.

TABLE II.

Corrections given by Different Methods in Terms of 0·001°.

	Gay-Lussac. Thread Length.			Hällström.	Thiesen.	Marek.	Bessel.
	1·6°.	2·0°.	4·0°.				
100 ...	0	0	0	0	0	0	0
104 ...	121	120	116	120	121	—	120
108 ...	155	155	151	153	156	155	151
112 ...	106	109	104	107	109	—	104
116 ...	108	116	113	115	117	117	115
120 ...	130	136	135	137	138	—	135
124 ...	106	112	111	109	113	112	109
128 ...	108	111	111	114	112	—	108
132 ...	56	60	61	56	61	62	54
136 ...	2	10	12	13	10	—	4
140 ...	0	0	0	0	0	0	0

In estimating the value of the agreements between the various columns in this table, it must be remembered that whereas the two first Gay-Lussac corrections and those given by Bessel's method are quite independent of the others, observations on the same threads were employed in the other methods. All the measurements, for instance, worked up according to Marek's formulæ, were also employed in the calculations required in Thiesen's method. It will be seen that the difference between the corrections for the same point only in one instance exceeds 0·01°.

On the other hand, the amount of labour involved in the different methods is very different. Gay-Lussac's method can be applied in a few hours; the observations and calculations necessary for Bessel's occupy six or seven days.

The following table gives the number of actual measurements required in such method.

TABLE III.

Method.	No. of Measures Required. (1) Principal Corrctns.	(2) Preliminary Curve.	(3) Total.	No. of Points. Corrd. (1) Principal Corrections.	(2) Total.
Gay-Lussac I...	26	—	26	26	26
,, II...	20	—	20	20	20
,, III...	10	20	30	10	20
Hällström	11	20	31	10	20
Thiesen	54	20	74	10	20
Marek.....	14	20	34	5	20
Rudberg.....	15	20	35	12	31
Bessel	138	—	138	148	148

A detailed discussion of the results arrived at by the different methods, awards, on the whole, the palm to Bessel's, but the Committee consider that equally good results can be obtained with much less labour by repeating Gay-Lussac's method with two or three threads of different lengths, and taking the mean of the curves so obtained. Thus, the mean of the numbers in the first two columns of Table II. nowhere differs from the corresponding number in the last column by 0·005° (0·05 mm.).

The Committee, for convenience, finally define three standards of accuracy, viz., that the corrected scale shall at no point be in error by 0·1, 0·05, and 0·02 mm. respectively. In the thermometer used these would correspond to about 0·01°, 0·005°, and 0·002°. They consider that 0·05 mm. is about the limit of the error of an unassisted-eye reading, and that the second standard is therefore that which will be most generally aimed at for very accurate work. The Report contains details of the methods which the Committee think suited to attain each of these standards with the least trouble. In brief, they state that the first can be reached by a calibration by Gay-Lussac's method conducted with a dividing engine, the second by correcting according to Bessel's method or by the mean of two of Gay-Lussac's curves when the measurements are made with Mr. Brown's instrument, the third can be obtained only by the most elaborate methods and apparatus. On the whole, therefore, the result of the investigation is in favour of the repetition of the less elaborate rather than of the use of the more theoretically perfect methods.

[Two very interesting papers upon the formation of hail were read by Prof. Silvanus P. Thompson, the first a translation of Schwedoff's pamphlet, "*Sur l'Origine de la Grêle*," and the second by himself. As, irrespective of the theory in the first, both contain much valuable information, we have great pleasure in stating that Professor Thompson has allowed us to print both *in extenso*.]

On the Origin of Hail. By PROF. THÉODORE SCHWEDOFF, *of Odessa.*

The efforts of savants, including some of the most eminent, to elucidate the problems relating to the origin of hail, are generally well known; but if we compare our present knowledge on this subject with that of two centuries ago, we are astonished at the utter lack of progress. Without going into details, the most salient facts relative to this phenomenon do not adapt themselves to any explanation by the theories propounded down to the present day.

Let us begin by considering the size of hailstones.

In 1819, the hailstones fell so as to penetrate the roofs of houses, and many of them measured as much as 37 centimetres (14½ in.) in circumference. (4¼ in. in diameter). In 1846, at Utrecht, there fell a hailstone measuring 65 centims. (26 in.) in circumference, (5¾ in. in diameter), Hailstones that fell at Kivacht (Zealand) in 1863, penetrated not only the roofs, but also the ceilings. A similar hailstone, after coming through the roof, wounded a man who was beneath so severely, that he kept his bed for more than a month. This hailstone, picked up after its fall, still weighed six kilogrammes (13 lbs.). This fact can be authenticated. A still more remarkable fact is often cited, namely, the fall of a block of ice in Hungary, on May 8th, 1802. This block was three feet long, by two feet wide. It is true that this fact is called in question by certain savants, but simply because it does not square with the supposition that hailstones are formed in our atmosphere. But on this reasoning, neither the hailstone weighing six kilogrammes (13 lbs), nor that sixty-five centimetres (26 inches) in circumference, should be more authentic, for they do not agree any better with the hypothesis of the atmospheric origin of hail.

To turn the flank of this difficulty some have had recourse to ascending ærial currents, which, while holding a hailstone in suspension, bring it the vapour and the cold necessary for the congelation of this vapour. Without denying the existence of such currents, I only observe that the facts reveal no connexion whatever between the fall of hail and atmospheric currents. M. Abich, who has had many opportunities of observing hail, and who has made a profound study of it, finds that hail does not depend upon the rise or fall of barometric pressure, which must, however, be intimately connected with the direction of atmospheric currents. I will cite only one case of this kind. On the 14th of January, 1860, on the Atlantic, at three days' distance from the Cape of Good Hope, there fell hailstones as large as half a brick, though the barometer was almost stationary, and nothing presaged a storm. To sustain in suspension such a hailstone, however, the velocity of the ascending currents must have been from 30 to 40 metres per second (70 to 90 miles per hour), and the lowering of the barometer that would have resulted from it could not have been less that 10 millimetres (0·39 in.)

Let us pass to the quantity of ice precipitated during a hailstorm. In 1876, at Mavrino, in Italy, the thickness of the layer of ice was from 10 to 20 centimetres (4 to 8 in.) It was from 22 to 30 centimetres (9 to 12 in.) in 1818, in

the island of Stronsa in Scotland ; upwards of 25 centimetres (10 in.) in 1863, at Kivacht, in Zealand ; upwards of 30 centimetres (12 in.) in 1869, in the Caucasus ; upwards of 40 centimetres (15 in.) in 1830, in Mexico. Now the true atmospheric deposits, rain and snow, never attain the tenth part of this quantity. The most disastrous tropical deluges rarely attain 2·5 centimetres (1·00 in.)*, even if they last several successive hours, and hail never lasts more than 20 minutes. Besides, it is possible to show by calculation that the layer of water that the atmosphere would be capable of depositing, could not possibly, under the most advantageous conditions, exceed 4 to 5 centimetres (1½ to 2 inches) in thickness, whatever the hypothesis that might be suggested about the distribution of vapour in the various strata of the atmosphere before and after the fall of the hail.

Nor is the temperature of hailstones more easily explained. We know that the temperature of freshly frozen ice is equal to zero (Centigrade) whatever may be the temperature of the surrounding medium. Even in the case where the water, still remaining liquid, is cooled below zero, the ice which results therefrom is never at any other than zero temperature (32° F.). It is quite otherwise with hail. Hail that fell in Alsace in 1877 had a temperature of —2° to —4° C. (28°·4 to 24°·8 F.); that of the air being +27° C. (80°·6 F.) Cailletet found the temperature of hail that fell in the month of July equal to —9° C. (15°·8 F.). According to Boussingault, the temperature of hail that fell in 1875 was —13° C. (8°·6 F.) ; that of the air being equal to +26° C. (78°·8 F.)

(To be continued.)

RADIANT HEAT.—Some interesting experiments have recently been made in connection with this subject by Professor S. P. Langley, of the Alleghany Observatory. He finds, as one of the results of these experiments carried on at Mount Whitney, that the true solar constant or amount of heat sent to the earth is one-half greater than that determined by Pouillet and by Herschel near the sea level, and even greater than the latest values assigned by M. Violle. But the temperature of space, on the other hand, is lower than that assigned by M. Pouillet. If the atmosphere of the earth were withdrawn, the temperature of the latter would greatly fall, even though the sun's radiant heat were materially greater than it is. Mr. Langley believes that this temperature under such circumstances would be —50° Fahr., that is, that mercury would remain a solid under the vertical rays of a tropical sun if radiation into space were wholly unchecked, or even if, the atmosphere existing, it let radiations of all wave lengths pass out as easily as they come in. It is not merely by the absorption of the air but by the selective quality of this absorption that the actual surface temperature of the earth is maintained. Without this comparatively little known function, it appears doubtful whether, even though the air supported respiration and combustion as now, life could be maintained on this planet. The temperature of a planet, consequently, probably depends far less on its neighbourhood to or remoteness from the sun than upon the constitution of its gaseous envelope, and it is perhaps not too much to say, that we could approximately indicate already the constitution of an atmosphere which could make Mercury a colder planet than the earth, or Neptune as warm and habitable a one.

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* Surely a misprint for 25 centimetres, or 10 in.—*Ed. M. M.*

THE PAST SUMMER.

To the Editor of the Meteorological Magazine.

SIR,—In a letter which appeared in the March number of your Magazine, Mr. Brumham wrote as follows: "In every case when extremely high pressure has occurred about the end of December, in January, or early in February, the following summer has been remarkably hot, or the harvest remarkably good. In many instances both occurred." And then, after giving examples, he adds:—"So we may expect a warm summer and a good harvest to gladden us this year." I suppose it is hardly necessary to adduce figures to prove that the late summer has not been "remarkably hot," or even "warm." But two sentences from the "Report on the weather over the British islands during the four weeks which ended August 28th, 1882," appended to the official weekly Weather Report published in the *Times* of yesterday may be worth quoting as the words of one whose duty it has been to collect and tabulate the readings of the thermometer from about fifty representative British stations day by day and week by week:—"It was reserved to the second week of August," so he writes, "to produce the only temperatures (*i.e.*, maximum temperatures) above 80° which have been recorded over England this summer, and even this happened only once over our southern counties." And further on in the same report he speaks of—"Ten days of moderately fine weather as the only period of the year worthy of the name of summer at all."

This is the third failure on the part of Mr. Brumham to which I have had to call attention within the year; and, while I fully recognise the indefatigable industry and perseverance displayed by him, I would again ask, as I have asked before, what practical advantage can be expected from research of this kind? Mr. Brumham's predictions, founded as they are upon the simple observation of a few cases of sequences, unsupported by any theory or antecedent probability, seem to me to belong to the same category as the weather rule (devoutly believed in by thousands of persons in this country), according to which a wet Friday is inevitably followed by a wet Sunday. In other words they are founded, as the result has shown in the three last, as in several other, cases, on an insufficient induction of instances. In the case of the Friday and Sunday weather rule, any one who will take the trouble to do so may convince himself of its fallacy by observations extending at furthest over three or four months (I have known it hold true for nine or ten consecutive weeks). In the case of Mr. Brumham's rules a longer period is necessarily required in order to demonstrate their fallacy. In the meantime, even though a sequence which Mr. Brumham has found to hold, say five or six times, should hold a sixth or seventh time, it is not to be hastily assumed that he has established anything more than a somewhat remarkable coincidence.

G. T. RYVES, F.M.S.

Tean Vicarage, Stoke-on-Trent, Sept. 8th, 1882.

AURORA BOREALIS OF OCTOBER 2ND.

To the Editor of the Meteorological Magazine.

SIR,—There has been a rather remarkable display of Aurora Borealis here this evening. I first saw it at 7 p.m., when the greater part of the sky was covered with patches of white light, flashing very rapidly from N. to S. In the S.E. was a large oval patch of light, steady, and very bright. It was about 30 degrees above the horizon, and moved slowly until it was due S. of this place, at 7.39 p.m., when it went out as suddenly as if it had been blown out. Did any one else observe this? After it had disappeared, the flashing in the northern part of the sky ceased, and only the usual auroral arch remained.—I remain, Sir, yours truly,

W. C. HUGHES, F.M.S.

2, St. Martin's-square, Scarborough, Oct. 2nd, 1882.

SOLAR HALOS AND THE WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—During many months past I have noticed a relation between solar halos and the subsequent weather at this station, I have found that drizzle and rain came on invariably between six and twenty-four hours; this would, no doubt, be an extension of the state of the upper atmosphere to a lower level. If this forecast were always as good a one as I have found it since I first noticed it, it would take a high rank in practical weather lore. Perhaps some observer may have noticed it and determined percentages of success.

H. GARRETT.

Ivybank, Highfield, Southampton, Oct. 4th, 1882.

[It would probably be useful if our readers generally would state their experience on this subject. Recollecting that it was mentioned in a rather scarce pamphlet by Mr. E. J. Lowe, F.R.S., ("Prognostications of the Weather, or Signs of Atmospheric Changes," London, 1849,) we have copied out the paragraphs bearing upon it:—

"It is said to be a sign of rain when the sun or moon is surrounded by a halo." During the last eight years, more than 300 solar and lunar halos have been registered at Highfield House, Nottingham; and in this large number, fine weather has more frequently followed than otherwise. From the 1st of November, 1840, to the 1st of November, 1848, 204 solar halos were observed; 133 of these were followed by 24 hours' fine weather, and the remaining 71 by rain. (If the rain fallen in the 24 hours is not sufficient to be measured in the gauge, the day is accounted fine.) In the same time, 102 lunar halos were recorded, 51 being followed by fine weather, and 51 by rain. Therefore, in these 306 halos, we find 184 followed by fine weather and 122 by rain." . . . "My friend, James G. Tatem, Esq., (of High Wycombe,) who has been a zealous observer of atmospheric changes for the last thirty years, noticed since 1823, 109 lunar halos; 54 were followed by rain and 55 by fine weather."]—ED. *Met. Mag.*

SUPPLEMENTARY TABLE OF RAINFALL, SEPTEMBER, 1882.

[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	3·12	XI.	Solva	4·66
,,	Margate, Birchington...	3·98	,,	Castle Malgwyn	5·43
,,	Littlehampton	2·21	,,	Rhayader, Nantgwillt..	3·63
,,	St. Leonards	3·37	,,	Carno, Tybritle	3·33
,,	Hailsham	3·40	,,	Corwen, Rhug	2·33
,,	I. of W., St. Lawrence.	2·62	,,	Port Madoc	3·62
,,	Alton, Ashdell.....	2·58	,,	I. of Man, Douglas	3·92
III.	Great Missenden.....	2·70	XII.	Carsphairn	5·58
,,	Winslow, Addington ...	2·55	,,	Melrose, Abbey Gate...	2·24
,,	Oxford, Magdalen Col...	2·08	XIII.	N. Esk Res. [Penicuick]	3·10
,,	Northampton	3·10	XIV.	Ayr, Cassillis House ...	3·34
,,	Cambridge, Beech Ho...	1·93	,,	Glasgow, Queen's Park.	3·46
IV.	Southend	2·73	XV.	Islay, Gruinart School..	5·36
,,	Harlow, Sheering	2·56	XVI.	St. Andrews, Newton Bk	1·44
,,	Diss	2·40	,,	Aberfeldy H.R.S.	...
,,	Swaffham	3·01	,,	Dalnaspidal	4·78
,,	Hindringham	2·73	XVII.	Tomintoul.....	...
V.	Salisbury, Alderbury...	2·88	,,	Keith H.R.S.	3·64
,,	Calne, Compton Bassett	2·60	XVIII.	Forres H.R.S.	5·28
,,	Beaminster Vicarage ...	2·82	,,	Strome Ferry H.R.S....	6·28
,,	Ashburton, Holne Vic..	5·33	,,	Lochbroom	3·72
,,	Torrington, Langtree W.	4·93	,,	Tain, Springfield.....	3·56
,,	Lynmouth, Glenthorne.	3·68	,,	Loch Shiel, Glenaladale	7·19
,,	St. Austell, Cosgarne...	...	XIX.	Lairg H.R.S.	...
,,	Taunton, Fullands	2·78	,,	Forsinard H.R.S.	5·60
VI.	Bristol, Clifton	2·70	,,	Watten H.R.S.	2·66
,,	Ross	3·02	XX.	Fermoy, Glenville	2·93
,,	Wem, Sansaw Hall.....	2·01	,,	Tralee, Castlemorris ...	3·63
,,	Cheadle, The Heath Ho.	2·16	,,	Cahir, Tubrid	1·35
,,	Worcester, Diglis Lock	2·15	,,	Newcastle West	2·07
,,	Coventry, Coundon	2·73	,,	Kilrush	2·63
VII.	Melton, Coston	2·61	,,	Corofin	2·04
,,	Ketton Hall [Stamford]	2·25	XXI.	Kilkenny, Butler House	...
,,	Horncastle, Bucknall...	2·16	,,	Carlow, Browne's Hill..	3·16
VIII.	Macclesfield, The Park.	1·99	,,	Navan, Balrath	3·98
,,	Walton-on-the-Hill.....	2·78	,,	Athlone, Twyford	2·19
,,	Broughton-in-Furness ..	3·46	XXII.	Mullingar, Belvedere ...	1·84
IX.	Wakefield, Stanley Vic.	2·07	,,	Clifden, Kylemore	...
,,	Ripon, Mickley	2·40	,,	Crossmolina, Enniscoe..	3·44
,,	Scarborough.....	1·08	XXIII.	Carrick-on-Shannon ...	3·12
,,	East Layton [Darlington]	1·81	,,	Dowra	2·49
,,	Middleton, Mickleton..	2·80	,,	Rockcorry.....	2·82
X.	Haltwhistle, Unthank..	1·74	,,	Warrenpoint	4·06
,,	Carlisle, St. James Rd...	1·86	,,	Newtownards	3·32
,,	Shap, Copy Hill	2·50	,,	Belfast, New Barnsley .	4·54
XI.	Llanfrechfa Grange	4·23	,,	Bushmills	4·15
,,	Llandovery	3·17	,,	Buncrana	5·18

SEPTEMBER, 1882.

Div		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·39	— ·11	·86	28	9	70·6	3	37·8	15	0	0
II.		Maidstone (Hunton Court)...	3·42	+ 1·11	·80	19	15	...	...	...	...	...	...
,,		Strathfield Turgiss	2·55	+ ·25	1·00	19	12	69·6	3	32·5	15	0	6
III.		Hitchin	1·78	— ·70	·48	19	16	66·0	3	35·0	14	0	...
,,		Banbury	...	...	...	...	...	...	...	...	...	...	...
IV.		Bury St. Edmunds (Culford)	2·44	— ·34	·56	28	18	70·0	3	35·0	14	..	...
,,		Norwich (Cossey)	2·38	— ·70	·56	28	16	71·0	10	38·0	15	...	...
V.		Bridport	3·25	...	·98	28	14	...	..	...	...	...	...
,,		Barnstaple.....	3·94	— ·34	1·13	14	15	83·0	20	40·0	19	...	...
,,		Bodmin	5·28	+ ·04	1·54	26	20	70·0	8	40·0	13	0	0
VI.		Cirencester	3·25	+ ·11	·69	1	16	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	2·74	— ·73	·44	26	21	65·5	16	41·0	13	0	0
,,		Tenbury (Orleton)	3·14	— ·21	·58	28	20	68·2	8	31·8	15	2	4
VII.		Leicester	2·51	...	·64	19	18	69·5	8	34·0	15	0	2
,,		Boston	3·34	+ ·73	·73	12	11	67·0	3	38·0	16	0	...
,,		Grimsby.....	1·68	— 1·39	·34	12	14	69·0	1	39·0	15	0	...
,,		Hesley Hall [Tickhill].....	1·11	...	·33	29	14	70·0	8	32·0	15	1	...
VIII.		Manchester (Ardwick).....	1·78	— 1·99	·40	28	15	66·0	10	42·0	12	0	...
IX.		Wetherby (Ribstone Hall) ..	1·81	— 1·27	·42	4	11	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·66	— 1·92	·62	1	22	67·0	7	33·0	11	0	...
X.		North Shields	..	...	...	...	..	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	8·18	— 5·04	2·35	1	19	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely).....	3·65	— 1·15	·90	1	14	...	...	...	...	...	...
,,		Haverfordwest	4·54	— ·51	1·04	25	17	65·0	8, 30	33·9	12	0	4
,,		Plinlimmon (Cwmsymlog) ...	5·56	...	1·12	1	20	...	...	...	...	...	...
,,		Llandudno.....	1·98	— 1·77	·33	17	18	67·2	1	42·0	14	0	...
XII.		Cargen [Dumfries]	2·18	— 2·23	1·11	1	13	67·4	3	35·2	12	0	...
,,		Hawick	2·04	— ·60	·58	1	13	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	3·29	— 1·11	·72	1	16	...	...	...	...	...	.
XV.		Lochgilphead (Kilmory).....	7·61	+ 1·85	1·89	1	24	...	...	32·0	30	1	...
,,		Appin (Airds)	7·43	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	7·37	...	1·24	27	24	...	...	...	.	...	...
XVI.		Loch Leven Sluices	2·40	— ·83	1·00	2	8	...	...	...	...	...	...
,,		Arbroath	1·69	— 1·38	·55	1	12	67·0	2	37·0	12	0	...
XVII.		Braemar	3·09	— ·85	·59	27	20	62·0	9	27·0	12	5	14
,,		Aberdeen	3·04	...	·86	1	17	65·0	2, 7	34·0	11*b*	0	...
XVIII		Skye (Sligachan)	8·46	...	1·90	10	25	...	...	...	...	...	...
,,		Culloden	6·48	+ 3·58	1·95	15	15	64·1	9	36·2	29	0	4
XIX.		Dunrobin	3·60	...	·76	1	18	65·0	7	37·0	12	0	...
,,		Orkney (Sandwick)..... ..	3·04	— ·45	·63	9	16	64·2	9	40·0	12	0	0
XX.	IRELAND.	Cork (Blackrock)	2·24	— 1·91	·44	30	16	78·0	9	34·0	27	0	...
,,		Dromore Castle	3·19	...	·54	2	15	69·0	4	39·0	24*c*	0	...
,,		Waterford (Brook Lodge) ...	3·30	...	·46	26	16	64·0	13*a*	36·0	28	0	...
,,		Killaloe	3·31	...	·94	1	17	74·0	9	33·0	26	0	...
XXI.		Portarlington	1·80	— 1·38	·55	26	19	68·0	1	36·0	13	0	...
,,		Dublin (Monkstown)	...	...	...	...	...	...	...	...	...	...	...
XXII.		Ballinasloe	1·51	...	·43	1	17	66·0	9	36·0	29*d*	0	...
XXIII.		Waringstown	4·98	+ 1·63	1·48	26	19	70·0	8	34·0	11	0	2
,,		Londonderry...	...	...	...	...	...	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·57	+ ·53	1·50	26	18	67·0	24	32·0	11	1	5

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

a And 14, 21. *b* And 28. *c* And 25, 26, 27. *d* And 30.

METEOROLOGICAL NOTES ON SEPTEMBER.

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 weather of the month was rather unsettled, the harvest was on the whole satisfactory, but the yield varies much, there is an average of wheat, an excess of oats, and a deficiency of barley. T on 11th and 13th.

CULFORD.—Wet and unsettled till the 21st, followed by a very fine week with heavy dews. Potato crop free from disease. Strong breeze on 2nd; distant T on 13th; frost on grass on 14th; L on 19th; heavy dew on 25th.

COSSEY.—A cold month, making harvest slow, but five consecutive fine days from 21st to 25th, inclusive, enabled many farmers to finish.

BODMIN.—A cold, rainy, and unseasonable month; mean temp. 55°·3.

CIRENCESTER.—Not a good month for gathering in the remainder of the harvest.

WOOLSTASTON.—A favourable month on the whole for harvest operations; mean temp. 53°·1.

ORLETON.—The first 10 days were warm and generally fine, but the remainder of the month was very cold, cloudy, and damp, with frequent R, and very few fine days. A late and difficult harvest. The mean temp. was nearly 3° below the average, and lower than that of any other September during the last 21 years, except that of 1877; the bar. was generally low after the 10th, but the fluctuations were not great, T was heard on the 3rd and 12th; frost occurred on the mornings of the 12th, 13th, 15th, and 16th, and fogs on several mornings in the middle of the month.

LEICESTER.—TS on 3rd; white frosts on 8th, 15th, and 16th.

GRIMSBY.—Distant T on 27th.

WALES.

HAVERFORDWEST.—The stormy wet weather of August was continued into September with very high tides; fine on the whole, but with occasional wet days from 3rd to 19th, the nights being cold from 6th to 14th, and again on the 17th and 18th; very fine weather from the 16th to 24th, and from 25th to the end very wet, stormy and mild; solar halo on the 8th; grand display of sheet L to S.E. from 8 p.m. till midnight on 12th, and distant T to the extreme S.

LLANDUDNO.—The mean temp. of September was 3°·4 below the average, and though the month was showery, the aggregate rainfall was nearly 50 per cent. below the average. There was likewise a deficiency of bright sunshine, the number of hours in the month amounting only to 101·8; nevertheless, there were some remarkably fine days.

SCOTLAND.

CARGEN.—A fine harvest month on the whole. Crops well secured; all crops in this immediate neighbourhood above the average; mean temp. 54°·7, 0°·2 below the average; T on 13th.

HAWICK.—A remarkably mild month; several peals of T on the afternoon of 27th. The crops in this district are all good.

ABERDEEN.—Except in the early part of the month, when heavy R fell for three days, the weather was very favourable for harvest operations. Rainfall fully 0·50 in. below the average; T and L on 2nd; brilliant aurora on 5th, and faint aurora on 11th; heavy dew on 28th and 29th.

SLIGACHAN.—A cold, wet, ungenial month; only six dry days; one of the worst haymaking seasons I have known, a great deal yet unsecured; very heavy R on the morning of the 10th, 1·90 in. fell in little over six hours.

SANDWICK.—The rainfall in September was rather above the average, but the weather was in general favourable for harvest work, and there was no equinoctial gale; one, however, came on October 1st, when it blew 60 miles an hour; T on 7th; auroræ on 4th, 5th, 11th, 17th, and 18th.

IRELAND.

DROMORE.—A good harvest month on the whole. Oats well got in, a crop considerably above the average.

WATERFORD.—The early part of the month was favourable for getting in the harvest, but a break occurred on the 23rd, and the remainder of the month was wet and unsettled, gale from S.W. on the 30th, T on 12th with H.

KILLALOE.—A fairly average harvest month, and autumn work more successful than was hoped for in August. Mean temp. 55°·1, being below the average of the last five years.

EDENFEL.—September was a seasonable month, the rainfall, though in the aggregate considerably above the average, having nearly all fallen on six days, notably on the 1st and 26th, when 1·22 in. and 1·50 in. fell respectively.

HAILSTORM ON SEPTEMBER 12TH.

To the Editor of the Meteorological Magazine.

SIR,—On 12th inst., at 2.15 p.m., we had a remarkable hailstorm—in 20 minutes 0·20 in. of hailstones fell, of large size; my lawn was perfectly white for nearly an hour; geraniums, mangold leaves, &c., cut to pieces. Before 3 p.m. 0·36 in. fell. The thermometer in the shade did not fall below 54°. At a point only 1200 yards from my gauge not one single drop of rain or a hailstone fell.

Yours faithfully,

R. H. LIPSCOMB.

East Budleigh, Budleigh Salterton, Sep. 21st, 1882.

MULTIPLE RAINBOWS.

To the Editor of the Meteorological Magazine.

SIR,—I did not observe the rainbow referred to by Mr. Lawrence, but I send the following notes on the subject, in case you think them worth publishing: On 24th July, 1882, at 7.10 p.m., and on 19th May, 1881, from 6 p.m. to 6.10 p.m., unusually bright and perfect bows were noticed here; in the latter case especially the colours were remarkably well defined. I give the colours below; the supernumerary bows followed immediately below the primary, and were narrow:—

24th July, 1882.		19th May, 1881.	
Green, Yellow, Red	*Outer.*	Green, Yellow, Red	*Outer.*
Red, Yellow, Green, Blue	*Primary.*	Red, Yellow, Green, Blue	*Primary.*
Crimson, Green	(1) *Supernumerary*	Red, Yellow, Green	(1) *Supernumerary.*
Crimson, Green	(2) *Supernumerary.*	Red	(2) *Supernumerary.*

Yours faithfully,

E. T. DOWSON.

Geldeston, Beccles, August 30th, 1882.

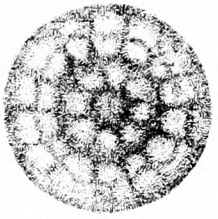

Fig. 1

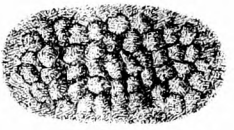

Fig. 2.

Fig. 3.

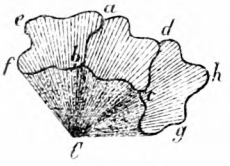

Fig. 4.

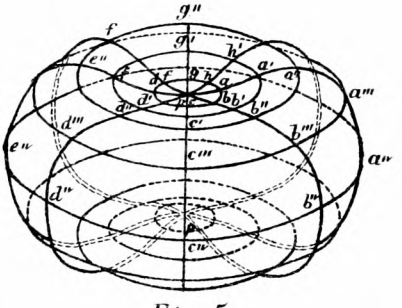

Fig. 5.

Fig. 6.

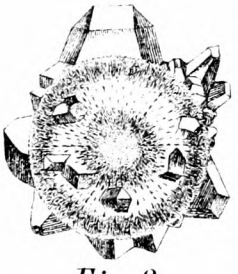

Fig. 8

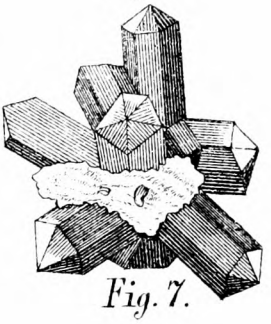

Fig. 7.

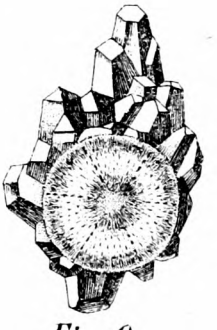

Fig. 9.

1. Observed by Abich in the Caucasus.
2. " " "
3. " " "
4. Segment of Fig. 1
5. Illustrative of Schwedoff's theory of formation.
6. Observed by Neuchel at Tiflis.
7. " " Secchi in Italy.
8. " " Abich in the Caucasus.
9. " " " " "

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

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IS THE ROYAL CHARTER GALE PERIODIC?

The sharp squall, which surprised many persons on the morning of Oct. 24th, 1882, reminded us of an old article in this Magazine, and we now submit a continuation of it for the fifteen years which have elapsed since we wrote it.

In Vol. II. of this Magazine, *i.e.*, in the number for November, 1867, we inserted under the above heading a short list of storms, &c., from 1820 to 1867, which might possibly have some bearing on the question. We introduced the subject with all reserve, commencing with the following words:—

"We anticipate an immediate negative reply to the above query, but that will not deter us from examining the facts, at least, such as are within our reach."

For the convenience of those who have not a perfect set of this Magazine, we may add that in subsequent numbers the theory of periodicity was maintained by T. Beesley, E. J. Lowe, P. H. Newnham, J. Murray, G. V. Vernon, and others.

SOME STORMS IN OCTOBER 1868-1882.

1868.—Gale on 24th; trees down at Selborne and Banbury. At Huddersfield the velocity was 52 miles an hour.

1869.—Oct. 18th, severe gale on Lincolnshire coast. Many trees uprooted.

1870.—October 19. A storm of small extent but great intensity passed from Cornwall to Cambridge at an average velocity of about 50 miles an hour. Much structural damage.

1871.—A destructive storm at Guildford on the 1st, but after that date the month remarkably calm.

1872.—No very general and violent gale, or perhaps the continuous and excessive rains occupied all the thoughts of the observers. "Very high winds," or "gales," are, however, reported from Northumberland for October 11th; Llandudno, 23rd and 24th; and the North of Scotland, 30th and 31st.

1873.—Considerable fall of the barometer and heavy gale at Bridport and other places on 22nd and 23rd.
1874.—Gale on 6th and 7th. A storm, high wind, or very heavy gale reported from nearly all stations on 21st.
1875.—No remarkably high winds.
1876.—Some sharp local squalls on 11th, but no general gale during the month.
1877.—Very heavy gale on 14th–15th, doing great damage.
1878.—Gale on 9th. Destructive whirlwind passed over Walmer on 24th, and sharp local squalls on 28th.
1879.—Generally very calm in England; gale in Scotland on 19th.
1880.—Gale on 27th.
1881.—Violent gale October 13th–14th.
1882.—October 24th. Sharp storm in early part of day.

THE BRITISH ASSOCIATION AT SOUTHAMPTON.

(*Continued from page* 138.)

On the Origin of Hail. By PROF. THÉODORE SCHWEDOFF, *of Odessa.*

As is well-known, hail is most often granular in appearance. This is the best recognised fact amongst authors of hail-theories, because it seems to tell in favour of the hypothesis that hailstones must be disorderly conglomerates formed in the atmosphere by the mutual adhesion of ice-grains hurried about and agitated by atmospheric whirlwinds.

We have only to take a glance at figures 1 and 2 to conceive doubts as to this manner of regarding them. These figures represent the polar and equatorial surfaces of numerous hailstones observed by Abich in the Caucasus, on the 8th of June, 1869 (27th of May, Russian calendar). "The regularity of the hailstones," says M. Abich*, and the originality of their structure, which I had never observed until then, gave to these bodies a peculiar interest. A third of all the hailstones that fell were perfect spheroids, which in form and magnitude resembled mandarins (mandarin oranges). This type, common to all these bodies, revealed the existence of a general law of their formation, and presented, in certain examples, varieties allied with one another by intermediate forms, recalling the varieties of type in the organic world. . . . ."

At first sight the mass of the hailstone seemed to be composed of grains agglomerated concentrically and successively around a nucleus, and separated one from another by layers of snow. But a closer examination persuaded the observer that the mass, of which each of the hailstones had been formed, was of pure transparant ice, traversed by an innumerable quantity of little fissures and capillary canals, whose relative abundance in certain layers impressed on these a milky opaque appearance. These canals and fissures were always directed along radii of the hailstone, their pointed extremities being toward the central region. It is the regular distribution of these fissures, according to certain surfaces which give to the hailstone a granular appearance; and it is the

* *Annales de la Société Russe de Géographie. Section du Caucase*, T.X., part 3, 1879, p. 21, 22 (in Russian).

general convergence of these same fissures toward the central region, which impressed on the latter the character of a nucleus. That which might be taken for a nucleus was in reality intimately related to the exterior form of the hailstone. "In the hailstones that were not much flattened the nucleus had an undefined spherical form. . . . . But in the hailstones that were much flattened this nucleus was almost cylindrical, and one saw the bases (of the cylinder) at the poles of the hailstone, which were most often slightly concave. In this last case a sheaf of layers of transparent ice extended from the nucleus in the form of radii (Fig. 3), and constituted planes which, crossing one another, separated the whole volume of the hailstone, longitudinally, into separate compartments. At their equatorial surface the hailstones presented a network of joints. . . . ." (as in Fig. 2).

The regularity of form and structure observed by M. Abich is not an isolated case; it is found in greater or less perfection in other hailstones. The unknown laws which that savant suspected to intervene in the formation of hail really exist. They are as follow:—

1. The exterior surface of a spheroidal hailstone is a surface of equilibrium (or level-surface) of a fluid mass endowed with rotation about its axis.

2. The surfaces of the heterogeneous layers which divide the hailstone into separate compartments are normal or orthogonal to the surfaces of equilibrium in that hailstone.

It follows from the first law that four types of surface are possible in a spheroidal hailstone.

(*a*) A perfect sphere, or rather a slightly oblate ellipsoid. This is the case of the hailstones occurring most commonly.

(*b*) A very oblate ellipsoid. Hailstones of this form are also not rare; observers ordinarily compare them to biconvex lenses. If the flattening of form is very considerable, the hailstone may become a disk. The Utrecht hailstone that was 65 centimetres (26 in.) in circumference was of this form.

(*c*) A toroidal surface, or a quasi-spheroidal surface excessively oblate and concave at the two poles. The hailstones observed by Abich on the 8th of June, 1869, were exactly of this form. Another case of this kind has been reported to me by M. Lagounowitche, who had found amongst some hailstones fallen on the 14th (June 2nd, Russian calendar) of June, 1880, in the province of Minsk (Russia), little spheroids of ice, much flattened, and furnished with "two little fossettes" at the extremities of the axis.

(*d*) An annular surface. I only know of a single case of such hailstones, which has also been reported to me by M. Lagounowitche. According to this observer, certain hailstones that fell on the 14th of June were pierced from side to side by a hole or canal, the axis of which occupied the centre of the hailstone.

The second law indicates to us that for a spherical figure the only possible system of the surfaces of the segmental parts will be represented by conical or pyramidal surfaces, the apices of which are at the centre C of the spheroid (Fig 4), the bases of these conical surfaces being delineated by the curves *a b c d*, *a b e f*, &c., traced arbitrarily upon the surface of the hailstone. It is the intersection of these conical segmental structures with the surface of the hailstone which determines the distribution of the superficial joints; and it is the

general convergence of these same surfaces towards the centre which gives to that part the appearance of a central nucleus. Hailstones in the form of cones and pyramids, which are often found in hail, are only fragments of the spherical or spheroidal stones broken in their fall.

As to the cases (*b*) (*c*) (*d*), they comprise, according to the second law, two systems of surfaces of layers. The first corresponds to meridional planes passing through the axis of rotation, and the second is engendered by the rotation of the curves orthogonal to the surfaces of equilibrium. The intersection of the two systems of segmentation with the external surface of the hailstone forms two systems of joints of which one set $a\ a'\ a''\ a'''\ \ldots$, $b\ b'\ b''\ b'''\ \ldots$, (Fig. 5), converge towards the poles p and p'; while the others, $a\ b\ c\ d\ \ldots$, $a'\ b'\ c'\ d'\ \ldots$, are concentric with the axis of rotation. The axial part of the spheroid limited by the layer $a\ b\ c\ d\ \ldots$, corresponds to the nucleus which, in this case, has the appearance of a cylindrical body. All these conclusions are confirmed by the observations that I have just cited.

We can see from this that the opinion widely spread amongst savants that hailstones are disorderly conglomerations of grains accumulated concentrically about a central nucleus, is based upon a misunderstanding. Hailstones show a regularity of structure so precise that we cannot put down whirlwinds in the atmosphere as the cause of them. But there remain other facts less easy still to reconcile with the hypothesis of atmospheric origin of these bodies.

Hailstones often show highly developed crystalline forms. Such have been the cases observed by Adamson, in 1769 at Paris; by Delcros, in 1819, in the south of France; by Neuchel (Fig. 6), in 1863, at Tiflis; by Abich in 1869, at Bely-Klutch, in the Caucasus; and by Secchi, in 1876, in Italy (Fig. 7). According to M. Abich, hailstones that fell on the 21st (9th Rus. Cal.) of June, 1869 (Figs. 8 and 9), consisted of a very oblate central spheroid, and a group of crystals planted all around it. The spheroid offered a remarkable regularity of structure. The fissures and capillary tubes which rendered this mass slightly opaque, had their pointed ends converging towards the central region to which they gave the appearance of a nucleus. Six rays, or rather six meridianal planes, distant 60° one from another, set out from the nucleus in the manner of the rays of a wheel. These rays could only be distinguished from the central mass by the branching of the fissures, which were microscopic and very much compressed in the radial planes, though they were wider apart and visible to the naked eye in the remainder of the spheroid. As to the crystals they were formed of perfectly-transparent ice, were distributed, for the most part, over the equator of the spheroid, and rose, either solitary or in groups, to a height of from 15 to 30 millimetres (0·6 to 1·2 in.) above the surface of the spheroid. It is a fact worthy of being noted here that ten years later, on the 29th (17th Rus. Cal.) of June, 1879, at the same hour of the day, the same original forms reappeared at Bâle. The hailstones that fell at Bâle "offered not only a resemblance but quite a concordance with those which Abich had observed in 1869." But more remarkable still is the fact that in the two cases cited the atmospheric conditions were diametrically opposite. At Bâle the thermometer indicated 30° (86° F.), the air was oppressive, it was a perfect calm, and the hailstones fell almost vertically; whilst at Bely-Klutch, the temperature did not exceed 12°·5 (54°·5 F.), atmosphere was furiously agitated, and the hailstones dashed from all quarters of the horizon.

II.

Experience teaches us that to form a regular crystal of even small dimensions, the liquid has need of perfect and prolonged repose. In the case of water, it is in vain to take all possible precautions to preserve it against internal currents and sudden variations of temperature during freezing: for one only obtains crystals of insignificant dimensions, most often microscopical, and having the form of hexagonal prisms — never that of pyramids. It follows — at least unless you wish to make out no case for physics — that the formation of a pyramidal crystal of ice from 15 to 20 millimetres (0·6 to 0·8 in.) in thickness in the space of a few minutes, or, at most, a few hours, and in the midst of the fury of a tempest, must be considered at least as a miraculous fact. Now, as a miracle is not within the domain of reason, we are obliged to seek for the origin of hail outside our atmosphere, outside our planet, in the inter-planetary space.

However bizarre this idea may appear at the first glance, it is not on that account less conformable to the truths established by modern science. If chemical analysis of meteorites has revealed to us the existence in inter-planetary space of iron, silicon, nickel, oxygen, hydrogen, &c., there should be no plausible reason for denying the possibility of the existence of meteorites composed of oxygen and hydrogen alone. Now in consequence of the low temperature of celestial space, such meteorites could be nothing but icicles or hail-stones. Considered from this point of view, hail emerges from the rank of astonishing and marvellous phenomena, and takes its place in the class of facts that have been well known for some time past—in the class of meteoric showers.

A detailed comparison between the phenomena which accompany hail, and those proper to the fall of meteorites, plainly confirms this way of looking at the matter.

Hail comes from very characteristic clouds, sometimes dark, almost black, at other times very bright, but always dense, with clear-cut and agitated outlines; we recognise them amongst storm-clouds. The same character of clouds is repeated in the falls of meteorites. The famous meteorites of the 26th of April, 1803, were precipitated from a little cloud of rectangular form, from from which vapours rushed as if at an explosion. The meteorites of the 13th of June, 1819, descended from a greyish-white cloud, which afterwards was dissipated in smoke. The meteorite of the 14th of May, 1864, left on its track a sort of long white cloud, which lasted more than a quarter of an hour. The meteorite of Poultousk was accompanied by a pale train. The hail of stones in 1868 in Piedmont was discharged from a cloud of irregular form enveloped in an atmosphere of smoke, &c.

A short time before the hail falls there is often heard a peculiar sound, resembling neither the sound of a tempest nor that of peals of thunder. Certain observers compare this noise to that of a jar of walnuts that is shaken. Peltier cites a hailstorm preceded by a noise so intense that at first he thought it the arrival of a squadron of cavalry. According to M. Abich, the hailstorm of the 8th of June, 1869, was preceded by a noise similar to the roaring of an impetuous torrent, and that of the 27th of June by a sort of crackling. The hail at the Orkneys in 1818 was preceded by a noise like the cannonade of several pieces of artillery. The same thing is to be found in falls of meteorites. The fall of meteorites at Aigle was preceded by a sort of discharge which

resembled a fusillade, after which one heard a frightful beating as of drums. The hail of stones on the 13th of June, 1819, was preceded by a long rolling with crashing and a sound as of musketry. The bolide which fell on the 13th of May, 1831, was accompanied by three violent detonations as loud as the explosion of a piece of artillery, followed by a noise like the rolling of a heavy carriage over an uneven pavement, &c. It has been sought to explain this noise, in the case of hail, by the mutual clashing of the hailstones; but this cause would not be at all proportional to the effect which it would have to produce. Moreover, on this hypothesis, the noise ought to increase on the approach of the hailstones, and to last all the while that it is hailing. Now, it is heard a little before it hails. The thing becomes very simple to explain, however, from the point of view of the cosmical origin of the hailstones. Meteorites detonate at the moment of their entrance into our atmosphere, in consequence of the sudden condensation of the air, and they fall to the ground without noise, having lost their planetary velocity in consequence of the resistance of our atmosphere. The same thing happens to aqueous meteorites, that is to say, to hailstones.

The spherical form predominates in hailstones, and this is precisely the case of meteorites in general. "The globular structure," says M. Daubrée, "is so frequent in the common type of meteorites, that it has procured for this group the denomination of chondrite. Of ten falls, nine at least belong to it."

Hailstones are often surrounded by a friable pellicle, apparently of the nature of snow. This pellicle, which some persons have made out to be a layer of snow, formed by the precipitation of atmospheric vapours, is repeated in meteorites, which are, however, anything rather than an atmospheric sediment. "One observes," says M. Daubrée, "that each grain (of a meteorite) is enveloped in a metallic pellicle more or less thin, the structure of which is much more confused than that of the rest of the mass."

The crystals of ice that are formed in the depths of our atmosphere are always very small, and can in no way be compared with the enormous crystals which sometimes accompany hail. The same difference is found in meteorites. "If," observes the same savant, "one traces out the orientation of the octahedra (in meteoric iron) one recognizes that in many masses of meteoric iron they present a parallelism, from which it results that they constitute, taken as a whole a single crystal. The dimensions of these crystals are so considerable as to contrast with the structure, which is observed in artificial iron, even when the state of the latter is as pronounced as possible; for even then, the cleavage planes are oriented in all directions, as one sees in a host of minerals and of terrestrial rocks."

The crystals of ice which accompany hail present, moreover, this peculiarity, that their form is often pyramidal, whilst the crystals of ice of atmospheric origin are prisms. Now the same difference of crystalline form is repeated in meteorites. According to M. Daubrée, the crystals of meteoric iron are octahedra, and the crystals of artificial iron are always cubes.

But that which agrees best with the cosmic origin of hailstones is that they are sometimes accompanied by true meteoric masses. "More than once," says M. Baumhauer, "showers of hail have been observed in which the hailstones had a metallic nucleus, and I presume that this fact would present itself frequently, if the trouble were often taken to examine hailstones. It was thus, for example, that Eversmann found in hailstones that fell at Sterlit-

amansk, in the province of Orenburg, in Russia, obtuse-angled octahedra of sulphide of iron, in which Hermann found by analysis 90 per cent. of iron. Similarly there fell on the 21st of June, 1821, in the province of Majo in Spain, hailstones with metallic nuclei, in which Pictet proved the presence of iron . .

But the case which, above all, merits our attention, is that of the shower at Padua, on the 26th of August 1834, of hailstones with nuclei of a dark grey colour. These nuclei, examined by Cozari, consisted of grains of different sizes, the largest of which could be attracted by the magnet, and were found to be composed of iron and nickel. The identity of this matter with that of ærolites can scarcely be open to doubt." An analogous observation has been made at Stockholm by Nordenskiöld, who proved the presence of little dark grains of metallic iron in some hailstones. I think it appropriate to note here a fact relating to the colour of hailstones. According to M. Lagounowitche, many of the hailstones that fell on the 14th (2nd O. S.) of June 1880, in the province of Minsk, were visibly coloured, some rose, others clear blue, recalling the colours of solutions of salts of nickel and cobalt, bodies very frequent amongst meteoric masses.

It has been sought to explain the presence of stony masses in hailstones, by the supposition that hurricanes raised the stony matters from the serface of the soil, and carried them up into the clouds; and it is this way of regarding them that has caused so general an indifference with respect to the stones that accompany hail. In 1815 the Academy of Sciences of St. Petersburg received a case containing specimens of stones that fell during a hailstorm at Wilna, of which some hundreds weighed as much as a pound. It is not known what subsequently became of these stones, at least no traces of them are to be found in the museums of the Academy. Nor is better information to be obtained about the stony masses which accompanied showers of hail at Permj in 1809, at Fatesch in 1844, and at Nachraschinsk in 1833 (Russia). Later, when the cosmic origin of such masses had become evident, it has been sought to explain their presence in hailstones by supposing that atmospheric vapours congeal around stony masses of cosmic origin floating in the air.

All these suppositions become unnecessary from the moment that one adopts a cosmic origin for hailstones themselves. That which appears astonishing, improbable and doubtful in hailstones of terrestrial origin, becomes natural, logical, and necessary in hail of cosmic origin. Hailstones sometimes have enormous dimensions, for there are no limits to the size of celestial bodies. The quantity of them is often extraordinary, for celestial space has no bounds. The form of them is most often spheroidal, for that form is the typical one for celestial bodies. Certain hailstones offer a development of ice-crystals, unknown on the surface of our globe, for the crystallisation of these masses is effected during thousands of years, and under conditions of repose unknown on the surface of the earth. The temperature of hail is very low, because the temperature of celestial space is so also. Lastly, hailstones are sometimes accompanied by meteorites, because these two kinds of bodies belong to the same family, and travel together through the depths of the sky.

Considered from this point of view, each hailstone has its history, its periods of formation. In the first period it is collecting itself together in consequence of the mutual attraction of particles dispersed throughout cosmic space; in the second it accommodates itself to the conditions of equilibrium determined by its volume and its velocity of rotation, and is constituting itself a more or

less oblate spheroid; lastly, in the third period the mass obeys internal molecular forces, and crystallizes.

I do not conceal from myself that the ideas that I am putting forward may raise a crowd of objections. It may be asked, how can the ice of hailstones take the form of a spheroid whilst remaining solid. How does the same ice crystallize while still remaining solid? Why does not hail fall in winter, whilst the true meteorites fall at all seasons? &c.

All these questions, which may appear to be serious objections to my theory, are for me only so many sources for deductions of the highest interest, which, however, I cannot condense into a few pages. I will content myself by observing here that, great as the progress of science may appear to be to-day, it is necessarily flecked with prejudices of ancient date, which can only be effaced with great pains, and which make us see an obstacle where our descendants will see only a corroboration and a proof.

"ROGERS' BLAST."

[THIS term was quoted by Mr. F. Coventry, in Vol. XV., p. 58, of this Magazine, as a common name for a small local whirlwind. We are indebted to him for calling our attention to two exhaustive notes upon the subject which appeared in *Notes and Queries*, for July 3, 1880, and which we reprint with great pleasure.]—ED.

I found what I suspect to be the right explanation of this expression in less than a minute in the first book I opened. I will give the process of reasoning as an example. When words occur of which the former element is obscure, we expect both elements to have the same meaning. This is very common in English, especially in place-names. Thus *Derwent-water* means "white-water-water;" *water* being added from ignorance of the sense of *Der*.* Hence *rodges-blast* must mean "blast-blast," and *rodges* is a corruption of a foreign word meaning "blast." But it is notorious that Norfolk words, if not Anglo-Saxon, are mostly Scandinavian; and the best representative of Scandinavian is Icelandic. Next, since English *dg* commonly stands for *g* (as in *bridge* for *brig*), one will have to look for *rog*, or, as *g* is often put for older *k*, for *rok*. So I said to myself, suppose I look for *rog* or *rok* in Vigfusson's *Icelandic Dictionary*.

* There are few subjects on which opinions differ more than upon derivations. The above translation of Derwent struck us as unfamiliar, and on turning to the latest Lake Guide Book (Jenkinson's) we find :—

Derwent, Dwr-gwyn, "clear-water" (Taylor); or from Derwyn, equivalent to the "winding river" (Ferguson). Sullivan suggests a third derivation, dur-gwent, "the beautiful water." The course of the river Derwent is not tortuous. Either of the other two names would be more characteristic. *Jenkinson's Practical Guide to the English Lakes.*

These various opinions do not differ as much as usual, and we suppose it may be accepted that Der (Celtic Dwr) represents water (possibly in the form of a river, but at any rate water.) And if "went" is the equivalent of clear, white or beautiful; and if the true line of beauty is a curve, we may, perhaps, recognize the equivalent of "beautiful" in Ferguson's "winding."—ED.

On opening it, the first word I raw was *rok*, the splashing, foaming sea; the second was *roka*, a whirlwind. Now *roka* would regularly pass into *rogga* and *rodge* or *roger*, the former if it became one syllable, the latter if pronounced as two syllables. The rest of the derivation now becomes easy. *Roka* is one of the numerous derivatives of the strong verb *rjúka*, to reek, being formed from the pp. *rokinn*. *Rjúka* is cognate with A.-S. *reócan*, whence modern English *reek*, and with the G. *riechen*, whence the substantive *rauch*. So little is English etymology understood that, in a very recent number of the *Academy*, the English word *reek* was actually derived from the German word *rauch*, which is much worse than deriving Portuguese words from Italian. I believe that a little thought in these matters will often save a great deal of labour and guesswork.

WALTER W. SKEAT.

This expression should rather be "rogers-blast," and it is so given by Halliwell, with the explanation quoted from Forby: "A sudden and local motion of the air, no otherwise perceptible but by its whirling up the dust on a dry road in perfectly calm weather, somewhat in the manner of a waterspout." This explanation is good so far as it goes, but the term includes whirlwinds of a more violent character, the leading idea being that of a rotatory motion. It is derived from a Scandinavian source, and will be found in use, I think, principally in those districts where the Danish element has been predominant. *Roka* in Icelandic or Old Norse is a whirlwind. *Rok* is explained by Holmboe (*Det Norske Sprogs*) as "en storm, som hvirvler Vand og Sand op i Luften," a storm which whirls the water and sand up in the air. *Roka-blástr* in Icelandic is the blast of a whirlwind. From the same radical idea of twirling comes the term *rock* for the distaff used in spinning, which is common to all the Teutonic tongues, though the radical from which it springs has been lost in all except the Norse. It is true that it was the spindle, and not the *rock*, which gave the twist to the thread, but it was one and the same operation. Our old ballads and poetry are full of allusions to the *rock*, both before and after the introduction of the spinning wheel. Thus in the ancient song of "My Joe Janet," the lady sings:—

> "My spinning wheel is auld and stiff,
> The *rock* o't winna stand, sir;
> To keep the temper-pin in tiff
> Employs aft my hand, sir."

The "temper pin" was a wooden peg used to regulate the motion of the wheel. So Parnell:—

> "Flow from the *rock*, my flax, and swiftly flow;
> Pursue thy thread, the spindle runs below."

Wachter (*sub voce* "Rocken") connects *rock* with Gr. τρόχος, the *t* disappearing by aphæresis. The Greek word undoubtedly means a circular course, but Fick, who is usually very accurate, gives no countenance to the connexion of the words.

J. A. PICTON.

Sandyknowe, Wavertree.

REMARKABLE RAINFALL.

To the Editor of the Meteorological Magazine.

The following are the quantities of rain which have fallen in Clifton during the last four days, each "day" of rainfall ending at 9 a.m. of the day following that to which the quantity is assigned :—

October	21	0·395	inches
,,	22	1·240	,,
,,	23	1·789	,,
,,	24	0·286	,,
	Total	3·710	

Actually, nearly the whole of this quantity fell within a period of 60 hours, namely, between midnight on Saturday and noon on Tuesday.

The records of thirty years supply no complete parallel to this persistent downpour. The nearest approaches were on March 11—13, 1859, when 3·041 inches fell in 48 hours; on August 6, 1865, when 2·682 inches fell in 24 hours; and on July 14—15, 1875, when 3·080 inches fell in 38 hours.

Thick snow fell with the rain on Tuesday morning, partially whitening the roofs of houses and other exposed surfaces. The 24th of October is an unusually early date for the first snow.

GEORGE F. BURDER.

Clifton, 25th October, 1882.

[In thorough agreement with the above is the information which we have received, through Mr. H. J. Martin, C.E., from Mr. T. Howard, C.E., of Bristol, that the flood produced by the above rain was the highest on record, reaching for the total discharge through the Avon (say under the Suspension Bridge at Clifton) 48,000,000 cubic feet, or about 300,000,000 gallons per hour.—ED.]

HEARING THE AURORA BY TELEPHONE.

An observer of the recent aurora at Mont Clair, N.J., August 4, writes that on connecting the two poles of his telephone, one with the water pipe leading to cistern near his dwelling, and one with the gas pipe leading all over town, he heard the electrical crackle going on substantially the same as is heard when the same connection is made during thunder-storms. He, however, reports that the aurora crackle was more delicate in its sound than the thunder-storm crackle, and that besides the crackle there were at intervals of perhaps half a second each, separate short taps on the telephone diaphragm that gave a slight ringing sound.—*Scientific American.*

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0–10
England, London	74·2	29	37·3	16	66·9	45·5	44·8	69	129·7	32·8	1·20	11	4·8
Cape of Good Hope	75·8	6	34·2	29	67·0	48·3	52·8	80	...	...	2·78	7	5·7
Mauritius	81·3	5, 12	63·1	31	79·2	68·7	64·1	72	...	...	·87	8	3·7
Calcutta	100·3	3	66·2	7	93·0	73·8	72·7	71	161·7	61·8	6·05	12	4·9
Bombay	91·8	31	76·6	3	89·5	79·7	74·8	72	148·6	68·7	·02	1	3·0
Ceylon	91·2	6	71·8	16	87·6	77·2	73·2	74	156·0	68·3	12·78	20	7·0
Melbourne	69·0	4	38·0	20	62·6	48·9	46·2	73	120·0	30·6	2·55	16	6·4
Adelaide	77·5	11	44·0	8	65·4	53·0	48·9	68	141·6	34·5	2·21	17	6·6
Wellington	64·0	19	39·0	25	58·3	47·2	...	...	114·0	31·0	5·62	17	...
Auckland	66·1	2	42·6	23	62·5	49·6	49·5	79	97·0	38·0	3·35	21	5·4
Falkland Isles	48·8	12	24·4	29	41·6	33·1	34·6	88	104·1	20·0	5·19	28	6·6
Jamaica	88·3	31	67·8	1	85·9	72·8	71·6	77	...	61·8	2·17	5	4·3
Barbados	83·0	var.	70·0	var.	82·0	72·0	72·2	77	146·0	69·0	2·93	19	6·0
Toronto	70·9	30	30·0	2	57·3	40·6	38·0	65	128·0	24·0	3·58	11	6·2
New Brunswick, S. John	60·0	13	27·0	5	51·8	36·7	37·5	76	...	...	3·15	11	5·5
Cape Breton, Sydney	68·6	29	26·7	5	50·6	34·0	34·8	78	...	...	5·52	17	5·9
Newfoundlnd, S. John's	...	...	...	...	...	...	...	...	...	...	...	..	...
Manitoba, Winnipeg	78·2	16	20·0	22	62·7	36·9	37·4	61	135·8	...	1·41	10	4·1

REMARKS, MAY, 1882.

Mauritius.—Rainfall 3·27 in. below average, mean temp. 0°·7 above it, mean pressure 30·073 in. ·020 in. below average. Mean hourly velocity of wind 8·9 miles; greatest 22·5 miles; least 1·9 miles, prevailing direction S.E. to E.; L on 7th, T and L on 22nd. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. 1°·8, and rainfall 0·41 in. above average; pressure, humidity, and amount of cloud all about the average; prevailing wind N, strong breezes occurring on 12 days; violent westerly squalls on the 12th and 15th; heavy dew on 4 days, hoar frost on 20th, lunar halo on 5th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. about 1°·5 above average, but the weather over the agricultural portions of the colony was fine and showery and suitable to the young wheat crops. Mean pressure slightly above average, and rainfall about 1·00 in. below it. C. TODD.

Wellington.—Dull, showery weather up to 14th, with strong winds on 8th, 9th, 12th, and 13th; cold and wet with fresh wind from 14th to 19th; remainder of month fine and pleasant (excepting 21st); prevailing wind N.W.; T on 5th; slight earthquakes on 14th and 15th. Mean temp. about the average; pressure below it. R. B. GORE.

Auckland.—Very showery till 21st, but fine from 22nd to 29th; prevailing wind S.W. E. B. DICKSON.

BARBADOS.—Mean pressure slightly, and mean temp. (76°·1) 1° below the average; prevailing wind N.E., average velocity 15·2 miles, extremes 21·3 miles and 10·1 miles. Rainfall 52% below the average, and the evaporation (5·30 in.) 20% above it. Five days were clouded. R. BOWIE WALCOTT.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1882.

STATIONS. *(Those in italics are South of the Equator.)*	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	74·3	27*	41·5	13	66·8	49·4	47·6	71	130·0	36·9	2·30	18	6·8
Cape of Good Hope	75·0	21	34·0	18	63·8	46·6	48·8	80	...	...	3·29	12	4·8
Mauritius	80·3	3	58·2	29	74·8	65·0	59·4	70	...	...	2·86	12	5·0
Calcutta	98·9	3	72·2	2	90·1	77·9	78·3	84	158·4	70·2	9·99	20	7·5
Bombay	90·8	1	74·6	3	85·8	78·1	77·4	86	148·6	69·0	27·5	25	8·0
Ceylon	86·7	16	74·3	6, 23	84·7	77·7	72·3	75	152·0	64·0	6·61	16	7·1
Melbourne	62·0	10	31·5	9	55·7	42·1	40·9	77	110·0	24·4	1·37	13	5·4
Adelaide	63·0	7	36·8	28	57·9	44·1	43·0	74	134·0	29·5	1·62	16	6·5
Wellington	60·1	21	38·7	6	54·9	47·1	...	...	109·0	33·0	5·98	19	...
Auckland	64·5	16	40·2	6	59·9	49·7	49·9	83	...	40·0	5·54	22	8·2
Falkland Isles	45 1	15†	19·5	5	39·8	31·7	34·1	90	86·1	17·7	2·24	20	7·4
Jamaica	90·9	3	71·1	13	88·7	74 8	73·5	75	...	64·7	·76	2	5·1
Barbados	83·0	19‡	70·0	29	82·0	73·0	73·4	84	148·0	68·0	4·28	16	6·5
Toronto	85·4	25	37·0	2	70·7	52·0	51·5	69	144·0	35·0	2·63	12	5·4
New Brunswick, S.John	79·0	26§	41·0	6	62·8	48·7	49·5	80	...	...	6·65	13	6·3
Cape Breton, Sydney	77·7	24	35·0	13	65·8	46·3	49·2	82	...	...	6·17	19	6·8
Newfoundlnd, S.John's	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	84·5	6	30·8	1	72·2	45·9	46·6	67	154·0	...	1·37	6	4·0

* And 29. † And 20. ‡ And 20. § And 27.

REMARKS, JUNE, 1882.

Mauritius.—Rainfall ·90 in. above the average, mean temp. 0°·3 below it; mean pressure 30·173 in., ·010 in. below average. Mean hourly velocity of wind 10·4 miles; greatest 37·0 miles on 14th, least 2·3 miles on 10th and 21st, prevailing direction S.E. by S. to E. by S. C. MELDRUM, F.R.S.

Melbourne.—Mean pressure about the average, mean temp. of air, of dew-point, amount of cloud and rainfall all below the average; prevailing direction of wind S.W., W. and N., strong breezes occurring on 7 days; heavy dew on 8 days; hoar frost on 6 days; ice on the 9th, dense fog on the 8th and 27th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. nearly 3° below average of 25 years, rainfall likewise below the mean; but the mean pressure was slightly above it. C. TODD.

Wellington.—First 3 days fine; then wet unpleasant weather till 10th, and stormy on 4th and 5th; a few fine days followed, but from 15th to 22nd was stormy with heavy rains; remainder of month fine; H on 5th, fog on 12th, 13th, 14th, and 28th; prevailing winds N.W. and S.E., slight earthquakes on 6th and 11th. Mean temp. 2°·0 above average; pressure also above it. R. B. GORE.

Auckland.—Rain very heavy and continuous throughout the month, max. fall 1·80 in. on the 4th; wind mostly light to moderate, moving from W. to N.E. and back to W. twice in the month; very strong on 15th; dense mist on 1st, 2nd, 19th, and 20th. E. B. DICKSON.

BARBADOS.—Mean pressure and temp. (76°·8), both slightly below the average. Prevailing wind N.E., average velocity 15·7 miles, extremes 22 miles and 10 miles; rainfall 30% below the average, and evaporation (4·45 in.) 22% above it; six days were overcast. R. BOWIE WALCOTT.

SYDNEY, NOVA SCOTIA.—Snow banks 3ft. deep on country roads on 9th.

SUPPLEMENTARY TABLE OF RAINFALL,

OCTOBER, 1882.

[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	6·78	XI.	Solva	6·17
,,	Margate, Birchington...	5·04	,,	Castle Malgwyn	6·62
,,	Littlehampton	8·08	,,	Rhayader, Nantgwillt..	6·67
,,	St. Leonards	8·01	,,	Carno, Tybritle	6·17
,,	Hailsham	9·89	,,	Corwen, Rhug	3·70
,,	I. of W., St. Lawrence.	8·14	,,	Port Madoc	6·63
,,	Alton, Ashdell.....	6·62	,,	I. of Man, Douglas	5·27
III.	Great Missenden.....	7·32	XII.	Carsphairn	6·84
,,	Winslow, Addington ...	6·02	,,	Melrose, Abbey Gate...	2·97
,,	Oxford, Magdalen Col...	5·59	XIII.	N. Esk Res. [Penicuick]	3·35
,,	Northampton	5·18	XIV.	Ayr, Cassillis House ..	2·73
,,	Cambridge, Beech Ho...	4·78	,,	Glasgow, Queen's Park.	3·36
IV.	Southend	4·32	XV.	Islay, Gruinart School..	4·67
,,	Harlow, Sheering	5·04	XVI.	St. Andrews, Newton Bk.	3·95
,,	Diss	6·80	,,	Aberfeldy H.R.S.	3·49
,,	Swaffham	4·65	,,	Dalnaspidal	5·89
,,	Hindringham	4·71	XVII.	Tomintoul.....	...
V.	Salisbury, Alderbury...	6·57	,,	Keith H.R.S.	1·63
,,	Calne, Compton Bassett	6·05	XVIII.	Forres H.R.S.	1·24
,,	Beaminster Vicarage ...	9·58	,,	Strome Ferry H.R.S....	3·33
,,	Ashburton, Holne Vic..	9·11	,,	Lochbroom	1·21
,,	Torrington, Langtree W.	7·46	,,	Tain, Springfield.....	1·43
,,	Lynmouth, Glenthorne.	7·59	,,	Loch Shiel, Glenaladale	6·72
,,	St. Austell, Cosgarne...	...	XIX.	Lairg H.R.S.	1·87
,,	Taunton, Fullands	7·24	,,	Forsinard H.R.S.	1·92
VI.	Bristol, Clifton	7·14	,,	Watten H.R.S.	2·54
,,	Ross	5·80	XX.	Fermoy, Glenville	5·95
,,	Wem, Sansaw Hall.....	4·22	,,	Tralee, Castlemorris ...	4·40
,,	Cheadle, The Heath Ho.	5·37	,,	Cahir, Tubrid	4·56
,,	Worcester, Diglis Lock	4·97	,,	Newcastle West	4·31
,,	Coventry, Coundon	5·53	,,	Kilrush	...
VII.	Melton, Coston	5·11	,,	Corofin	4·72
,,	Ketton Hall [Stamford]	5·58	XXI.	Kilkenny, Butler House	...
,,	Horncastle, Bucknall ...	4·27	,,	Carlow, Browne's Hill..	3·32
VIII.	Macclesfield, The Park.	3·78	,,	Navan, Balrath	3·58
,,	Walton-on-the-Hill.....	2·90	,,	Athlone, Twyford	3·44
,,	Broughton-in-Furness ..	5·44	XXII.	Mullingar, Belvedere ...	3·33
IX.	Wakefield, Stanley Vic.	3·90	,,	Clifden, Kylemore	10·32
,,	Ripon, Mickley	4·51	,,	Crossmolina, Enniscoe..	4·12
,,	Scarborough.....	4·70	XXIII.	Carrick-on-Shannon ...	3·20
,,	East Layton [Darlington]	3·30	,,	Dowra	2·65
,,	Middleton, Mickleton ..	3·54	,,	Rockcorry.....	2·72
X.	Haltwhistle, Unthank..	3·87	,,	Warrenpoint	4·08
,,	Carlisle, St. James Rd...	2·69	,,	Newtownards	3·26
,,	Shap, Copy Hill	4·17	,,	Belfast, New Barnsley .	2·97
XI.	Llanfrechfa Grange	8·25	,,	Bushmills	2·70
,,	Llandovery	5·79	,,	Buncrana	3·08

OCTOBER, 1882.

iv		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	4·96	+ 2·26	·59	21	23	70·4	1	31·9	26	1	4
II.		Maidstone (Hunton Court)...	5·81	+ 3·35	1·01	28	22	...	...	...	...	...	...
,,		Strathfield Turgiss	5·79	+ 3·05	·99	15	23	69·0	1	27·9	26	2	9
III.		Hitchin	5·62	+ 3·44	1·12	27	25	64·0	1	30·0	25	1	...
,,		Banbury	5·84	+ 3·08	1·11	24	27	65·5	1	28·0	26	2	...
IV.		Bury St. Edmunds (Culford)	5·31	+ 3·14	1·04	24	25	69·0	1	29·0	24	4	..
,,		Norwich (Cossey)	5·83	+ 3·50	1·34	21	19	69·0	1	31·5	26	1	2
V.		Bridport	8·37	...	1·70	23	22	...	..	...	...	...	...
,,		Barnstaple.....	7·38	+ 1·93	1·27	23	21	70·0	2, 3	39·0	30	0	..
,,		Bodmin	7·32	+ 1·05	1·25	23	26	61·0	1	35·0	29	0	3
VI.		Cirencester	6·29	+ 3·05	1·04	23	23	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	5·46	+ ·86	·72	24	26	62·5	1	36·0	27	0	3
,,		Tenbury (Orleton)	5·76	+ 2·52	·90	24	28	66·8	1	26·7	26	3	5
VII.		Leicester	5·56	...	1·28	24	28	67·4	1	30·2	26	1	4
,,		Boston	4·78	+ 2·75	1·48	24	17	70·0	1	32·0	26	1	...
,,		Grimsby.....	4·99	+ 2·34	1·51	24	25	68·5	1	37·0	25*a*	0	...
,,		Hesley Hall [Tickhill].....	4·88	...	1·53	25	23	70·0	2	29·0	26	1	...
VIII.		Manchester (Ardwick).....	3·11	— 1·32	·56	24	18	68·0	2	35·0	25	0	...
IX.		Wetherby (Ribstone Hall) ...	3·90	+ ·54	1·08	24	16	...	...	...	...	...	...
,,		Skipton (Arncliffe)	6·13	— 1·13	1·04	19	28	64·0	3	34·0	29	0	...
X.		North Shields	2·96	+ ·45	·47	15	19	68·8	1	31·5	26	2	2
,,		Borrowdale (Seathwaite).....	9·14	— 7·41	1·49	19	21	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely).....	8·56	+ 3·33	1·32	23	21	...	...	...	...	...	...
,,		Haverfordwest	7·56	+ 1·11	1·26	31	20	63·0	1, 2	34·0	28	0	7
,,		Plinlimmon (Cwmsymlog) ...	7·34	...	·91	30	22	...	...	...	..	...	...
,,		Llandudno.....	2·64	— 1·95	·38	14	20	71·2	1	38·4	26	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	4·57	— 1·14	·94	19	17	66·0	1	30·0	26	1	...
,,		Hawick	2·73	— ·44	·60	16	22	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	3·41	— 1·53	·69	15	19	...	...	...	...	...	.
XV.		Lochgilphead (Kilmory).....	4·58	— 3·74	·56	30	20	...	...	25·0	29	4	...
,,		Appin (Airds)	5·96	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	6·23	...	·97	21	22	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·90	— ·41	·80	8	17	...	...	...	...	...	...
,,		Arbroath	3·06	+ ·19	1·19	15	15	62·0	4	33·0	26	0	...
XVII.		Braemar	3·22	— 1·26	·37	7	24	63·0	1	23·0	26	5	19
,,		Aberdeen	2·93	...	·58	15	24	64·0	1, 4	30·0	29*b*	2	...
XVIII		Skye (Sligachan)	7·70	...	1·71	3	14	...	...	...	...	..	...
,,		Culloden	1·79	— ·50	·67	16	...	68·0	1	29·5	30	3	13
XIX.		Dunrobin	1·50	...	·54	19	11	...	...	...	...	...	...
,,		Orkney (Sandwick)	3·10	— 1·19	·77	19	17	63·5	2	35·7	26	0	5
XX.	IRELAND.	Cork (Blackrock)	5·35	+ ·61	2·22	18	19	65·0	4	31·0	24	3	...
,,		Dromore Castle	7·25	...	1·54	18	18	65·0	4	34·0	24	0	...
,,		Waterford (Brook Lodge) ...	5·72	...	1·91	18	19	61·5	14	30·0	26	2	...
,,		Killaloe	4·52	...	·92	18	14	67·0	4	29·0	26	1	...
XXI.		Portarlington	2·42	— 1·05	·66	18	18	62·0	14	29·0	25	4	...
,,		Dublin (Monkstown)	...	...	...	...	...	...	...	...	..	...	...
XXII.		Ballinasloe	3·43	...	·92	18	21	64·0	1	28·0	26	5	...
XXIII.		Waringstown	2·42	— 1·19	·54	18	17	66·0	1	28·0	24*c*	3	6
,,		Londonderry...	...	...	...	...	...	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·50	— 1·82	·85	18	15	64·0	1	26·0	28	5	...

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

a And 26, 30. *b* And 30. *c* And 28.

METEOROLOGICAL NOTES ON OCTOBER.

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

ENGLAND.

STRATHFIELD TURGISS.—A very wet and unsettled month, stormy and changeable; all agricultural work suspended. Rainfall more than double the average, temp. also much above the average. Lowlands flooded on 16th; rooks reforming their nests on 20th.

HITCHEN.—With two exceptions the wettest October for more than 30 years; temp. much below the average; terrific gale on the 24th, more violent than that of October 14th, 1881.

BANBURY.—A singularly wet month, both in amount and frequency of R, the total fall being more than twice the average, and the largest recorded in October during 22 years, with the exception of October, 1875 (7·80 in.). Mean temp. 48°·5. Heavy gale on 24th, with heavy R, S, and sleet: 1·73 in. fell in about 12 hours, causing great floods, which threw down many trees and walls; the bar. fell to 28·715 (corrected and reduced). High wind on 5th, 15th, 27th, and 28th; distant T and L on 8th; aurora on 2nd.

CULFORD.—Very wet and stormy during the month. Gale on 24th, with S, H, and R, and very low temp. and pressure. L on 11th.

COSSEY.—An unfavourable month for farm work, the heavy rains delaying wheat sowing on all but the light lands. Heavy gale with torrents of R and a rapid fall of temp. on 24th.

BRIDPORT.—T and L on 24th.

BODMIN.—Mean temp. of the month 51°·4.

CIRENCESTER.—A very wet month. On the morning of the 24th a remarkable storm occurred with heavy R, which turned to S about 10 a.m.; the ground was quite covered for some hours; on the Cotswold hills the S lay in places for two days.

WOOLSTASTON.—A month of constant R and fog, only five fine days; a good deal of grain still standing in the fields in the higher lands at the end of the month. Mean temp. 48°·1.

ORLETON.—A very cloudy rainy month with occasional sunshine; the nights were generally cloudy, and in the middle of the month very dark, and there were few frosts. Rainfall more than double the average; the bar. was low and very unsteady, with frequent gales of wind; temp. more than ·5° below the average. On the 24th, at 5.30 a.m., R set in, falling in sheets after 6 a.m., with a rapid decrease of temperature, and changing to S at 10 a.m., which covered the ground in half an hour, and continued to fall till noon, when it again changed, and R fell lightly till 3 p.m., with an increase of temp.; more than 1·50 in. of R and S fell in 7½ hours. L on 20th and 22nd.

BOSTON.—The total rainfall was more than double the average, and has only once been exceeded in October in 20 years, viz., October, 1880, when 7·14 in. fell. In consequence of this heavy rain, there was a great deal of land flooded, and several of the protecting banks gave way. On the 28th the tide rose 3 ft. 8 in. above its ordinary height (17 ft. above Ordnance datum), a rise which has only been equalled twice within the last 20 years.

KILLINGHOLME.—First week of the month very fine, but during the remainder there were only three days without R. Very little wheat sown on heavy land.

SEATHWAITE.—With the exception of a few H showers the month was remarkably mild and fine. T on 23rd and 29th.

WALES.

HAVERFORDWEST.—The month commenced stormy, but the weather soon became fine and calm, with very high pressure on the 4th (bar., 9 p.m., 30·593 in., corrected and reduced); the fine weather lasted, with the exception

of a slight disturbance on the 11th, till the 14th, after which date it gradually became unsettled, and the last ten days of the month were very cold, wet, and stormy. The month was, on the whole, very mild, several wild roses and a wild strawberry being seen in the last week. T, L, H, and R and heavy floods on 26th; furious gale with heavy R and great floods on 31st.

LLANDUDNO.—At Llandudno, October is, on the average, the wettest of all the months, but this year is an exception, and we happily escaped the deluges of R which have fallen at many other stations. The month was showery, certainly (as well as cloudy), if we count the number of days on which R fell, but the aggregate fall was nearly 60 per cent. below the average of 21 years; the humidity was also below the average. Mean temp. 51°·1, a fraction of a degree below the average; range 32°·8, mean daily range 8°·7.

SCOTLAND.

CARGEN.—A dull gloomy month, but very mild; a considerable number of ripe strawberries having been gathered; temp 1°·7 above average; duration of sunshine 90 hours, 37 hours below average. Gale on 1st; T and L on 2nd.

HAWICK.—The month, on the whole, though mild, was one of drizzle, which aggravated the potatoe disease and delayed the harvest, which was not quite finished at the end of the month. Hurricane on 1st; T nearly all day on 26th; first frost on 25th.

QUINISH.—Nearly all the grain in the district was secured during the last half of the month with great difficulty in indifferent condition. During the whole of this season the saving of hay and corn has been exceptionally difficult, and should the rainfall of November and December equal the average, this year will be one of the wettest on record.

BRAEMAR.—An exceedingly damp and dull month, doing much injury to an excellent crop; lunar rainbow on 21st.

ABERDEEN.—Although the weather was damp and misty during the greater part of the month, the rainfall was below the average. Brilliant aurora on 2nd.

SLIGACHAN.—The month was ushered in by a hurricane from S.W., which continued for 24 hours, doing great damage to corn which was partly in stook, scattering it over the fields, and carrying some out to sea. Hay crop good, but injured by wet; potatoe crop much diseased. Gale on 1st; T and L on 2nd.

CULLODEN.—The month was fine generally, some days, between the intervals of rainfall, particularly so. None of the heavy storms experienced in England reached the northern parts of this kingdom.

SANDWICK.—October was mild and dry, the rainfall being considerably below the average. October is generally the wettest month here, but this year there have already been four months that have exceeded it. Strong breezes occurred from S E., but no such storms as visited England. On the last four days N. and N.W. winds prevailed reducing the temperature. Aurora on 9th and 10th.

IRELAND.

CORK.—Very stormy on 1st, wind pressure 40lbs. to the square foot; mean temp. of month 49°·3.

DROMORE.—Very heavy gale on 1st, which culminated in a squall about 9·30 a.m., doing very great damage to trees, houses, and stacks; all the mischief was done in the space of about 20 minutes and the gale quickly abated. With this exception the early part of the month was very fine, but a good deal of R fell in the latter half.

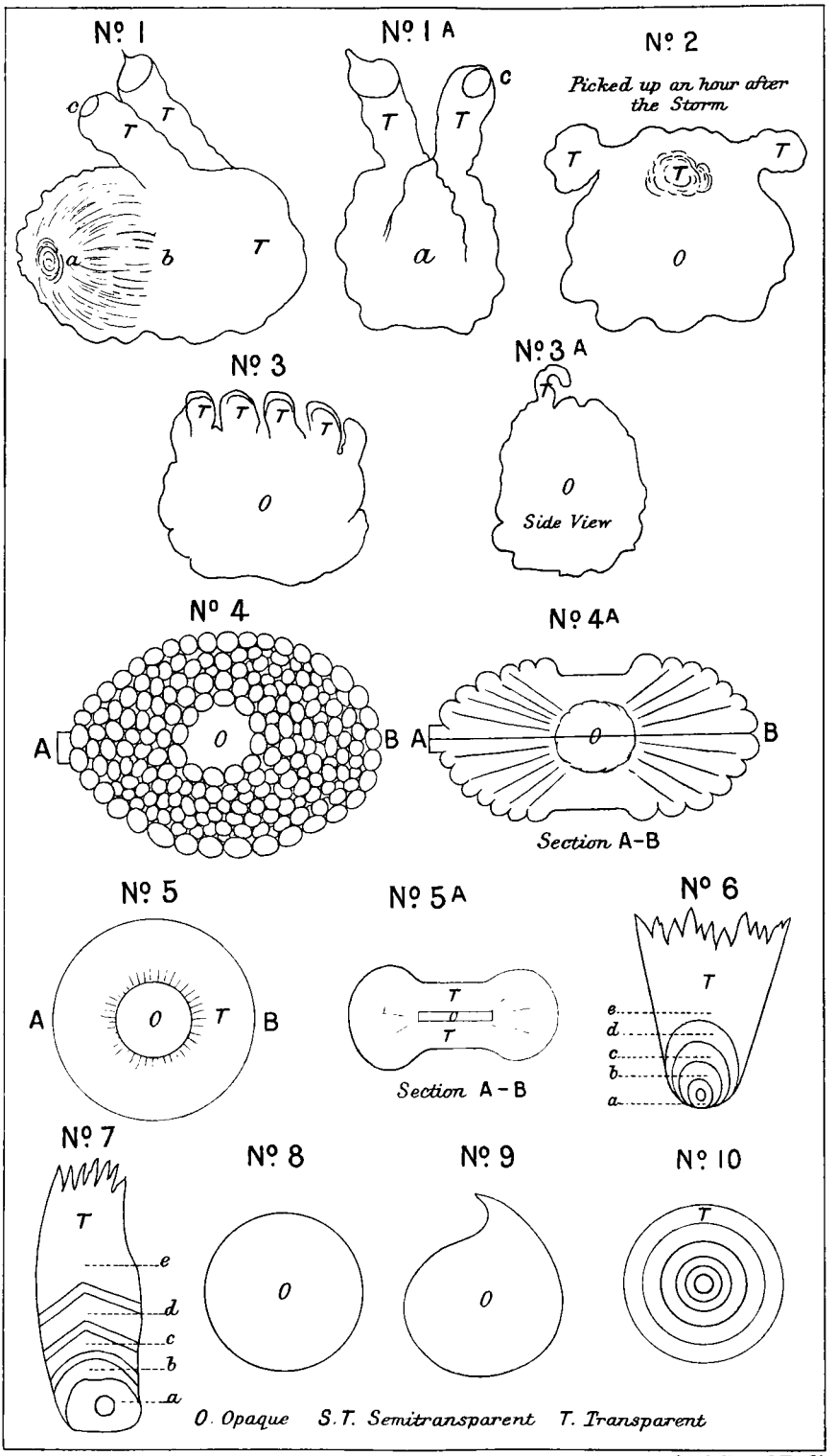
WATERFORD.—Gales from S.W. on 1st and 18th; T on 2nd; TS on 7th; L on 11th; fog on 8th, 9th, and 13th.

KILLALOE.—Gale from S.E. on 1st of great violence from 10 a.m. to 4 p.m.

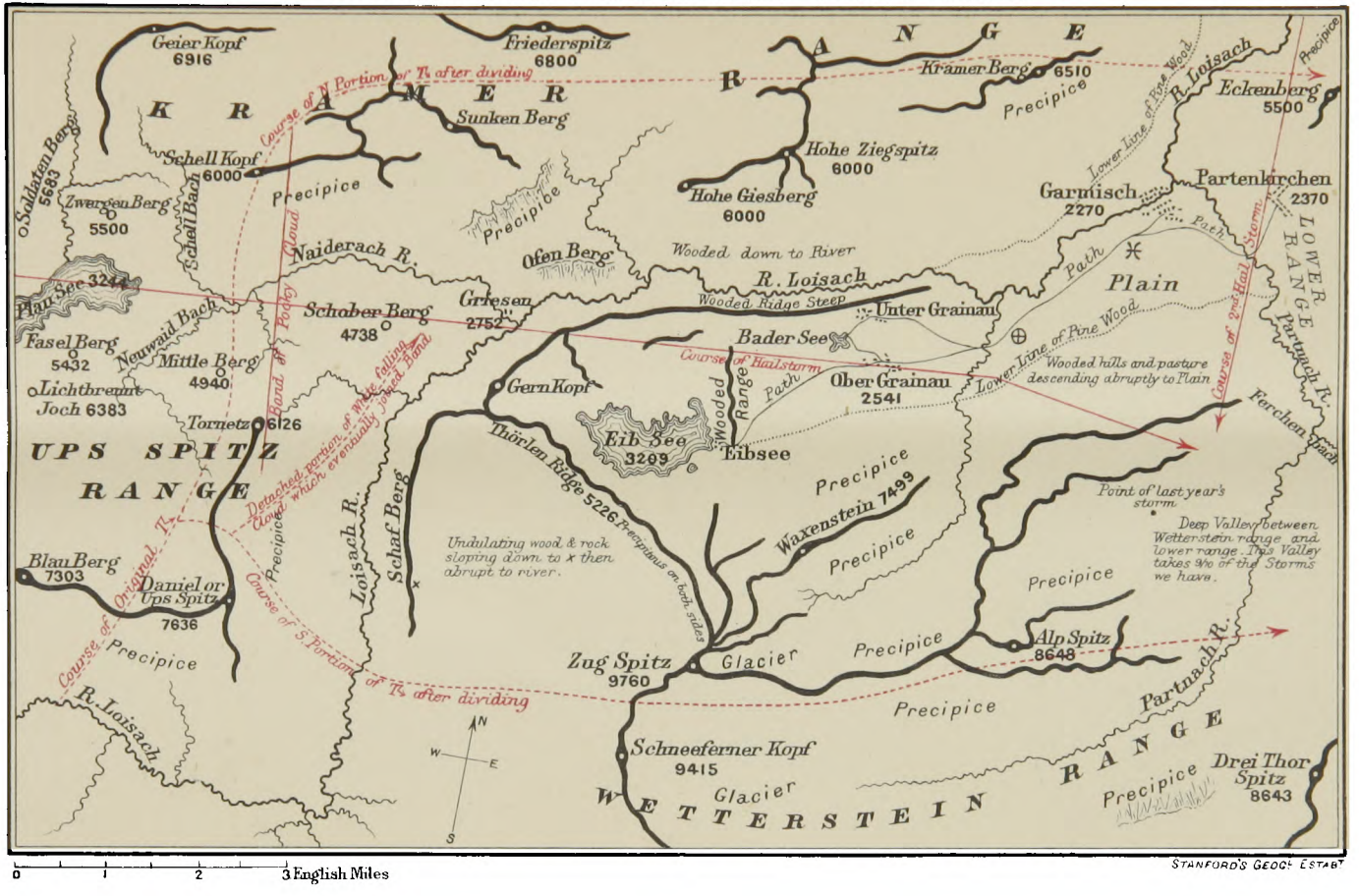
BALLINASLOE.—Month generally cold, wet, and blustery, but the rainfall was slightly below the average. Violent storm on 1st, doing much damage to trees and houses.

WARINGSTOWN.—Very severe gale S.S.E. to S S.W. on 1st.

EDENFEL.—We experienced here during the past month weather finer than that reported from any other district in the three kingdoms.


Nº 1
Nº 1 A
Nº 2
Picked up an hour after the Storm
Nº 3
Nº 3 A
Side View
Nº 4
Nº 4A
Section A-B
Nº 5
Nº 5A
Section A-B
Nº 6
Nº 7
Nº 8
Nº 9
Nº 10
O. Opaque S.T. Semitransparent T. Transparent
Stanford's Geogl Estabt

HAILSTORM AT OBER GRAINAU 4th JUNE 1882.



SYMONS'S

MONTHLY

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HAILSTORM AT OBER GRAINAU, BAVARIA, 4TH JUNE, 1882.

[AS many of our readers are aware, Col. Ward, F.R.A.S., F.M.S., has for some time been devoting considerable attention to the forms of hail which fall in different parts of Bavaria, and we are indebted to him for the following very interesting and carefully prepared account and illustrations.—ED. *Met. Mag.*]

OBER GRAINAU, is four miles W. of Partenkirchen,* Bavaria, 2752 ft. above sea level, and at the northern base of Zugspitz (9760 ft.).

From 23rd to 31st May, fine hot weather, with continual TSS on mountains; first three days of June very fine.

Morning of June 4th hot; sun burning; air full of electricity. Temperature, 72°·0; after storm, 68°·0. Barometer steady at 27·600 in., as shown by registering aneroid. General direction of wind, as indicated by cir. and cir-c, S.W.; N.N.E. breeze down the valley, as usual in fine weather.

We started for the Eib See about 2.30 p.m. About 3.30 heavy TS in S. and S.E. A second came up from S.W. behind Daniel or Ups Spitz; loud thunder; no L visible; apparently very heavy rain falling. After passing the peak of the Daniel the storm divided, one part passing towards S. and E. over the Zugspitz, and along the Wetterstein range; the other and heavier part going N. and towards E. along the ridge of the Kramer Berg, the two parts being connected by a band of dark gray pocky-looking cloud, having a flat under surface, beneath which blue sky and mountains over the Plan See were visible.

From the S. portion of the divided storm, a considerable fragment of cloud seemed to detach itself, and to travel down the valley, following the course of the River Loisach, till it joined the band of cloud; it was very white, and rain or hail fell from it during its course. At ten minutes to 4 a long loud peal of thunder rolled along this band of

* Partenkirchen is in Lat. 47° 28′ N., and Lon. 11° 5′ E., and 2,269 ft. above sea level.

cloud, followed by a loud roaring, which at first seemed like a continuation of the peal, and the whole valley was filled with falling matter, which on approaching looked like immense drops of rain, but were, as it afterwards proved, large hailstones. The noise sounded as if a lake had burst, and was rushing down the valley, and our first thought was, Has the Eibsee burst? We hurried to an eminence to get a better view, the roaring increased, and we had barely reached the shelter of a châlet when a few immense drops of rain, like half-crowns, fell, and here and there a huge pure white hail-stone, which bounded high into the air on reaching the ground. In a moment (4 p.m.) these became general, and fell incessantly, without any rain, thunder, or lightning, for seven or eight minutes, covering the ground. Cattle were running everywhere down the hill sides for shelter; twigs and branches were torn off by the hail, the stems of some being three-eights of an inch in diameter; the stones rebounded from the ground on to the roofs of the châlets, the eaves of which were 16 ft. from the ground; wooden tiles (new) were knocked off the châlet under which we were sheltering ourselves; these as they lay upon the ground being split in two by other hailstones, the latter themselves being shivered into small fragments if they chanced to fall on a rock or stone.

It was most curious to see these small snowballs, as they appeared to be, striking the hill slopes, and flying high into the air, to descend a second time, and roll down to collect in masses in the hollows.

The storm ceased as suddenly as it began, a few large stones falling here and there, a gentle light rain (more mist than rain) falling for a few moments; the sun then came out, and at 4.15 all was passed away, the cloud gradually dissolving, as it travelled towards the S.E. leaving only the two main storms N. and S. over the Kramer and Wetterstein ranges respectively.

Only a slight wind accompanied the storm; the hailstones did not vary much in size throughout, the average size being $1\frac{1}{4}$ inches, few less than $\frac{3}{4}$ inch in diameter; the largest, No. 4 in sketch, being two inches long by $1\frac{1}{2}$ wide, $1\frac{1}{4}$ thick, and, as far as could be judged, 2 oz. in weight. Larger ones must, we think, have fallen, as on the way home, more than an hour after the storm, No. 2 stone was picked up, and it was then $1\frac{1}{4}$ inches each way.

By the Bader See the ground was strewed with branches, and though the ground was covered with large hailstones, there was no trace of them in the lake, which is of the clearest green water, apparently a foot deep, but in reality many feet, and in some places sixty or more. At Unter Grainau, about a mile N. from Ober Grainau, and separated from the river Loisach by a wooded ridge, the stones were much smaller, though of the same shape and character. From Ober Grainau to the Eib See the stones were of the same size. At both places the natives had taken the precaution of shutting their outer shutters, otherwise not a window would have escaped. They were much amused at the interest we took in the storm, and at our making

measurements and sketches of the stones; they say these curious shapes are by no means uncommon, nor are such storms, though it is three years since they had one with such large hailstones, and on that occasion the storm lasted much longer, the hail being ancle deep, and in many places, on the adjoining hills, over the knees in depth.

From the spot marked ⊕ in the map (where No. 2 stone was picked up), to the spot marked ✕ near Garmisch, there was comparatively little hail, and none of the large size; but here again it increased in quantity, and we found on arrival at Partenkirchen that there had been a severe hailstorm lasting for about ten minutes, and later by more than half-an-hour than that at Grainau.

This storm evidently proceeded from the N. portion of the original TS, which passed along the Kramer range, and crossed the valley running N.E. to the plain and Munich. It came from N.N.E. with a very strong wind the main TS passing over the Eckenberg N.E. of Partenkirchen to the eastward. The hailstorm travelled S. towards the Wetterstein range, to about the same spot where the Grainau storm disappeared. The hailstones were not so large as those at Grainau, but were of the same form and character, their average size being three-quarters of an inch diameter, the largest one three-quarter inch; several being of the size of peas only. When cut across they shewed concentric rings like those at Grainau. Two hours after the storms had passed, the hailstones were still lying in the open.

The general form of the hailstones was round or oval, the latter were generally in two parts joined together like a walnut shell.

Some were opaque like porcelain, others semi-transparent with a nucleus and not a few perfectly transparent and clear.

Two, opaque and transparent, melted in the hand, retained their opacity and transparency respectively to the last.

Subjoined is a description of a few of the stones, the shape of some being most extraordinary. A map of the country shewing the course of the two storms is also added *(see frontispiece)*, on which the courses of the storms are marked in red. The heavy black lines indicate the general direction of the mountain ridges.

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ROBT. THOS. JACKSON.
SAMUEL SPACKMAN.

Although the hail appeared to be falling so thickly, Mr. Egerton, who was some seventy yards from the rest of the party, said that not more than seven or eight stones struck his umbrella on his way to rejoin them.

DESCRIPTION OF HAILSTONES. *(See next page.)*

No. 1.—Like a snail's head. Nucleus at *a*. Perfectly transparent from *b*. At *c* a depression, looking as if a point, similar to that on the other horn, had been knocked off.

Nos. 2 and 3.—Irregular and opaque masses of ice (like the majority of the stones), the protuberances transparent and in No. 3 detached.

No. 4.—Somewhat like a glass scent bottle—the centre opaque and depressed, with a smooth surface. Surface of stone covered with innumerable small lumps, varying in size, and looking like boiled sago. When cut lengthways on line A B, rays were found running from the nucleus to the ends. The two sides seemed joined like a walnut.

No. 5.—Centre opaque; outer part transparent, with faint short rays from nucleus.

Nos. 6 and 7.—Like comets. Nucleus pure white and rather soft; the rings (*a b c*) opaque, and divided by thin transparent lines; *d* semi-transparent; *e* clear as crystal.

Nos. 8 and 9.—Round and pear-shaped opaque stones.

No. 10.—Section of 8 and 9, shewing concentric rings, five in number, like the section of a radish, or the stem of a tree cut across; each ring increasing in width from nucleus, the outer ring almost transparent.

Nos. 2, 3, 4, 5, 8 and 9 very numerous, and not a few of No. 8 perfectly transparent, with slight rays from centre; no real nucleus.

No. 4 was the largest picked up of that form. It was 2 inches long, $1\frac{1}{2}$ wide, and $1\frac{1}{4}$ thick, and weighed at least 2 oz.

It must be understood that all the drawings are as near as may be two-thirds of the actual size of the stones.

THE RECENT AURORÆ.

THE periodicity of auroræ has been long recognised, and Prof. Piazzi Smyth, the Astronomer Royal for Scotland, has recently described how, upon two strangers calling on him for meteorological information, he pointed out to them on his chart the auroral curve rising high towards the end of 1882. Accordingly, the last month (November) has witnessed a grand outbreak of these phenomena.

The accounts are probably not yet all published, but judging from what we have received, this display, or rather series of displays, extended at least from the 13th to the 24th of the month, and during this period not only were they seen when the nights were fine and clear, but cloudy nights showed an auroral glow, while the perturbations of the magnetic needle indicated that the displays, though invisible to us, were going on during each day.

The papers and scientific prints have teemed with reports, including two from the observatories at Greenwich and Edinburgh (the display in the latter case marred sadly by the smoke of Auld Reekie); from Leeds, Bristol, York, Bedford, Cirencester, Huntingdon, Windsor, and a host of places, with more or less graphic descriptions of what was seen. It is not easy to analyse these, but the accounts generally tend to show that the auroræ were earlier, and

of a more brilliant description, consisting of arches, glows, streamers, and beams in the north; and later both as to coming and leaving in the south, where they were more quiescent with much glow, and not so much of the moving streamers and arches. The descriptions, however, vary much. Hardly two are at all alike, but among them arches, beams, rays, glows, and in fact all the auroral phenomena (except the formation of the corona, of which we have seen no account) take a part. Perhaps the most interesting among these phenomena occurred about 6 p.m. on the 17th, when a bright beam of white-green light formed in the E., rose and drifted in about two minutes across the S. near the moon (then in declination 10° 35′ 28″ S) and sank in the W. It was to many a startling and almost awe-inspiring sight to see this brilliant mass of cloud-light, some 20° long and 3° broad passing along the heavens.

Some observers have assigned, in the *Times* and elsewhere, to this beam the name and character of a meteor, but it is as well to record that it was truly part of the aurora, as proved by a published observation, that it presented the auroral and not a meteoric spectrum. This point is the more important, owing to the "beam" being likely to prove of use in determining the height of the aurora, as it was seen to pass above, across or below the moon, according to the observer's station.

At the Southern and Eastern stations it passed above the moon; at the North and West below; and at intermediate stations across.

Different writers to "Nature" assign to this beam the varying heights of 44, 170, 200 and 212 miles, but as Messrs. De la Rue and Müller's vacuum experiments affirm that at 124 miles, no discharge could pass, the character of the aurora as an electric discharge in air, will apparently require further investigation and elucidation. It is unfortunate that, owing to the moonlight, the recent displays have not added much to our knowledge of the auroral spectrum. The yellow green (Prof. Piazzi Smyth's "citron" line) was seen universally. The red line occasionally, and faintly. The other lines either not at all, or else so vaguely as to render measures impracticable.

However, many observers have specially noted the brilliant green tint and phosphorescent appearance in the displays, which strongly suggest that the aurora, with its absence of recognized air spectrum and lines not far out of position with the bands of phosphoretted hydrogen, may be some form of phosphorescence excited by the polar electric discharges.

Our notice must also include sunspots and earth currents. The sunspots (according to Mr. Rodwell) have been abundant, and of considerable size since August last. During the recent auroræ a grand one has been observed. This was the largest one photographed at Greenwich, according to Mr. Brodie, measuring 56,000 miles by 51,000, and estimated by Capt. Noble to contain 2,000,000,000 square miles of surface. Very noticeable, too, has been the activity

of these spots or solar storms. The large one was observed to change its details in a few hours, and between 4 o'clock one afternoon and 10 the next morning, the umbræ had quite altered in shape. Smaller spots have also been in abundance, and mostly have shewn considerable signs of activity. But again, as to these, the low altitude of the sun prevented such observations of the changes in minute detail of the surface as might have been desirable. Enough, however, was seen to show the great solar disturbance which was taking place. With regard to the earth currents, the public journals have contained many and almost marvellous accounts of the trouble and difficulty experienced in working the State telegraphic communications during the auroral epoch.

In some cases the wires were so highly charged that all ordinary working was temporarily set aside. These charges were not intense (no sparks or shocks are recorded), but had the effect of gradually drawing the needle aside to some 45° from the vertical, where it would remain, and then go back to the same angle on the other side, showing that a succession of positive and negative currents was flowing. The difficulty of working is got over in these cases by partly revolving the needle card with its studs, and working the needle while in its diverted position, and it was curious to see messages sent under these circumstances.

On examining the times when the wires were most strongly charged, it was found that they coincided closely with the outbursts of the auroral displays. These too appear to have reached a maximum about midnight, and a similar maximum about midday as evidenced by the needle disturbances. Atmospheric electricity was, as a rule, more than usually quiescent, while these earth currents were so strong. The passage of the "bright beam" before mentioned was accompanied at Sidmouth by an an unusually strong telegraphic disturbance. A pointsman had false signals conveyed to him; bells were set ringing, and other interruptions to his work experienced. The declination and horizontal needles in our national and other observatories, registered correspondingly considerable movements in both directions.

Nor were these manifestations of auroral and magnetic disturbances local to Great Britain. From America and Sweden, from Rome, Florence, and Spain, came accounts also, though, perhaps, we must receive with caution the report that in America the earth currents were strong and persistent enough to work an electric lamp.

The entire history of this series of auroræ, sunspots, and magnetic disturbances will doubtless, when collected, prove of the highest interest and value. The meteorological conditions pending the auroral period, of course differed according to locality; but speaking generally, the weather may be described as of an unsettled character, with rather low temperature, and with varying sky conditions, auroræ being reported from some places, which, from the presence of clouds, were not seen short distances off.

Some observers report storm clouds and lightning in the early part of the period, while others speak of peculiarly coloured sunsets and so-called magnetic arrangement of clouds. Winds mostly N and W, and of medium force seem to have prevailed and to have been accompanied by varying, but mainly low dew-point, hygrometric conditions. The auroræ passed off with a warmer temperature and air more saturated with moisture, but a still unsettled character of weather, solar and lunar halos (in some cases of abnormal form) being seen. The popular impression that auroræ predict an inclement winter, appears likely to be confirmed by the recent cold wave experienced here and abroad. The large quantity of berries on fruit-bearing shrubs is also by tradition connected with a hard winter—while one observer with more perhaps of reason for his theory, associates the movements of certain insects with such a forecast. Certainly everyone has remarked on the sudden and violent changes of weather conditions which have accompanied and followed our Northern Light period of 1882.

J. R. C.

THE METEOROLOGICAL SOCIETY.

The opening meeting of the session was held on Wednesday evening, the 15th ult., at the Institution of Civil Engineers, Mr. J. K. Laughton, F.R.A.S., president, in the chair.

Eleven new Fellows were elected, viz. :—Rev. J. Brunskill, F. B. Buckland, C. F. Casella, W. H. M. Christie, F.R.S. (*Astronomer Royal*), A. Cresswell, R. S. Culley, C. Morris, O. L. O'Connor, H. Parker, F.Z.S., A. Rowntree, and D. R. Sharpe.

The papers read were :—1. "On Certain Types of British Weather," by the Hon. Ralph Abercromby, F.M.S. The author shows that there is a tendency of the weather all over the temperate zone to occur in spells associated with certain types of pressure-distribution. In Great Britain there are at least four persistent types—the southerly, the westerly, the northerly, and the easterly. In spite of much fluctuation, one or other of these types will often continue for weeks together, and tend to recur at the same date every year. The value of the recognition of type groups is shown in the following ways :—(1). They explain many phenomena of weather, and many popular prognostics. (2). In some cases they enable forecasts to be issued with greater certainty and longer in advance than usual. (3). We can by their means correct statistical results, by giving the real test of identity of recurrent weather, which no single item, such as heat, cold, rain, &c., can do. (4). They enable us to treat such geological questions, as the influence of changing distribution of land and sea on climate, in a more satisfactory manner than can be done by any other mode.

2. "On the use of Kites for Meteorological Observation," by Prof E. Douglas Archibald, M.A., F.M.S. In this paper the autho advocates the use of kites for Meteorological Observations, and

describes the mode in which they may be best flown so as not to be mere toys, but scientific instruments, capable of ascending to great heights, 1000 ft. or more, remaining steady in currents of varying velocity, being manipulated with ease and rapidity by the observer, and carrying instruments of considerable weight.

3. "The Meteorology of Mozufferpore, Tirhoot, 1881," by Charles M. Pearson, F.M.S.

At the close of the meeting, Mr. S. G. Denton, F.M.S., exhibited a set of 46 mercurial thermometers, which were made by him between February and June, 1881; they were all tested at Kew Observatory in June, 1881, were then placed at the observatory under seal, and the case was only opened for their reverification in January 1882 and June 1882, when it was found that scarcely any rise of zero point had taken place. As no paper descriptive of the mode of manufacture was submitted to the Society, we can of course merely state the above somewhat remarkable facts. Until the method adopted is explained, we shall prefer to rely upon age as the most certain mode of escaping serious change of zero, but in cases where a thermometer of special pattern is required to be made and and used within a few months, Mr. Denton's method whatever it may be, appears likely to be very valuable.

GREAT RAINFALL IN THE NORTH EAST OF THE UNITED STATES.

SEPTEMBER 20TH-24TH, 1882.

[OUR readers are probably aware that the average rainfall of New York and over the State of New Jersey is about 40 inches, or much the same as at stations clear of hills on the western coast of the British Isles. With this fact before them they will realise the exceptional character of the above rainfall, the following notes respecting which we extract from No. 9 of the "New Jersey Weather Review," edited by Mr. W. Earle Cass.—ED. *Met. Mag.*]

One of the most memorable rain storms that has ever been recorded in the State of New Jersey, occurred on Sept. 20th to 24th. Beginning on the 20th with light rains which gradually increased, until they reached an amount that has never been equalled in this State, so far as the records show, except in isolated localities. The result of all this downpour was the rising of the various streams, especially in Passaic, Essex, Union, Middlesex and Mercer counties, until they were beyond control, when, breaking all bounds, they carried destruction before them, such as was never known in this State before. Space will not allow of an extended notice of this storm, and as the daily press has furnished far more information in regard to it than can possibly be inserted here, only such matter as is noteworthy to the meteorologist will be given.

Rainfall of September 20th, 21st, 22nd and 23rd, 1882.

	20th.	21st.	22nd.	23rd.	TOTAL.
Port Jervis, N.Y.	...	·09	1·38	2·61	4·08
Newton	·07	·50	2·17	2·855	5·59
White Plains, N.Y.	...	...	..	3·35	...
Delaware, Water Gap. Pa.	...	...	1·45	2.40	3·85
Paterson	...	·95	5·55	11·40	17·90
Caldwell	...	·80	2·38	7·75	10·93
Belvidere.....	...	·02	2·85	1·95	4·82
South Orange	...	...	3·50	7·50	11·52
Newark, Summer Place..	·13	·35	3·33	7·39	11·20
,, Lombardy St.	...	...	...	8·67	12·60
New York Sig. Office ...	·57	·78	1·49	6·17	9·01
,, ,, Central Park.	...	...	...	...	11·65
Readington	...	·30	4·20	4·50	9·00
Somerville	·35	...	3·34	4·35	8·04
New Brunswick.....	·62	·61	4·12	6·49	11·84
Sandy Hook	·33	·30	2·23	2·14	5·00
Princeton.....	...	·30	2·49	5·69	8·48
Freehold	·48	·32	2·72	3·33	6·85
Fallsington, Pa.....	1·65	·17	2·20	4·94	8·96
Moorestown	...	·51	2·33	4·66	7·50
Philadelphia, Sig. Office..	...	1·72	4·65	3·72	10·09
Barnegat	·82	·19	·40	·94	2·35
Atco	...	...	...	5·45	5·45
Vineland	...	21st to 26th	...	...	6·09
Atlantic City	...	·16	·39	·17	0·72
Cape May	...	·30	·11	·92	1·33

Special Measures of Rain during the Storm.—At New Brunswick, 23rd, 6.30 p.m., 1·10 inch in 30 minutes. Newark, 23rd, 1 p.m., 0·82 inch in 30 minutes, 7 p.m. to 8 p.m. 0·865 inch, 8 p.m. to 9 p.m. 0·95 inch. Newton, 22nd, 2·17 inch in five hours, 23rd, 0·925 inch in 30 minutes. South Orange, 23rd, 9 a.m. to 11 p.m. 7½ in Moorestown, 23rd, 2 p.m. to 8.30 p.m. 3·29 inch. The amount of rain at Paterson and New York Central Park, as shown by Prof. Draper's self-recording rain gauges, was as follows :—

From	To	Hrs.	Min.	New York.	Paterson.
9 p.m. on the 20th...	8 a.m. on the 21st ..	11	...	1·00	·82
9 a.m. ,, ,, 21st...	7 p.m. ,, ,, ,, ...	10	...	...	·08
7 p.m. ,, ,, ,, ...	4 a.m. ,, ,, 22nd..	9	...	·01	·12
4 a.m. ,, ,, 22nd..	8 a.m. ,, ,, ,, ...	4	...	·25	·13
8 a.m. ,, ,, ,, ...	9 a.m. ,, ,, ,, ...	1	...	·05	·78
9 a.m. ,, ,, ,, ...	Noon ,, ,, ,, ...	3	...	·40	2·00
Noon ,, ,, ,, ...	2 p.m. ,. ,, ,. ...	2	..	...	1·60
2 p.m. ,, ,, ,, ...	5 p.m. ,, ,, ,, ...	3	...	1·62	·92
5 p.m. ,, ,, ,, ...	4 a.m. ,, ,, ,, ...	11	...	...	·05
4 a.m. ,, ,, 23rd...	9 a.m. ,, ,, ,, ...	5	...	·67	·40
9 a.m. ,, ,, ,, ...	10.30 a.m. ,, ,, ,, ...	1	30	...	1·00
10.30 a.m. ,, ,, ,, ...	11 a.m. ., ,, ,, ...	0	30	·27	·30
11 a.m. ,, ,, ,, ...	1 p.m. ,, ,, ,, ...	2	...	...	3·70
1 p.m. ,, ,, ,, ...	Midnight ,, ,, ,, ...	11	...	7·38	6·00
				11·65	17·90

Observers' Remarks.—Paterson, "The above table readily shows why an excess of rain fell here. The rainfall in Paterson was nearly continuous, while in New York there were several periods in which no rain whatever fell. The table shows that during 9½ hours on the 22nd and 23rd, only 0·45 inch fell in New York, whilst in Paterson for the same time and hours 9·08 inches fell. In a few cases the New York rainfall was in excess of the Paterson fall, but not to any large amount." Freehold—"Clouds very dense, p.ms. of 22nd and 23rd so as to require lights in the class rooms at 3 p.m. for some 15 min. No damage by storm of 22nd and 23rd around here, except to one or two small bridges. No damage between Jamesburg and Sea Girt, but plenty on the New York and Long Branch lines." Fallsington, Pa. "No particular damage done in this vicinity except the washing away of towuship bridges." Moorestown.—"The heaviest noted rainfall during 19 years' observations, and most harmful, nearly every mill dam in this vicinity was swept away, bridges were removed, and trains hindered for many hours by wash-outs on the track as never before since construction." South Orange—"The rainfall of the whole period * * * was the largest amount from any storm in 13 years. The tornado and waterspout which passed over this section in August 1875, precipitated 5·40 inches of water, the most of which fell in two hours, and did more damage to roads and bridges than the present storm. Considering the severity of the rain of the 23rd, the damage done in the town and township was very small."

THE OCTOBER FLOOD.

In our last number, under the title of "Remarkable Rainfall," we printed a letter from Dr. Burder, of Clifton, reporting the fall of October 22-23, to which, for persistent downpour, the records of the previous thirty years afforded no complete parallel. We also stated that the discharge of the Avon at Bristol was unprecedented.

We have subsequently been favoured with a note from Messrs. C. Lucy and Nephew, of Stratford-on-Avon, giving the daily rainfall during October as follows:—

		in.				in.				in
Oct.	1	—	.. ...	Oct.	12	0·25	.....	Oct.	23	0·07
,,	2	0·15	.....	,,	13	0·23	.....	,,	24	2·30†
,,	3	—	.....	,,	14	0·05	.....	,,	25	0·02
,,	4	—	.....	,,	15	—	.....	,,	26	—
,,	5	—	.....	,,	16	0·70	.....	,,	27	—
,,	6	—	.....	,,	17	0·50	.....	,,	28	0·40
,,	7	0·12	.....	,,	18	—	.....	,,	29	—
,,	8	—	.....	,,	19	0·18	.....	,,	30	0·05
,,	9	—	.....	,,	20	0·20	.....	,,	31	0·23
,,	10	—	.....	,,	21	0·10	.....			—
,,	11	0·21	.....	,,	22	0·62	.....		Total	6·38

† This 2·30 in. fell in twelve hours.

and the following note :—

"On the 25th October, this year, we registered the highest flood on the Avon here since 1801 ; the water rising to a point two inches higher than in the memorable flood which reached its highest point July 22nd, 1875."

We reprint for comparison, and also as an indication of the class of information which is urgently needed, a paragraph from a paper on "Floods in England and Wales in 1875," read before the Institution of Civil Engineers in 1876.

"At Stratford-on-Avon a flood board was placed by the bank of the river, at the Stratford Flour Mills at the beginning of the present century, and every occasion when the floods have risen to 4 ft. above the weir has been recorded. Messrs. C. Lucy and Nephew, in sending the following list, remark that of a total of ten floods which have exceeded 4 ft. in height, four were in 1875, being the only instance where more than one flood has reached over the 4 ft. in the same year.

			ft	in.
1801	.....	Date unknown	7	$2\frac{1}{2}$
1821	.....	December 25th	5	$8\frac{1}{4}$
1848	.....	October 1st	6	$4\frac{1}{2}$
1852	.....	November 12th.....	5	$10\frac{1}{2}$
1853	.....	July 15th	5	5
1872	.....	December 14th	5	4
1875	.....	July 22nd	6	8
,,	.....	October 12th	4	9
,,	.....	October 21st	6	$0\frac{1}{2}$
,,	.....	November 14th	5	9
1882	... ..	October 25th.....	6	10

We have added the recent flood so as to complete the list.

We shall be greatly obliged by any of our readers who can supply lists of flood levels doing so, and by all, who have convenient opportunities, commencing similar records. Accurate details of the highest points reached by floods are of extreme engineering importance.

HALOS AND WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—In accordance with your suggestion in the *Meteorological Magazine* for October, I send you some notes on halos and weather.

Of 122 solar halos observed here from October 1st, 1880, to October 31st, 1882, 73 were followed by rain within 24 hours, and 49 by fine weather, but in 22 cases out of the 49 rain fell within 48 hours. Of 21 lunar halos 12 were followed by rain in 24 hours, 9 by fine weather, with rain in 48 hours in 5 of the 9. The largest number of halos was noted in the month of May. In the present month (November) 6 solar and 4 lunar halos have occurred, and after all of them rain fell within 24 hours.

Yours truly,

E. T. DOWSON.

Geldeston, Beccles, Nov. 22nd, 1882.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1882.

STATIONS. *(Those in italics are South of the Equator.)*	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	77·8	30	46·0	1	71·5	53·0	52·0	74	128·8	44·1	2·95	18	6·1
Cape of Good Hope	77·4	15	34·0	14	64·0	46·2	49·6	82	...	...	5·33	12	4·1
Mauritius	75·6	5	60·6	19	73·0	65·5	59·9	73	...	...	2·76	19	6·1
Calcutta	92·5	1	75·9	15	88·3	78·2	78·2	86	160·2	74·0	11·76	28	8·2
Bombay	84·9	29	74·9	27	82·4	76·0	76·1	90	143·3	71·2	26·94	30	9·6
Ceylon	86·3	26	71·8	15	84·0	75·8	72·1	78	152·6	65·0	12·89	19	8·2
Melbourne	64·0	7	33·0	21	54·7	42·1	39·4	74	112·9	27·0	2·25	16	6·1
Adelaide	69·7	6	34·5	17*	56·8	41·9	41·4	74	129·5	27·5	2·12	16	5·8
Wellington	61·0	14	37·0	20	53·4	44·0	...	...	114·0	30·0	8·67	23	...
Auckland	62·0	1	37·6	24	57·3	46·3	46·6	83	...	32·9	9·16	25	6·2
Falkland Isles	46·9	12	23.2	24	40·1	32·1	34·1	92	85·0	20·0	·84	21	7·1
Jamaica	90·8	12†	71·8	7	88·4	73·9	73·2	77	...	65·7	2·03	6	4·1
Barbados	83·0	var.	70·0	8, 11	82·0	73·0	73·6	82	148·0	70·0	5·99	20	6·0
Toronto	89·9	26	51·3	20	76·9	56·9	56·6	70	144·5	46·0	1·06	11	5·5
New Brunswick, S. John	74·0	12‡	44·0	3	66·2	52·6	54·9	85	...	...	4·64	14	6·0
Cape Breton, Sydney	83·9	26	46·0	1	72·9	53·7	55·8	75	...	...	3·68	13	5·6
Newfoundlnd, S. John's	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	85·7	24	37·5	13	74·7	53·1	56·3	77	149·5	...	6·61	12	4·6

* And 28. † And 26. ‡ And 15.

REMARKS, JULY, 1882.

Mauritius.—Mean temp. and rainfall both a little above average; mean pressure 30·243 in.; mean hourly velocity of wind 13·6 miles; extremes 31·6 miles and 1.9 miles; prevailing direction E.S.E. C. MELDRUM, F.R.S.

Ceylon.—Thunderstorms occurred on 4 days, and T was heard on 2 other days. J. STODDART.

Melbourne.—Mean pressure, temp., humidity, and amount of cloud all about the average; rainfall above it; prevailing wind N., heavy squalls occurring on 5 days; hoar frost on 4 days, and ice on 21st. Snowstorm on 26th over a great portion of S. eastern Australia. L on 3 days; H on 27th; dense fog on 19th. R. L. J. ELLERY.

Adelaide.—Mean pressure (30·145 in.) slightly, mean temp. (49°·3) 2°·5, and rainfall nearly ·50 in. below average. The latter part of the month was very cold, and frost was of frequent occurrence. C. TODD.

Wellington.—Unpleasant, showery, squally weather, almost throughout the month, and only a few fine days. Strong winds on 7 days, prevailing direction, N.W.; T on 2 days, H on 2 days; rainfall on 27th 2·90 in., causing much damage by floods. Mean temp. above, and mean pressure below average. R. B. GORE.

Auckland.—Mean pressure ·2 in., and mean temp. °·8 below average; rainfall nearly double the average; wind mostly W. and S.W. Weather constantly wet and stormy. E. B. DICKSON.

BARBADOS.—Mean pressure slightly below average, mean temp., 76°·7 also slightly below average; prevailing wind N.E., average velocity 12·6 miles, extremes 19 miles and 7 miles. Rainfall 3% below, and evaporation 35% above average. TSS on 3 days. R. BOWIE WALCOTT.

WINNIPEG.—Rainfall 3·97 in. above average, and the largest fall in any month during 10 years, excepting June, 1877, when 7·69 in. fell.

SUPPLEMENTARY TABLE OF RAINFALL, NOVEMBER, 1882.

[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	3·17	XI.	Solva	4·11
,,	Margate, Birchington...	3·19	,,	Castle Malgwyn	6·77
,,	Littlehampton	3·90	,,	Rhayader, Nantgwillt..	11·63
,,	St. Leonards	3·57	,,	Carno, Tybritle	10·92
,,	Hailsham	4·31	,,	Corwen, Rhug	6·37
,,	I. of W., St. Lawrence.	4·02	,,	Port Madoc	7·92
,,	Alton, Ashdell.....	4·23	,,	I. of Man, Douglas	8·29
III.	Great Missenden.....	3·62	XII.	Carsphairn	10·01
,,	Winslow, Addington ...	4·35	,,	Melrose, Abbey Gate...	3·77
,,	Oxford, Magdalen Col...	3·42	XIII.	N. Esk Res. [Penicuick]	4·45
,,	Northampton	3·40	XIV.	Ayr, Cassillis House ..	6·18
,,	Cambridge, Beech Ho...	2·41	,,	Glasgow, Queen's Park.	5·50
IV.	Southend	2·93	XV.	Islay, Gruinart School..	7·41
,,	Harlow, Sheering	3·21	XVI.	St.Andrews,NewtonBk	4·69
,,	Diss	2·96	,,	Aberfeldy H.R.S.	4·55
,,	Swaffham	3·32	,,	Dalnaspidal	7·73
,,	Hindringham	4·24	XVII.	Tomintoul.....	...
V.	Salisbury, Alderbury...	3·65	,,	Keith H.R.S.	4·30
,,	Calne, Compton Bassett	4·30	XVIII.	Forres H.R.S.	2·54
,,	Beaminster Vicarage ...	4·22	,,	Strome Ferry H.R.S....	10·46
,,	Ashburton, Holne Vic..	9·54	,,	Lochbroom	6·66
,,	Torrington,LangtreeW.	7·55	,,	Tain, Springfield.....	2·48
,,	Lynmouth, Glenthorne.	8·58	,,	Loch Shiel, Glenaladale	14·51
,,	St. Austell, Cosgarne...	...	XIX.	Lairg H.R.S.	...
,,	Taunton, Fullands	3·61	,,	Forsinard H.R.S.	4·60
VI.	Bristol, Clifton	...	,,	Watten H.R.S.	3·91
,,	Ross	3·82	XX.	Fermoy, Glenville	5·74
,,	Wem, Sansaw Hall.....	3·88	,,	Tralee, Castlemorris ...	6·52
,,	Cheadle, The Heath Ho.	4·93	,,	Cahir, Tubrid	3·99
,,	Worcester, Diglis Lock	3·97	,,	Newcastle West	6·53
,,	Coventry, Coundon	4·05	,,	Kilrush	...
VII.	Melton, Coston	3·57	,,	Corofin	6·70
,,	Ketton Hall [Stamford]	3·38	XXI.	Kilkenny, Butler House	...
,,	Horncastle, Bucknall ...	3·03	,,	Carlow, Browne's Hill..	3·90
VIII.	Macclesfield, The Park	6·18	,,	Navan, Balrath	4·22
,,	Walton-on-the-Hill.....	4·60	,,	Athlone, Twyford	7·12
,,	Broughton-in-Furness ..	9·59	XXII.	Mullingar, Belvedere ...	6·28
IX.	Wakefield, Stanley Vic.	2·92	,,	Clifden, Kylemore	11·90
,,	Ripon, Mickley	4·19	,,	Crossmolina, Enniscoe..	8·71
,,	Scarborough.....	3·86	XXIII.	Carrick-on-Shannon ...	4·57
,,	EastLayton[Darlington]	3·37	,,	Dowra	7·49
,,	Middleton, Mickleton ..	6·08	,,	Rockcorry.....	6·27
X.	Haltwhistle, Unthank..	4·86	,,	Warrenpoint	7·80
,,	Carlisle, St. James Rd...	5·31	,,	Newtownards	4·54
,,	Shap, Copy Hill	6·88	,,	Belfast, New Barnsley .	7·64
XI.	Llanfrechfa Grange	6·62	,,	Bushmills	7·48
,,	Llandovery	8·21	,,	Buncrana	7·82

NOVEMBER, 1882.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·57	+ ·13	·43	15	18	61·8	5	25·4	18	4	12
II.		Maidstone (Hunton Court)...	3·46	+ ·56	·57	14	22	...	...	...	...	...	...
,,		Strathfield Turgiss	2·77	+ ·02	·52	6,15	20	60·3	5	21·2	18	8	19
III.		Hitchin	3·26	+ ·65	·95	15	23	57·0	5	22·0	17	13	...
,,		Banbury	4·25	+ 1·54	·86	6	23	59·0	5	22·0	18	13	...
IV.		Bury St. Edmunds (Culford)	2·70	— ·13	·42	6	24	60·0	5	24·0	17	9	..
,,		Norwich (Cossey)	3·68	+ ·37	·84	6	21	59·5	5	24·5	18	7	10
V.		Bridport	3·60	...	·68	6	19	...	..	...	...	...	...
,,		Barnstaple.....	7·61	+ 3·46	·89	6	24	61·0	6	28·0	15	...	..
,,		Bodmin	6·10	+ ·78	·70	6	27	56·0	4	29·0	15	2	5
VI.		Cirencester	4·79	+ 1·81	·66	6	20	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	5·20	+ 1·76	·63	23	26	57·0	5	29·0	15	10	20
,,		Tenbury (Orleton)	3·99	+ 1·13	·58	6	23	61·5	5	22·0	18	10	17
VII.		Leicester	3·18	...	·57	6	25	58·5	5	22·0	18	7	16
,,		Boston	2·79	+ ·42	·65	6	19	60·0	5	26·0	18	3	...
,,		Grimsby.....	2·96	— ·14	·52	3	24	58·0	5	27·0	18	5	...
,,		Hesley Hall [Tickhill].....	3·08	...	·39	4	23	56·0	4	23·0	18	7	...
VIII.		Manchester (Ardwick).....	6·01	+ 3·04	·69	20	25	56·0	1	29·0	12*a*	0	...
IX.		Wetherby (Ribstone Hall) ..	2·95	+ ·19	·38	4. 26	15	...	...	...	...	...	...
,,		Skipton (Arncliffe)	9·87	+ 4·12	1·32	5	27	54·0	5	22·0	17	...	...
X.		North Shields	2·71	— ·74	·42	18	23	59·5	5	27·2	18	11	11
,,		Borrowdale (Seathwaite).....	18·52	+ 6·70	2·52	3	23	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely).....	6·01	+ 1·81	·91	6	17	...	...	...	...	...	...
,,		Haverfordwest	6·33	+ ·99	·70	3	20	...	...	25·0	14	5	12
,,		Plinlimmon (Cwmsymlog)...	9·27	...	·82	21	25	...	...	...	...	...	...
,,		Llandudno.....	3·91	·00	·48	5	23	56·1	5	30·2	15	1	...
XII.	SCOTLAND.	Cargen [Dumfries]	5·39	+ 1·48	1·03	3	20	...	...	...	...	...	...
,,		Hawick	3·21	·00	·64	3	22	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	6·50	+ 2·95	·98	4	20	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	11·89	+ 6·53	1·15	3	23	...	...	24·0	17	15	...
,,		Appin (Airds)	8·84	...	...	...	...	...	...	...	...	...	.
,,		Mull (Quinish).....	9·35	...	·96	21	26	...	...	...	...	...	...
XVI.		Loch Leven Sluices	4·50	+ ·95	·60	6	17	...	...	...	...	...	...
,,		Arbroath	3·42	+ ·27	·53	5	20	53·0	1	28·0	20	13	...
XVII.		Braemar	5·52	+ 1·75	·89	3	20	48·8	1	16·8	30	21	29
,,		Aberdeen	5·22	...	·88	25	25	53·0	1	26·0	19	11	...
VIII		Skye (Sligachan)	...	...	...	...	...	...	...	...	...	...	...
,,		Culloden	2·20	— ·50	...	...	...	53·2	1	26·8	14*b*	12	26
XIX.		Dunrobin	3·66	...	·50	26	18	52·0	1	27·5	14	13	...
,,		Orkney (Sandwick)..... ..	4·02	— ·42	·68	18	21	51·2	1	30·2	20	5	19
XX.	IRELAND.	Cork (Blackrock)	5·10	+ ·49	1·19	30	23	56·0	5	26·0	13	8	...
,,		Dromore Castle	9·05	...	·95	3	27	56·0	4	31·0	13	...	...
,,		Waterford (Brook Lodge) ...	4·14	...	·88	30	22	57·5	5, 22	29·0	12	6	...
,,		Killaloe	7·63	...	·75	3	22	58·0	2	27·0	12	6	...
XXI.		Portarlington	4·47	+ 2·07	·57	3	25	56·5	5	25·0	11	7	...
,,		Dublin (Monkstown)	...	...	...	...	...	...	...	...	...	...	...
XXII.		Ballinasloe	5·49	...	·64	4,7	26	54·0	1, 5	25·0	12*c*	11	...
XIII.		Waringstown	5·11	+ 2·40	1·13	15	23	57·0	1	23·0	11	13	22
,,		Londonderry...	...	...	...	...	...	...	...	...	...	...	...
,,		Omagh (Edenfel).....	6·85	+ 3·80	·85	15	26	55·0	5	24·0	11	15	...

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

a And 18. *b* And 17. *c* And 14.

METEOROLOGICAL NOTES ON NOVEMBER.

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 weather of the month was unsettled and changeable; very wet without very much R; the country was much flooded, and the sodden state of the land will probably bring again the fluke in sheep. Primroses in flower on 5th; swallow seen on 18th.

HITCHEN.—On the 15th the heaviest fall of S since January 1881.

BANBURY.—Mean temp. 41°·6; mean pressure low, but weather generally fine when it was lowest. S on 16th 3½ in. deep, and much more in the country; floods frequent; high wind almost daily till 14th; L frequent at night during first part of month. Remarkbly fine rosy aurora on 17th.

CULFORD.—High winds, continual wet, and frequent frosts caused the leaves to fall early; root crops exceedingly good.

COSSEY.—Brilliant aurora on 17th; solar halo on 21st; L all the evening of 8th.

BODMIN.—The singular characteristic of the month was that the most unfavourable weather nearly always followed a rising bar. and that the lowest bar. was attended by better weather. Mean temp. 45°·0.

CIRENCESTER.—A mild month with considerable rainfall; land so wet that wheat could not be planted.

WOOLSTASTON.—A month of incessant R; mean temp. 41°·0; T and L with H on morning of 4th, and again with very violent H on 8th from 9.30 to 10.30 p.m. A remarkable display of aurora in the early morning of 18th. S on 15th.

ORLETON.—The first six days were warm with R daily and rough wind; on the night of 6th a heavy fall of R occurred, and the remainder of the month was generally cold and rainy with occasional sunshine and strong gales of wind. A fall of S occurred on 15th, covering the ground to a depth of from three to six inches. Very little wheat planted owing to the wetness of the land. Mean temp. 1°·5 above the average of 20 years; bar. low and very unsteady, with frequent changes of wind. Auroræ on 17th and 27th.

KILLINGHOLME.—Weather very unsettled, and farm work at a standstill, owing to the almost daily R.

SEATHWAITE.—H and T frequent during the month; eight falls of R exceeding 1 in. in 24 hours. Gale on 5th; aurora on 17th.

WALES.

LLANDUDNO.—A showery and unusually dull month, the total duration of bright sunshine being only 31·7 hours. Mean temp. about 0°·8 below the average, but frost occurred on one night only; electrical and atmospheric storms were frequent. S on distant hills from 8th to end of month.

SCOTLAND.

CARGEN.—A dull, stormy month. Duration of sunshine 72 hours, 22 hours below average; T and L frequent during first part of month; auroræ on 13th and 17th.

HAWICK.—A month of very variable weather; magnificent aurora on 17th.

BRAEMAR.—A very unsettled month, frequent heavy storms with R and S. Auroræ on 13th and 20th.

ABERDEEN.—The weather was rainy and unsettled throughout the month, and the total rainfall is about two inches above the average; L on 20th; auroræ on 13th, 17th, and 18th; from 17th to 19th telegraphic communication was interrupted by powerful earth currents.

CULLODEN.—The weather during the month was favourable for field labour, the period from 11th to 22nd being very fine; moderate frosts at night very general all through the month.

SANDWICK.—November was damp and calm, and the ground was so wet as to put a stop to ploughing, but this must have been owing to a want of evaporation during the calm weather rather than to the fall of R, which was not great. The month was remarkable for frequent displays of aurora (seen on 10 nights), those on 12th, 13th, and 20th having been particularly brilliant, and that on

17th a fiery red colour; gales of 50 miles an hour for two hours on 4th, and three hours on 18th.

IRELAND.

DROMORE.—The month was incessantly rainy, but not generally cold; on the evening of the 22nd, a lunar rainbow was seen.

WATERFORD.—Rainfall above the average; prevailing winds S.W. and N.W. Gales on 3rd, 4th, and 19th; L on 7th; T and H on 8th; solar halo on 13th.

KILLALOE.—A very wintry month, unusally wet and stormy; L and T on 3rd.

BALLINASLOE.—The month was generally very squally and wet, with L and T in the early part; very high floods all over the country, and much damage to the potato crop.

WARINGSTOWN.—A very wet and gloomy month; the wettest November during 21 years; brilliant auroræ on 13th and 17th.

EDENFEL.—An extremely wet, cold, and inclement month; owing to the failure of the potato and the scarcity of turf (from the wet summer) there is much privation and suffering amongst the poor.

HALOS AND WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—In reply to the note in your October number, page 140, I give my experience.

The average number of days on which there are solar halos here, according to my observations from 1866 to 1879, is 76, and the average number of nights on which there are lunar halos is 25. In nearly all cases there was the ordinary halo of about 23° radius, as it seldom happens that there is any other kind of halo without this also being seen. Halos are common in very fine, even in settled fine, weather. When a covering of cirrus gradually overspreads the sky and grows thicker and thicker, as a rule it is a sign of the advance of a barometric depression, nearly always accompanied by more or less rain. In these cases a halo is usually seen upon the cirrus; but sometimes there is no halo, or at least it has escaped my observation. I am not aware, however, that on these occasions the rain is less likely to follow than when the halo is present. I am of the opinion that when halos are very striking, or when they are of any other kind than the ordinary one, or when there are mock-suns, rain usually follows; but not having kept account of the occasions when this occurs, I am merely giving my impression. Some of the most remarkable halos occur on the fringes of thunder-clouds or snow-clouds, and on these occasions there is usually, perhaps always, a shower; but it may not occur in the precise locality whence the halo was observed.

I have not noticed any other circumstances in which halos are directly connected with rain or snow; and bright halos undoubtedly occur without any rain following.

The number of halos per year, as mentioned above, is considerably greater than any of the numbers given in your note; it seems probable, therefore, that I have taken account of fainter halos or of more fleeting ones than the observers there named.—Yours truly,

THOS. WM. BACKHOUSE.

Sunderland, 28th Nov., 1882.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCIV.] JANUARY, 1883. [PRICE FOURPENCE, *or 5s. per ann. post free.*

THE RECENT FLOODS IN WESTERN EUROPE.

WE find ourselves in an unpleasant difficulty with respect to this subject, because it is contrary to our wish to put forward incomplete work, and on the other hand it is quite impossible for us to discuss thoroughly a question which involves the examination of all the rain and river records of Central and Western Europe. Yet it would scarcely be right to allow, what seem to have been amongst the greatest floods of the present century, to pass without notice. We console ourselves with the certainty that among the many Germans who are competent to grapple with the question, one or more is sure to undertake it, and to treat it with the exhaustiveness characteristic of his countrymen. We therefore proceed first to give a series of notes, as much condensed as possible, of the damage done; then (on page 181) a brief epitome of them, and a table of daily rainfall in parts of Austria, Germany, Belgium, and France, around those which have suffered most.

BERLIN, DEC. 28.

The *Rhine* province is threatened with a repetition of the late destructive inundations, and every hour brings intelligence of increasing danger. At *Cologne* this morning, about 10 o'clock, the river was 21 ft. deep, and gaining 2½ in. per hour. The quays were flooded, and several streets were already under water. A telegram from *Neuwied*, at noon, announced a general panic, caused by the unprecedentedly rapid rising of the *Rhine*, which it is feared would exceed the limit reached a week or two since. At *Mannheim* the *Neckar* had risen 18 ft. since the 26th, and burst its banks, flooding and devastating that neighbourhood. The quays and low-lying streets of *Frankfort-on-the-Maine* were covered this morning, and the stream was fast increasing in volume. At *Cassel* the *Fulda* is in the same condition. Since yesterday the *Lake of Constance*, through which the *Rhine* flows, had risen from 3·43 to 3·67 mètres (11 ft. 3 in. to 12 ft.), and at *Waldshut* the depth of the river is 5·60 mètres (18 ft. 4 in.). Five bridges, one of them a pontoon, have been destroyed, and several embankments have already been burst. All the right tributaries of the *Rhine* are reported to be deeply flooded.

According to a later telegram, the bridge at *Lörrach*, in the *Wiesen* district, was swept away, with about 20 persons who were crossing it, most of them being drowned. An attempt to pass a train over a flooded line from *Appenweier* to *Kork* resulted in the unrailing of the engine, and the death of one and the wounding of several passengers. Most of the railway lines near *Mannheim* have already been rendered useless.

WIESBADEN, JAN. 2.

The floods, which already far exceed all previous ones since 1784, are still increasing. After a slight fall last night the *Rhine* is to-day rising 2 in. hourly. The *Upper Neckar* and the *Main* are also rising rapidly. The principal scene of devastation is from *Rastadt* to *Worms*, where the entire *Rhine Valley* forms a great lake, in some places 20 miles broad, with a strong current of 15ft. per second (10 miles an hour!) In seven villages on the *Ried Plains* near *Worms*, 500 houses have been destroyed, and entire streets swept away. Pioneers with boats rescue the people from the roofs of the churches. The loss of life is yet unknown, but is certainly serious. Nearly all the cattle are drowned. The refugees are shelterod in schools and churches. The sappers are cutting dams to draw off the back water. *Mayence* is still free from water, by the enormous efforts of the soldiers and firemen. A temporary railway has been built for the rapid transport of materials for embankments. At *Lorch* a landslip is imminent. The inhabitants are leaving their homes. *Neuweid* is again completely submerged. The *Dusséldorff* market square is flooded. The rains continue.

VIENNA, JAN. 2.

The rain continues, and the waters are still rising. The villages along the *Danube* just above *Vienna* are flooded. The greenhouses stand in the water, so that fruits and vegetables are floating in masses down the river. Military aid has been required. The long dykes in the *Prater* are in a bad condition. Many cellars are filled with water. In one suburb the people have been dislodged in great numbers. Under the great bridge on the quay the *Danube* is 4 mètres (13 ft.) higher than the normal standard. News from *Linz* announces a continual increase of the water there. Immense masses of water are expected to reach *Vienna* at midnight, and it is feared that they may destroy the dykes on the left bank. *Stockerau* was in great danger last night. Many hundred head of game have been drowned, as well as deer, pheasants and innumerable herds of cattle. A railway guard on an exposed point perished with his wife and six children. In *Freisenheim* most of the inhabitants are sheltered in the church, school, and town hall, every other house having fallen in; but many inhabitants have been drowned. *Oppau* is worse off. Rarely before has Europe witnessed such disastrous floods.

THE HAGUE, JAN. 2.

The whole of the North-Eastern portion of *North Brabant* is completely under water. Hundreds of families have been driven from their homes, and are houseless, and obliged to camp out in the neighbouring districts.

WIESBADEN, JAN 3.

Bad news from *Worms* is still arriving. From the *Ried* districts, near *Worms*, at least 10,000 persons are homeless, and in danger of starvation. The neighbouring towns are crowded with refugees. There are 3,000 at *Ludwigshafen*, 2,000 at *Mannheim*, and 2,000 at *Worms* lodged in the schools and churches. A steamer, with 100 sappers and miners, left *Mayence* to-day for *Worms*. The situation at *Mayence* is extremely critical. More dykes are broken in the vicinity. The soldiers are building additional embankments. Sixteen steam pumps are working day and night, including several locomotive fire engines. The inhabitants are much excited. The *Bingen* station is flooded. The island of *Niederwerth*, below *Coblentz*, is entirely submerged. The inhabitants, with their cattle, have retired to the garrets of the houses.

VIENNA, JAN. 3.

The railway along the *Danube* is under water, as also half the *Prater*. One half of *Linz* is flooded. The firemen and soldiers spent the night on the bridge with torches, as a telegram from *Ottensheim*, three miles higher up, announced that the bridge of boats had been torn away with several persons upon it. The bridge left *Ottensheim* at nine and reached *Linz* at half-past ten. When it passed under the arches with a thundering noise its speed was very great.

The persons on it managed to run it on shore, after having spent the greater part of the night in terrible danger. No English post has reached *Vienna* to-day, the *Rhenish* railways being everywhere damaged by the floods. Sad news reaches us from those parts. In every village the houses are falling in. Churches and schools are the only places of shelter, and even these are not always safe. Still, people remain as long as they can in the upper storeys, because a great number of thieves are prowling about in boats, and, entering the houses by windows, steal all they can lay their hands on. From the higher *Danube* and its affluents there is better news. The water is gradually subsiding. But lower down, and through *Hungary*, the effect of the pressure above is severely felt. In *Pressburg* the bridge of boats has been removed, as it was in danger of being carried away. In *Pesth* and *Buda* the water has everywhere covered the lower quays.

GENEVA, JAN. 3.

Part of the line between *Geneva* and *Bellegarde* is washed away. Direct railway communication with *France* and *Italy* is temporarily suspended.

BADEN-BADEN, JAN. 4.

Dreadful accounts keep coming in from the flooded districts, and it is to be feared that not only is the loss of property very severe, but also of human lives. In *Frankenthal*, *Oppau*, *Edigheim*, *Moersch*, *Bodenheim*, *Roxheim*, and *Studernheim*, more than 500 houses have fallen in, and over 9,000 people are roofless. During the flood these villages seemed like little half-swamped islets in a raging inland sea. In one place, 50 head of cattle and horses were seen up to their necks in water, and benumbed with cold and fright. The village of *Edigheim* may be said simply to have been washed off the face of the earth. From the village of *Oppau* 30 persons were rescued with difficulty in a large boat, but such a storm of wind arose that the craft was upset against two trees, and only one life was saved. In one village near *Mannheim* the flood was so grievous that some unprincipled persons formed the design of piercing a dam, which would have relieved them, but have flooded the town. The design was discovered in time, and military with loaded muskets were posted along the threatened spot, with orders to shoot if need be.

PARIS, THURSDAY, JAN. 4.

The *Seine* is now dangerously high, its present rise being even greater than that recorded a few days ago. Several houses in the suburbs have been completely swept away, and numerous accidents are reported. Serious disasters are feared.

MACON, THURSDAY, JAN. 4.

Up to yesterday evening the waters of the *Saone* and *Doubs* had risen considerably, inundating several villages. Thirty-two houses have fallen in at *Longepierre*, on the *Doubs*, through their lowest storeys being submerged. Several streets in *Chalons* and *Macon* are under water. The shops are closed, and considerable damage has been done. The floods commenced subsiding this morning.

VIENNA, JANUARY 4.

The mails did not arrive yesterday from either *Paris* or *London*. As regards the direct line to *Paris*, *viâ Munich* and *Strasbourg*, the route was changed on the 31st ult., and a notice was published by the railway authorities informing the public that as, owing to the floods, communication between *Vienna* and *Paris*, *viâ Stuttgart* and *Carlsruhe*, was interrupted, the evening express would go *viâ Munich*, *Lindau*, *Romishorn* and *Bâle*, and a midday express *viâ Passau*, *Bingen*, and *Metz*, to *Paris*.

The condition of the river has not greatly changed, and causes considerable apprehension. In some places a slight falling of the water has been noticed, and for various reasons a hope is entertained that the worst is past.

In consequence of the floods, the railway bridge between *Tulln* and *Absdorf* has been carried away, and the traffic between *Vienna* and those places has been stopped. All through *Hungary*, the *Danube* and its affluents are gaining,

and partial floods have occurred. No great damage, however, is reported. At *Pesth*, as the water is still rising, and in some cases, owing to the delay in blocking up the sewers, has got into the cellars, a special protection committee has been formed.

BERLIN, JAN. 4.

According to a telegram from *Cologne*, the *Rhine* had only risen an inch and a half since yesterday evening, and immense quantities of drift of all kinds were floating past. At *Mayence*, on the other hand, it has fallen a little, but the general danger and distress are still very great. Thousands of poor people are roofless, and churches and other public buildings have been thrown open to shelter them, while food is supplied by the public authorities.

MANNHEIM, JAN. 4.

The state of things here almost defies description. The town appears to stand on an island in the midst of a vast sea. From the Observatory, as far as the eye can reach in either direction, there is an immense expanse of waters extending to the horizon. The whole of the *Pfalz*, or *Palatinate*, seems to be under water. At *Mannheim* at *Ludwigshafen*, and throughout this part of the *Neckar* and *Rhine* districts, the loss of property, including houses as well as furniture and domestic animals, is incalculable. At *Ludwigshafen*, where the population and soldiers have been working day and night to strengthen the embankment, all efforts have proved in vain. The great *Rhine* dam gave way before the rushing waters yesterday morning, and the lives of hundreds were therewith placed in the highest peril. Up to noon, however, four hundred and forty children had been saved by help of boats, which took them from the falling houses. A hundred and fifty sick persons, who were bed-ridden, were also rescued by a steamer. From the environs of *Ludwigshafen* upwards of 2,500 persons have had to seek shelter in the town, and are now housed there. The number of houses swept away or ruined by the inundation is unprecedented. The village of *Friesenheim* is entirely deserted, and sixty-eight houses there are destroyed. One-third of the inhabitants of *Oppau* have had to abandon their homes and seek shelter elsewhere. On Tuesday there were five hundred in the church and four hundred in the school-house. No fewer than one hundred and twelve houses have been destroyed at that place; sixty houses have fallen in at *Edigheim*, and forty at *Mörsch*. The condition of the large number of persons who have been rescued, and are now under shelter, is one of the deepest distress.

Many small towns on the *Danube* are three feet deep in water. The whole district south of *Pesth* is flooded. 75,000 acres of cultivated land are entirely submerged. In one place near *Worms*, thirteen persons who had taken refuge on the roof of a house were drowned when the house fell. The total loss of life is estimated at from sixty to seventy.

VIENNA, JAN. 5.

As yet the water has fallen but little. From higher up the river, however, accounts come of a lowering in the level, and the danger has therefore considerably diminished. There is a possibility that one or other of the embankments may give way; but, as all the weaker parts have been looked to, this is not very much to be feared. In *Pressburg* the lower streets are flooded. At *Pesth*, though the water is high, there is still no danger.

BERLIN, JAN. 5.

The news from the *Rhine* is rather better to-day. At *Cologne* the river is falling slowly, and a similar report comes from *Mayence*, where the water yesterday stood as high as it was in November. Cold, dry weather has now set in, and it is hoped that the worst has been reached; but the damage already done is enormons, and the distress among the inhabitants of the inundated districts is terrible.

GENEVA, JAN. 5.

The floods are abating, but very slowly, The plain between *Monthey* and *Martigny* is still under water. Most of the roads in the *Valais* are either blocked by earthslips, or severed by water. The *Sembrancher Tunnel*, in the

valley of *Entremont*, is blocked by an earthslip, and at *Nendaz*, in the same canton, several properties, consisting of meadows and vineyards, have been utterly destroyed by a great earthslip. The *Lake of Geneva* is now higher than it was ever before known to be at this time of the year. On December 30th its height was 92 centimètres (3 ft.) above its normal winter level, and only 10 centimètres (4 in.) below the *maximum* level of the summer of 1880. During the next two months, the spring floods will, in all probability, be more disastrous than those of last week ; and the lakes and rivers of *Central Europe*, fed by the snows which are now accumulating in such enormous quantities on the *Alps*, bid fair to be next summer fuller than they have yet been in the memory of man.

BERLIN, JAN, 7.

From *Cologne*, *Coblentz*, *Mayence*, and other places it is announced to-day that the *Rhine* has fallen considerably since last night, and that much more favourable weather is now setting in. Tne Grand Duke of Baden is exerting himself to the utmost in the inundated districts, directing the distribution of relief and superintending precautionary measures.

VIENNA, JAN. 7.

Since yesterday morning the water has fallen more than one mètre (3 ft. 3 in.) and as the accounts from higher up the river report a similar fall, and fine, frosty weather has set in, the danger of a flood here is considered over, and the committees of rescue have been dissolved in the suburbs. Lower down the river, though there is also some fall, the effect has not yet been much felt. In *Pressburg* the *Danube Quay* and a lower suberb are still flooded, while in the country over 30,000 acres are calculated to be under water. It is feared that considerable damage will be done to the crops.

VIENNA, JAN. 8.

As far down as *Vienna* the water all over *Hungary* is steadily falling, but in the *Pesth* district it has been rising, though slowly. For the last few days bad accounts have been coming from *Raab*, lying on the river of the same name at some distance from the *Danube*, and this morning, in spite of the efforts made to strengthen it, a portion of one of the dikes gave way, and a suburb has been flooded to the depth of a mètre (3 ft. 3 in.) No casualties occurred. According to the latest accounts, the water was still rising. The *Theiss*, on the contrary, is rather low, as there the cooler weather has prevented the melting of the snow.

COLOGNE, JAN. 11.

The city is again free from water. As an illustration of the dimensions assumed by the late floods, it has been calculated that the surface inundated between *Mannheim* and *Bingen* alone, measured about 660 square kilomètres (255 square miles), or 120 (45 miles) less than the whole area of the *Lake of Constance*.

VIENNA, JAN. 11.

The *Pesther Lloyd* furnishes details of the inundation of *Raab* and its neighbourhood, supplied by one who has visited the scene. He estimates the flooded district at 12 German square miles (265 square miles). Two of the villages, *Revfalu* and *Pathaza*, are completely destroyed. The water has undermined the houses, mostly built of sun-dried bricks, and but few of them remain standing. The church and some houses about it, lying rather high, have escaped. The population, being mostly engaged in shipping, and having plenty of boats, were able to escape in time to *Raab*. They have, however, in many cases, lost all their property. A good portion of the live stock was saved, and they, with the human fugitives, are housed in schools, barracks and the seminary. In every quarter the ladies have established soup kitchens. In all about 30 villages have been partially or totally flooded, while the number of the homeless refugees is estimated at 10,000.

From an examination of the above notes it appears that flooding has occurred on nearly all the principal European rivers—on the

Danube, the Rhine, the Rhone, and the Seine, and, as usual, it has been the low-lying cottages which have suffered most.

If we look carefully at the course of these rivers, we find that they all have their origin, or flow within a radius of 100 miles round Strasburg, and our present impression is that the floods were due chiefly to exceptional condensation on the mountain ranges of the Jura, the Vosges and Schwabia, and to a slight degree to similar falls on Thuringia and the Hartz mountains. There is only one fact which does not seem very easily explained by the theory of an excessive rainfall on the mountain ranges of West Central Europe, which we have advanced, viz., the flooding of Raab.

Raab is a small town on a river of the same name which rises not very far from Grätz, and flows into the Danube between Vienna and Buda Pesth. We do not quite understand why this river was flooded, unless it arose from the enormous current in the Danube damming back the waters of the tributary which, by the bye, flows through very level and low-lying ground. But the rain returns from Vienna and Trieste agree in suggesting that no exceptional rain seems likely to have occurred over the Raab watershed. Hence we come back to the idea that its flow (perhaps slightly greater than usual) was obstructed by the unusual level of the Danube, and so the water "backed up" and flooded the little town of Raab.

Rainfall in Western Europe, Dec. 24, 1882-*Jan.* 4, 1883.

	Austria.		Germany				Belgium	France.			England
Date.	Vienna	Prague	Munich	Carls-ruhe	Cassel	Ham-burgh	Brussels	Nancy	Lyons	Paris	London
Dec. 24	...	...	·08	...	...	·08	·35	...	...	·04	·07
25	·16	...	·32	·32	·04	·08	·39	?	·08	·04	·52
26	·39	·24	·51	1·18	·91	...	·71	·63	·04	·22	·21
27	·75	·24	·20	·67	·35	·24	·28	·35	...	·06	·07
28	...	·24	...	...	·39	·04	...	...	...	·01	·01
29	...	...	...	·04	·20	·24	·20	·04	...	·06	·20
30	·04	·08	·04	·12	·55	...	·20	·04	?	·04	·44
31	·28	·08	·35	·55	·20	...	·51	·20	·39	·43	·21
Jan. 1	·32	·51	·35	·04	·20	·32	·04	...	...	·01	·09
2	·39	...	·08	·32	·43	·08	·24	?	...	·02	·02
3	·04	·04	·16	...	·16	...	·04	·08	·04	·02	...
4	...	...	·04	·04	..	...	...	...	...	...	·03
Totals	2·37	1·43	2·13	3·28	3·43	1·08	2·96	1·34 ?	·55 ?	·95	1·87

The ? denotes that the amount for that station on that date has not been published.

There does not seem anything very exceptional in the above values, but we must remember that nearly all these stations are in comparatively low-lying cities, whereas the real cause of the rise of rivers is almost always to be found in the highlands, whence they take their origin, whether the specific cause be rain, or the rapid melting of snow, or the two causes combined. A rainfall of $3\frac{1}{4}$ inches in ten

days is probably not a frequent occurrence either at Cassel or Carlsruhe; but, considering the high temperature prevailing during the period, we expect to hear that at the mountain stations the fall was much heavier; and although nothing has been said upon the subject, we should not be astonished if the rain was warm enough and heavy enough to be appreciably augmented by melting snow off some of the lower mountains. This is, however, speculation, which may meet the fate that not unfrequently attends such efforts.

THE RECENT MILD WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—Will you kindly allow the following to appear in your Monthly Record. The figures show the mean temperatures recorded here for the seven days ending January 1st. Thermometers in Stevenson stand 4 ft. above the ground:—

Date.	Mean Temperature.	Excess over average 1814-73.
1882.—December 26	51°·2	+ 13°·4
,, 27	52 ·9	+ 15 ·3
,, 28	52 ·5	+ 15 ·0
,, 29	52 ·2	+ 14 ·8
,, 30	50 ·7	+ 13 ·4
,, 31	50 ·3	+ 13 ·1
1883.—January 1	53 ·0	+ 15 ·8
Mean of Week	51°·8	+ 14°·4

Such a succession of warm days in December is almost without precedent. Having carefully examined Mr. Jas. Glaisher's Tables of "The Mean Temperature of every day since 1814," I find *but two instances* of seven *consecutive days* in December giving so high a *mean temperature*, viz.:—

In 1848, Dec. 7—13	mean temp.	52°·9
,, 1856 ,, 6—12	,, ...	52°·3

I am, Sir,
Yours respectfully,
G. T. GWILLIAM.

Bayswater, Jan. 2nd, 1883.

[We are indebted to Mr. Gwilliam for calling attention to the late exceptionally warm period, and in order to make the comparison rigorously perfect add, a few other values.

In the first place, Mr. Gwilliam's observations being made (quite rightly) in a Stevenson stand are not strictly comparable with Mr. Glaisher's mean values, which were obtained from readings on a Glaisher stand; and secondly, Bayswater and Greenwich Observatory undoubtedly differ slightly in temperature. The mean temperature for Greenwich computed precisely, as was formerly done by Mr. Glaisher, is given for each day in the Registrar-General's Weekly Reports. Comparing them with the above values we shall see the

difference between the Stevenson screen at Bayswater and the Glaisher screen at Greenwich.

DATE ..:	Dec. 26	27	28	29	30	31	Jan. 1		MEAN.
Bayswater.....	51·2	52·9	52·5	52·2	50·7	50·3	53·0	...	51·83
Greenwich.....	51·1	53·9	52·8	51·8	50·9	50·3	53·7	...	52·07
Bayswater.....	+·1	—1·0	—·3	+·4	—·2	·0	—·7	...	—·24

We were not prepared for the above result, viz., that the mean temperature in a Stevenson screen at Bayswater is $\frac{1}{4}$ of a degree colder than on the Glaisher stand at Greenwich.

We next submit two other comparisons, viz., the recent temperatures at Greenwich with (1) the mean of the sixty-year period worked up by Mr. Glaisher, and (2) with the means deduced by Sir George Airy, F.R.S., from the Greenwich photographic record, 1847–68.

DATE.....	Dec. 26	27	28	29	30	31	Jan. 1	MEAN.
Greenwich, 1882-3...	51·1	53·9	52·8	51·8	50·9	50·3	53·7	... 52·07
,, 1814-73...	37·8	37 6	37·5	37·4	37·3	37·2	37·2	... 37·43
Excess	13·3	16·3	15·3	14·4	13·6	13·1	16·5	... 14·64
Greenwich, 1882-3...	51·1	53·9	52·8	51·8	50·9	50·3	53·7	... 52·07
,, 1847-68...	39·1	39·0	38·8	38·7	38·5	38·3	38·1	... 38·64
Excess	12·0	14·9	14·0	13·1	12·4	12·0	15·6	... 13·43

Thence finally we learn not merely that Mr. Gwilliam's inferences are correct, but also how markedly higher are the mean temperatures of the winters 1847–68 than those of the earlier period 1814–73, a feature to which Mr. Glaisher long since called attention. On the other hand, we must not forget that since both these averages were compiled, we have had several extremely cold winters in succession, the addition of which to the 1847–68 period might possibly lower it to a nearer agreement with 1814–73. —ED.]

RAIN AND DALTON GAUGES.

To the Editor of the Meteorological Magazine.

SIR,—Having had a percolation gauge in continuous operation for rather more than six years, I think that the results may be of interest to some of your readers.

In past generations it was the common opinion that the rain-clouds were supplied with their water from the neighbouring seas. The old agricultural reporters of the counties often spoke of a certain quantity of rain coming with the west or south-westerly wind from the Atlantic Ocean, and again so much being brought by an east wind from the German Ocean. They obviously attached little significance to what is termed a drying wind or a sunny day, or perhaps thought that the evaporation from the soil in the shape of aqueous vapour passed into space, and was never heard more of. The washer-woman, though a capital judge of a drying day when suspending her wet clothes, would take no account of what became of the moisture which disappeared in the process of drying.

Without evaporation and capillary action in the soil, with the

same amount of rainfall, our rivers would flow to the sea with more than double their present volume of water. We have for many years kept a record of the rainfall, and also a gauge filled with soil to the depth of 2½ ft. This soil consists of earth of a medium water-holding power, and what water percolates downwards through that soil is measured monthly. The following are the results for 1882 :—

1882.	Rainfall.	Percolation.	
	in.	in.	Per cent.
January	1·45	1·20	83
February	1·60	0·80	50
March	1·10	0·75	68
April	3·00	1·30	43
May.....	1·23	0 67	54
June	2·20	0·45	20
July.....	3·57	1·83	51
August	1·75	0·14	8
September	2·07	0·83	40
October	5·10	2·35	46
November	3·20	2·16	67
December	2·15	2·02	94
Total	28·42	14·50	52

It will be seen that almost one-half of the rainfall passed again upwards into the atmosphere in an imperceptible form.

The proportion of filtration in winter is much more than in the summer months, as may well be understood, and much also depends upon the character of the soil, whether porous or retentive. The third main factor is the state of the weather.

The following is the rainfall and filtration at our station in the past six years :—

Year.	Rainfall.	Percolation.	
	in.	in.	Per cent.
1877.....	26·35	12·19	46
1878.....	25.52	11·62	46
1879.....	27·91	15·57	56
1880.....	30·80	17·89	58
1881.....	25·30	12·60	50
1882.....	28·42	14·50	52
Mean ...	27·38	14.06	52

In these six years it will be seen that about one-half of the rainfall has been evaporated.

At Hemel Hempstead Mr. Dickinson found the average of eight years percolation through 3ft. of soil to be 42·4 per cent. of the total rainfall.

Dalton gauges of various depths are in operation at Rothamsted, from which it is found that the moisture in the soil is drawn up from considerable depths. One gauge is 5 ft. deep.

DAVID ROBIE.

Bedford, 10th January.

HAIL STORMS IN GERMANY, 1882.

To the Editor of the Meteorological Magazine.

SIR,—It may interest Col. Ward to know that a severe hailstorm visited Schwalbach on the 30th May last, accompanied by stones not unlike those which fell at Ober Grainau. The day was fine in the early part, but clouded in the afternoon, and at 6.40 p.m. the storm came.

The stones fell with considerable violence, bounding up some 18 inches on turf, and three to four feet on the stone balcony.

The sizes and shapes were very variable, and from sketches which I made, I give the particulars of some in eighths of inches: No. (1), egg-shaped, $\frac{3}{8}$ by $\frac{2}{8}$; (2), irregularly round, $\frac{3}{8}$; (3), round, with one flattened side, $\frac{5}{8}$ by $\frac{4}{8}$; (4), round, $\frac{5}{8}$; (5), egg-shaped, 1 in. by $\frac{5}{8}$; (6), a truncated cone, like a Minie rifle ball, but convex at base, $1\frac{3}{8}$ in. by 1 in.; (7), an irregular mass, something like Col. Ward's No. 2, $1\frac{3}{8}$ in. each way. Nos. (1) to (6) were mostly of true hail-stone look; No. (7) seemed more like a cake of ice, and is marked in the sketch "conglomerated." That the storm was heavy on the hills towards Schlangenbad was shown by the torrent of water which soon ran through the streets of our little watering-place, carrying away freshly-made parterres, filling the *quelle*, &c. The storm was followed at 7.40 by some of the finest cloud scenery I have ever seen. In the W. heavy long dark streaks of rain-cloud, mixed with a few lighter openings, lay on the horizon. As these were traced upwards they resolved themselves into rounder and bolder forms, until overhead there hung a perfect canopy of festooning, semi-balloon shapes,* of a lurid ochreous tint, and seemingly ready to burst. They did not do so, and a quarter of an hour later they were quickly dissolving into clouds of a more cirrus type, apparently tilted at an angle of 45°, and drifting rapidly from S. to N. These were met by others flying in a horizontal direction from N. to S., while scattered among both were irregular masses of very dark clouds, with fringed and fibrous edges, suggestive of electric repulsion. All this was accompanied by nearly every colour of the spectrum, little patches of blue sky being contrasted with red, yellow, violet, and even, here and there, green tints. I obtained two sketches of the forms in pencil; nothing but a Turner's brush could have given a true idea of the colours. A similar storm was reported at Berlin the day before.

J. RAND CAPRON, F.M.S.

Guildown, January 6th, 1883.

* Clouston's Pocky-cloud.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUG., 1882.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	80·8	6	45·0	31	70·6	52·7	51·7	72	128·3	40·2	1·48	12	6·4
Cape of Good Hope	83·5	...	35·9	...	67·3	45·7	48·3	77	...	...	2·47	6	3·5
Mauritius	75·5	19*	59·4	12	73·7	65·2	59·1	71	...	...	1·53	20	5·6
Calcutta	91·5	4	75·4	20‡	87·3	77·5	77·9	88	156·5	72·7	10·87	25	8·2
Bombay	86·2	20†	75·3	6	84·5	77·2	75·3	83	146·2	71·2	3·36	23	8·4
Ceylon	86·9	28	72·3	18	84·6	76·7	72·2	74	155·0	70·0	2·28	14	7·1
Melbourne	73·1	24	34·1	11	57·8	43·8	43·2	78	123·2	27·9	2·11	16	7·0
Adelaide	71·7	24	38·0	13	59·6	45·1	45·1	76	135·5	29·5	3·38	21	6·5
Wellington	60·0	26	36·0	18	51·5	41·8	...	...	111·0	30·0	7·79	19	...
Auckland	62·9	6	35·6	20	58·4	45·7	45·1	78	...	31·0	3·12	16	7·0
Falkland Isles	47·0	22	29·9	14	41·0	33·5	35·7	93	107·2	23·8	2·00	22	7·1
Jamaica	92·2	27	71·2	17	88·4	73·6	73·0	79	...	64·1	1·56	...	5·4
Barbados	84·0	var.	70·0	9	83·0	73·0	72·3	76	156·0	69·0	2·37	16	6·0
Toronto	86·9	7	46·8	20	76·0	59·2	60·8	76	145·0	42·4	2·51	14	6·1
New Brunswick, S.John	82·0	3	44·0	27§	67·1	53·1	54·3	82	...	...	1·89	4	4·5
Cape Breton, Sydney	84·5	5	47·0	30	71·6	56·1	57·8	83	...	...	5·48	16	6·4
Newfoundlnd, S.John's	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	90·1	27	41·0	31	80.0	53·7	60·2	77	142·0	...	1·51	7	2·2

* And 20. † And 25. ‡ And 21. § And 28.

Remarks, August, 1882.

Mauritius.—Rainfall ·63 in. below, and mean temp. 0°·2 above average; mean pressure, 30·190 in., extremes 30·343 in., and 29·884 in.; mean hourly velocity of wind 12·3 miles, extremes 29·9 miles, and 1·7 miles; prevailing direction E.S.E.
C. Meldrum, F.R.S.

Colombo.—Thunderstorms occurred on 1st, 2nd, 3rd, and 4th. J. H. Symonds.

Melbourne.—Mean pressure and temp. both slightly below average, amount of cloud and rainfall above it; prevailing direction of wind N.; strong breezes occurred on five days; L on 1st, H showers on 6th, dense fog on 19th, 22nd, and 27th, hoar frost on 11th and 15th, heavy dew on four days. R. L. J. Ellery, F.R.S.

Adelaide.—Weather on the whole mild and seasonable; mean temp. about 0°·7 above that of previous years; rainfall also above the average, but mean pressure was below it. C. Todd.

Auckland.—Weather variable; rainfall not excessive, and many fine days; wind mostly moderate, often very light, chiefly from S. and S.W. Clematis indivisa (first spring flower) bloomed on 9th, first oak leaves seen on 13th. E. B. Dickson.

Barbados.—Mean pressure slightly below average; mean temp. (77°·2) same as the average; prevailing wind N.E., average velocity 10 miles per hour, the extremes being 14·6 miles and 3 miles The rainfall was below the average. and the evaporation was 35° per cent. above it. Two days were overcast; TS on 17th.
R. Bowie Walcott.

SUPPLEMENTARY TABLE OF RAINFALL,

DECEMBER, 1882.

[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	3·25	XI.	Solva	5·25
,,	Margate, Birchington...	2·15	,,	Castle Malgwyn	5·70
,,	Littlehampton	2·75	,,	Rhayader, Nantgwillt..	9·23
,,	St. Leonards	3·23	,,	Carno, Tybritle	7·24
,,	Hailsham	3·68	,,	Corwen, Rhug	4·86
,,	I. of W., St. Lawrence.	3·16	,,	Port Madoc	8·17
,,	Alton, Ashdell.....	3·27	,,	I. of Man, Douglas	4·71
III.	Great Missenden.....	3·42	XII.	Carsphairn	4·97
,,	Winslow, Addington ...	3·28	,,	Melrose, Abbey Gate...	6·25
,,	Oxford, Magdalen Col...	3·20	XIII.	N. Esk Res. [Penicuick]	5·65
,,	Northampton	2·74	XIV.	Ayr, Cassillis House ...	4·08
,,	Cambridge, Beech Ho...	2·43	,,	Glasgow, Queen's Park.	4·42
IV.	Southend	2·36	XV.	Islay, Gruinart School..	5·32
,,	Harlow, Sheering	2·82	XVI.	St.Andrews,NewtonBk	5·54
,,	Diss	4.02	,,	Kemback	...
,,	Swaffham	3·90	,,	Aberfeldy H.R.S.	3·70
,,	Hindringham	3·78	,,	Dalnaspidal	6·79
V.	Salisbury, Alderbury...	2·85	XVII.	Tomintoul.....	...
,,	Calne, Compton Bassett	3·42	,,	Keith H.R.S.	3·29
,,	Beaminster Vicarage ...	4·88	XVIII.	Forres H.R.S.	3·49
,,	Ashburton, Holne Vic..	10·54	,,	Strome Ferry H.R.S....	6·61
,,	Torrington,Langtree W.	8·00	,,	Lochbroom	5·00
,,	Lynmouth, Glenthorne.	7·85	,,	Tain, Springfield.....	3·62
,,	St. Austell, Cosgarne...	...	,,	Loch Shiel, Glenaladale	9·94
,,	Taunton, Fullands	3·03	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	4·45	,,	Forsinard H.R.S.	4·96
,,	Ross	3·60	,,	Watten H.R.S.	4·52
,,	Wem, Sansaw Hall.....	3·27	XX.	Fermoy, Glenville	5·18
,,	Cheadle, The Heath Ho.	6·25	,,	Tralee, Castlemorris ...	2·92
,,	Worcester, Diglis Lock	2·81	,,	Cahir, Tubrid	3·93
,,	Coventry, Coundon	3·37	,,	Newcastle West	3·47
VII.	Melton, Coston	3·98	,,	Kilrush	...
,,	Ketton Hall [Stamford]	4·16	,,	Corofin	3·20
,,	Horncastle, Bucknall ...	4·47	XXI.	Kilkenny, Butler House	...
VIII.	Macclesfield, The Park	5·59	,,	Carlow, Browne's Hill..	3·46
,,	Walton-on-the-Hill.....	3·80	,,	Navan, Balrath	3·43
,,	Broughton-in-Furness ..	4·96	,,	Athlone, Twyford	3·04
IX.	Wakefield, Stanley Vic.	3·85	XXII.	Mullingar, Belvedere ...	3·61
,,	Ripon, Mickley	3·96	,,	Clifden, Kylemore	7·39
,,	Scarborough.....	3·86	,,	Crossmolina, Enniscoe..	5·61
,,	EastLayton[Darlington]	3·93	XXIII.	Carrick-on-Shannon ...	3·40
,,	Middleton, Mickleton ..	7·92	,,	Dowra	4·81
X.	Haltwhistle, Unthank..	3·67	,,	Rockcorry.....	3·70
,,	Carlisle, St. James Rd...	2·22	,,	Warrenpoint	4·90
,,	Shap, Copy Hill	5·70	,,	Newtownards	3·76
XI.	Llanfrechfa Grange	5·46	,,	Belfast, New Barnsley..	4·74
,,	Llandovery	6·90	,,	Bushmills	4·66
			,,	Buncrana	5·10

DECEMBER, 1882.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·51	+ ·34	·52	25	16	57·2	27	24·5	12	12	18
II.		Maidstone (Hunton Court)...	2·37	— ·03	·51	7	21	...	...	...	...	...	...
,,		Strathfield Turgiss	2·07	+ ·05	·43	30	20	57·2	27	17·5	12	14	18
III.		Hitchin	2·75	+ ·70	·67	30	23	52·0	27*b*	16·0	10	20	...
,,		Banbury	3·19	+ 1·04	·52	7	24	54·0	27*c*	14·5	12	17	...
IV.		Bury St. Edmunds (Culford)	3·49	+ 1·34	·90	25	21	56·0	28	16·0	11	15	..
,,		Norwich (Cossey)	3·77	+ 1·45	·84	7	18	57·0	29	22·0	12	15	18
V.		Bridport	4·10	...	·48	31	19	...	..	...	...	...	...
,,		Barnstaple.....	6·81	+ 3·05	1·02	12	23	56·5	31	18·0	11	...	..
,,		Bodmin	7·87	+ 2·42	1·11	17	29	55·0	30	23·0	10	7	10
VI.		Cirencester	3·79	+ 1·18	·50	29*a*	23	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	3·34	+ ·55	·36	25	25	54·5	27	19·0	12	15	18
,,		Tenbury (Orleton)	3·18	+ ·67	·31	6,12	24	56·5	27	16·5	11	12	18
VII.		Leicester	4·28	...	·74	25	23	50·0	28	16·4	12	12	13
,,		Boston	3·74	+ 1·67	·72	7	21	54·0	29	22·0	12	8	...
,,		Grimsby (Killingholme).....	4·67	+ 2·24	·91	7	27	53·0	29	22·0	12	12	...
,,		Hesley Hall [Tickhill].....	3·81	...	·98	8	19	...	...	...	...	...	...
VIII.		Manchester (Ardwick).....	4·17	+ 1·64	·94	7	18	52·0	28*d*	21·0	12	...	...
IX.		Wetherby (Ribstone Hall) ...	3·67	+ 1·46	·64	7	17	...	...	...	...	...	...
,,		Skipton (Arncliffe)	8·01	+ 2·73	1·30	6	23	50·0	28*e*	10·0	10*g*	...	...
X.		North Shields	3·69	+ ·60	·42	8	22	54·8	29	19·2	12	17	18
,,		Borrowdale (Seathwaite).....	12·29	— 1·44	2·02	28	22	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely).....	6·29	+ 2·38	·80	31	24	...	...	...	...	...	...
,,		Haverfordwest	6·90	+ 1·77	·87	25	23	53·0	28	21·0	10*h*	11	15
,,		Plinlimmon (Cwmsymlog) ...	7·05	...	1·62	25	17	...	...	...	..	...	...
,,		Llandudno.....	3·56	+ ·71	1·14	25	19	55·2	28	25·5	12	5	...
XII.		Cargen [Dumfries]	4·77	+ ·24	1·56	2	17	52·4	28	18·8	15	16	...
,,		Hawick	3·87	+ 1·01	·50	7	22	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	6·47	+ 2·38	·89	28	19	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	7·01	+ ·83	1·07	28	19	...	...	14·0	6	20	...
,,		Appin (Airds)	6·11	...	...	...	...	...	...	...	...	...	.
,,		Mull (Quinish).....	6·08	...	1·26	20	21	...	...	...	...	...	...
XVI.	SCOTLAND.	Loch Leven Sluices	5·10	+ 1·44	1·30	29	15	...	...	...	...	...	...
,,		Arbroath	4·77	+ 1·87	·73	28	17	47·0	18	12·0	15	18	...
XVII.		Braemar	3·31	— ·12	·56	16	20	44·3	28	–8·0	15	21	30
,,		Aberdeen	7·14	...	·65	28	28	48·0	27*f*	6·0	14	18	...
XVIII		Skye (Sligachan)	11·27	...	3.11	21	17	...	...	...	...	..	...
,,		Culloden	2·73	+ ·89	...	...	...	48·3	28	8·0	9	21	30
XIX.		Dunrobin	5·74	...	·90	9	19	47·7	28	19·0	8*i*	19	...
,,		Orkney (Sandwick)	4·72	+ ·33	·75	10	24	45·3	31	25·7	8	15	22
XX.	IRELAND.	Cork (Blackrock)	5·31	+ ·55	·67	29	20	55·0	27	15·0	9	15	...
,,		Dromore Castle	7·80	...	1·00	25	21	59·0	19	21·0	12*j*	13	...
,,		Waterford (Brook Lodge) ...	4·49	...	1·04	11	19	55·0	25	19·0	10*k*	13	...
,,		Killaloe	4·72	...	·68	24	16	55·0	27	15·0	14	13	...
XXI.		Portarlington	2·44	— ·42	·53	24	19	56·0	27	15·5	14	12	...
,,		Dublin (Monkstown)	...	...	...	...	...	...	...	...	..	...	...
XXII.		Ballinasloe	3·01	...	·68	24	20	52·0	27	17·0	14	18	...
XIII.		Waringstown	3·24	+ ·28	·60	26	16	55·0	27	10·0	13	15	18
,,		Londonderry.....	...	...	...	...	...	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·12	+ ·72	·73	20	19	52·0	28	13·0	13	21	...

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

a And 30. *b*, *c*, *f* And 28. *d*, *e* And 29. *g*, *k* And 11. *h* And 12. *i* And 13. *j* And 14.

METEOROLOGICAL NOTES ON DECEMBER.

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 TURGIS.—The month was remarkable for the large number of days on which rain fell, although in no large quantity. The early part of the month was cold and foggy with S, but from the 25th to the end the temp. was abnormally high, the average max. for the week being 54°·4 or 16°·0 above the average af 50 years.

BANBURY.—A dark and cheerless month, first half cold, with S, and frequent fog; latter half unusually mild and damp; S on seven days; fog on nine days; high wind on four days; T on 26th. Mean temp. 39°·8.

CULFORD.—A very unsettled month, R or S having fallen on no less than twenty-one days; unusually mild at the end of the month.

COSSEY.—A dull, wet month; unfavourable to agriculture. River valleys flooded nearly throughout the month.

BODMIN.—The number of rainy days since Sept. 22nd is unexampled, out of 100 days, there have been only ten without R. Average temp. 42°·8.

CIRENCESTER.—Cold weather prevailed in the middle of the month, but the remainder was mild with rainfall above the average.

WOOLSTASTON.—A severe spell of cold weather occurred during the first fortnight of the month, with S on six days. Owing to the water-logged condition of the soil from the constant R, much land was still unsown at the end of the month. Mean temp. 37°·6.

ORLETON.—The first half of the month was very cold, with a mean temp. below 32° for ten days, and the ground was covered with S after the 6th; the latter half of the month was very warm and rainy, with frequent rough winds, and a low fluctuating pressure. Mean temp. nearly °·5 below the average of 20 years.

LEICESTER.—Very dull and misty, with very little sunshine; rainfall heavy; S on 4th and 13th. Floods in the midlands.

KILLINGHOLME.—The month was wet throughout, the first half cold, the last half mild; farm prospects very gloomy.

ARDWICK.—The early part of the month gave promise of a proper winter month, and on the 6th, nearly one foot of S fell in the evening, but the weather afterwards became warmer and unseasonable, and very wet.

ARNCLIFFE.—Rather more than a foot of S fell on the 5th and 6th.

N. SHIELDS.—Snow fell on eight days. TS occurred on 7th and 9th.

SEATHWAITE.—Severe frost in the second week; rain almost daily after the 13th; weather at the end of the month more like May than December.

WALES.

HAVERFORDWEST.—The first week of the month was wet, with average temp. for the season; but from the 5th to the 14th was severe, with S 3 in. deep on the level, and great gloom; the rest of the month was mild, stormy, and wet, the air during the last week especially relaxing, with foggy atmosphere. S on five days; T with vivid L on 7th.

LLANDUDNO.—A singularly dull and sunless month, with a rainfall more than half-inch above, and a mean temp. 2° below the average; there were four nights of frost from 10th to 13th inclusive, with a slight fall of S on 12th and 13th. Geraniums and other tender plants sustained, but little damage from the frost, though the temp. fell to 25°·5. Only 22·6 hours of bright sunshine.

SCOTLAND.

CARGEN.—A very dull and gloomy month; great and sudden variations in temp., on several occasions amounting to 20°, and once to nearly 30° in the 24 hours; only 47 hours of sunshine, 15 hours below the average; mean height of bar. 39·555 in. also below average.

HARWICK.—The snowstorm of the 7th and 8th was the most severe ever experienced here; S lay fully three ft. deep, and trees and shrubs were very

much broken. Severe frost occurred on the night of the 11th, and not a few small birds were found lying dead under the hedges.

BRAEMAR.—The min. temp. on the 15th—8°·0 is the lowest recorded since December 25th, 1860.

ABERDEEN.—A very stormy month, with wind S and H, the rainfall being unusually heavy for December; viz., 4 in. above the average.

SLIGACHAN.—The month was on the whole very seasonable, although we had heavy R on the first four days, and again from the 20th to the end. From 4th to 20th was very fine, with hard frost from 5th to 16th; sheep and cattle doing well.

CULLODEN.—The month was marked by heavy falls of S, fully 14 in. falling in 12 hours on the 6th and 7th, and S was on the ground all through the month; very heavy R on the 28th and 29th; temp. very low during the entire month.

SANDWICK.—December was cold and wet, with much frost and S; during the last nine days there were frequent alternations of frost and thaw; T and L on 10th, and L on the two following nights; aurora on four nights.

IRELAND.

DROMORE.—First part of the month very cold, and frost severe; latter part remarkable for wet and high temp.

WATERFORD.—Rainfall above the average; fog on 8th, 9th, and 19th; S on 6th, 10th, and 11th; L on 7th; T on 11th.

KILLALOE.—Very sharp frost from 8th to 15th; temp very high in the latter part of the month; rainfall, average.

BALLINASLOE.—The first part of the month was fine, with fogs and hard frost from the 5th to 15th, the remainder very mild but wet, causing very considerable floods.

WARINGSTOWN.—A very peculiar frost occurred after the 6th, though not so severe as several we have had of late years. For a whole week the sun never came out sufficiently to thaw the rime on the trees, which was very beautiful, as there was much fog, both by day and night.

EDENFEL.—Hard, settled frost from 4th to 14th, accompanied by thick fog A sudden thaw followed, accompanied to the end of the month by almost constant rain, and a mean daily temp., reaching 49° on the 28th, the highest mean here for any in December during 20 years.

THE METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this society was held on Wednesday evening, the 20th ult., at the Institution of Civil Engineers, Mr. J. K. Laughton, M.A., F.R.A.S., president, in the chair.

Four new Fellows were elected, and Capt. J. de Brito Capello and Mr. W. Ferrel, M.A., were elected honorary members.

The following papers were read:—"Popular Weather Prognostics," by the Hon. R. Abercomby, F.M.S., and Mr. W. Marriott, F.M.S. The authors explain more than one hundred prognostics, by showing that they make their appearance in definite positions, relative to the areas of high and low atmospheric pressure, shown in synoptic charts. The method adopted not only explains many which have not hitherto been accounted for, but enables the failure, as well as the success, of any prognostic to be traced, by following the history of the weather of the day on a synoptic chart. The forms discussed are—Cyclones, anti-cyclones, wedge-shaped, and straight isobars. The weather in the last two is now described for the first time. The authors also point out (1), that for use at sea, and other solitary situations prognostics

will never be superseded ; and (2) that prognostics can be usefully combined with charts in synoptic forecasting—especially in certain classes of showers and thunderstorms which do not affect the reading of the barometer.

"Report on the Phenological Observations for the year 1882," by the Rev. T. A Preston, M.A., F.M.S. The report stated that the most important feature of the past phenological year was the mild winter. The effect of this upon vegetation was decidedly favourable; and had it not been for the gales—especially that of April 28th—the foliage would have been luxuriant, and, therefore, free from insect attacks, but the contrary effect has been produced on insect life, for the scarcity of insects, especially butterflies and moths, has been the general remark of entomologists.

Mr. J. S. Dyason, F.R.G.S., exhibited a series of typical clouds in monochrone, and also a series of sketches of clouds in colour made in June, July, and August, 1882.

SUN SPOT PERIODICITY.

The periodicity of sun spots is known to have been discovered by Herr Schwabe, of Dessau, and from personal observations he thought the period ten years. Subsequent researches have proved the phenomenon to be rather complex, and the conclusions arrived at by the *savans* who have studied it do not well agree. Herr Wolf, of Zurich, has recently made a fresh investigation (by a method we need not here describe) of the most complete and certain portion of the observations on record, that extending from 1751 to the present epoch. He deals with 120 years' observations, given in 1,440 monthly averages. His conclusions are these :—(1) There is a period of ten years ; (2) there is a second period of 11 years 4 months ; (3) there is not a period of 12 years, imputable to the action of Jupiter. It further appears that, notwithstanding the great difference of the two periods, the interval from a *minimum* to the following *maximum* is the same for both—viz., $4\frac{1}{2}$ years. Again, as 17 periods of 10 years are equivalent to 15 periods of 11 years 4 months, the complete phenomenon covers 170 years, after which the *maxima* and the *minima* are reproduced in the same order and with the same numerical values.

To have a full idea of the phenomenon, we have to add the other remarkable periodicity, not in the number but in the geographical distribution of the spots, suspected by Mr. Carrington, and brought into clear light by Herr Spœrer. It consists in this, that when after a *minimum* the spots commence to re-appear on the sun, they first do so suddenly at high latitudes and are then progressively restrained towards the zones near the equator, till the next epoch of *minimum*. No adequate explanation of these remarkable phenomena has yet been offered. —*Times*, Jan. 4.

[With reference to the above, we shall be glad if some of our astronomical readers will inform us (1) where these new dates of sunspot max. and min. are to be found ; (2) whether they agree with, or differ from the dates previously assigned ; and (3) whether astronomers are prepared to accept them as final and unalterable.—ED.]

END OF VOL. XVII.

ARRANGEMENTS

FOR THE

SYSTEMATIC OBSERVATION

AND

RECORD

OF THE

RAINFALL OF THE BRITISH ISLES.

COMPILED BY

G. J. SYMONS, F.R.S.,

Secretary of the Meteorological Society; Membre du Conseil de la Société Météorologique de France; Member of the Scottish Meteorological Society; Member of Council of the Royal Botanic Society; Member of Council of the Social Science Association; Registrar and Member of Council of the Sanitary Institute; Fellow of the Royal Colonial Institute; Hon. Mem. Watford Nat. Hist. Soc. &c.

SECOND EDITION.

LONDON:
EDWARD STANFORD, CHARING CROSS, S.W.
1882.

Introductory and Historical.—I cannot help this section appearing to be egotistical; the rainfall organization being entirely my own creation, it is impossible for it to be otherwise.

In the early part of the year 1859 I began collecting copies of records of the fall of rain, and early in 1861 wrote to all the observers of whom I was then aware, and asked them to send me all the records for the year 1860 that they could. I received 168 returns, and printed a table showing the total fall at all those places, being a larger number than had ever been classed together before. This publication gave a stimulus to observers, and from that time onwards their number has steadily increased until it now exceeds 2,000.

The amount of information published has increased even more, for whereas at first I printed only the total annual fall, I now publish essays on various branches of rainfall enquiry, and full abstracts of the most remarkable falls in short periods (ten minutes, half-an-hour, and so on), the heaviest falls in one day, tables of the monthly fall at several hundred stations, and, in short, give all the information which I can collect and which it seems expedient to print.

From the foregoing it will be evident that the compilation of the present annual volume (of which the short title is "British Rainfall, 1882," &c.) is a very serious labour. The mere checking of two thousand returns takes a long time, and so does the due arrangement of the various facts reported, and by no means the least onerous matter is ensuring the accuracy of the printing of the whole.

During the first few years I not only gave my own time gratuitously to the work, but also bore all the cost of postages and of printing. It soon, however, became far too costly for me to bear it all, and my correspondents most kindly offered to share it with me. In 1865 the price of the annual volume was fixed at five shillings, and, although the size and cost of the volume has since so largely increased, that the price to the general public has had to be doubled, observers are still allowed one copy at the old price. There are two reasons for this: (1) Because as the book could not be compiled without the help of observers, they ought to be allowed to have it as cheaply as possible; (2) Because a small number of the observers (about 300, whose subscriptions are duly published) contribute annual sums varying from one to ten guineas towards the general expenses of the work.

The existing state of matters is, therefore, shortly as follows. There

are about 2000 persons, well spread over England and Wales, Scotland and Ireland, each of whom is, I hope, strictly obeying the rules on page 5. To each of them I send on December 31st each year, blank forms for them to return to me filled with the facts observed by them. At the same time I send a list of the various publications, and invite such pecuniary aid as it may be agreeable to them to send.

I ought, perhaps, to say what becomes of the subscriptions. I will mention some of the outlets. (1) There are nearly a thousand observers whose returns have to be collected, examined, discussed, and printed, who do not contribute sixpence towards the cost thereof. (2) In some localities it is impossible to obtain volunteer observers, and there the observers receive regular salaries. (3) The mass of office work, correspondence, &c., is far beyond what I can myself accomplish; two regular assistants are, therefore, employed, and besides that, considerable sums are paid for extra assistance at times of pressure. (4) The expenditure for printing and postages is very large.

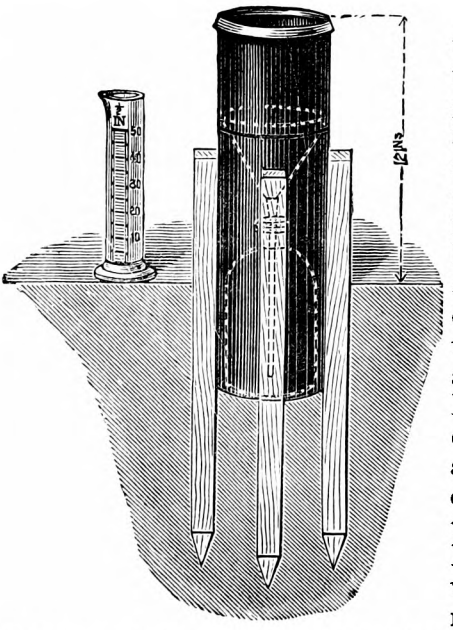
In addition to the annual volume, I publish a monthly periodical, *Symons's Monthly Meteorological Magazine*, giving, in addition to a full chronicle of the progress of meteorology, details of rainfall at about 100 stations. This is sent free to subscribers.

It may, perhaps, be added that it always affords me pleasure to reciprocate as far as possible the assistance which the observers render to me, either by affording them meteorological information, data as to the height of their stations above sea level, or advice as to the purchase of instruments.

In short, the state of the case is this: I have given myself up to the collection of statistics of rainfall—old ones and current ones; I invite everybody to help me, both with observations and funds, and I promise, in return, to render to all my correspondents all the help that is in my power.

Patterns of Rain Gauges, and where to buy them.—This is not a pleasant section to write, for there is considerable jealousy among the manufacturers, and I am almost certain to be accused of favouritism by some one. However, I have never patented any pattern of rain gauge, and, therefore, leave the field open to all.

Upon one point it is necessary to be despotic, viz., that amateurs never try to make their own gauges; they are almost certain to go wrong in some respect, and nothing is more vexing, both to the observers and to myself, than for it to be discovered after observations have been recorded for a long time that the labour of years is vitiated by an inaccurate instrument.



For use in ordinary localities I think the annexed is the best pattern; it is known as the Snowdon gauge; it is five inches in diameter, is easily fixed by four stakes, as shown; the glass jar when filled up to the top division holds 0·50 in., or half an inch, the bottle holds about three inches of rain, and, of course, in the very rare case of the fall exceeding that, the excess is saved by the can, and must be carefully measured. If made in japanned tin these cost from 16s. to 20s., but they are much stronger, and more durable, if made in copper, when they cost from 21s. to 30s. Negretti's have brought out a very stout pattern, in galvanized iron, at a still lower price. Where cost is no object, it is, by some, thought better to have a rather larger gauge, viz., eight inches diameter, costing from £2 to £3, but I do not advise it.

Snowdon pattern rain gauges can, no doubt, be obtained from any optician, but it may be convenient to give, in alphabetical order, the names and addresses of a few of the principal makers :—

CASELLA, L., 147, Holborn Bars, E.C.
HICKS, J. J., Hatton Garden, E.C.
NEGRETTI & ZAMBRA, Holborn Viaduct and Cornhill, E.C.
PASTORELLI, F., 10, New Bond Street.

Testing.—Wherever, and of whomsoever, rain gauges may be bought, it is very desirable that the purchaser should insist upon having certificates of their accuracy. Rain gauges are examined, and certificates issued, by Kew Observatory, and by myself, the charge in each case is the same, namely, 2s. 6d.

Blank Forms.—All blank forms required for returns to myself, and additional ones wherever desired, are supplied gratuitously, and even those sold are charged at little more than their actual cost.

Change of Residence.—Each observer is requested to decide upon a specific name for his station, and to notify immediately any change in the position of the gauge or the discontinuance of his record.

SUGGESTIONS FOR SECURING UNIFORMITY OF PRACTICE AMONG RAINFALL OBSERVERS.

I.—SITE.—A rain gauge should not be set on a slope or terrace, but on a level piece of ground, at a distance from shrubs, trees, walls, and buildings—at the very least, as many feet from their base as they are in height. Tall-growing flowers, vegetables, and bushes must be kept away from the gauge. If a thoroughly clear site cannot be obtained, shelter is most endurable from N.W., N., and E., less so from S., S.E., and W., and not at all from S.W. or N.E.

II.—OLD GAUGES.—Old established gauges should not be moved, nor their registration discontinued until, at least, two years after a new one has been in operation, otherwise the continuity of the register will be irreparably destroyed. Both the old and the new ones must be registered at the same time, and the results recorded for comparison.

III.—LEVEL AND FIXING.—The funnel of a rain gauge must be set quite level, and so firmly fixed that it will remain so in spite of any gale of wind or ordinary circumstance. Its correctness in this respect should be tested from time to time.

IV.—HEIGHT.—The funnels of gauges newly placed should be 1 ft. above grass. Information respecting height above sea level may be obtained from the Editor.

V.—RUST.—If the funnel of a japanned gauge becomes so oxidised as to retain the rain in its pores, or threatens to become rusty, it should have a coat of gas tar, or japan black, or a fresh funnel of zinc or copper should be provided.

VI.—FLOAT GAUGES.—If the measuring rod is detached from the float, it should never be left in the gauge. If it is attached to the float, it should be pegged or tied down, and only allowed to rise to its proper position at the time of reading. To allow for the weight of the float and rod, these gauges are generally so constructed as to show 0 only when a small amount of water is left in them. Care must always be taken to set the rod to the zero or 0.

VII.—CAN AND BOTTLE GAUGES.—The measuring glass should

always be held upright; the reading is to be taken midway between the two apparent surfaces of the water.

VIII.—TIME OF READING.—Nine a.m. daily; if taken only monthly, then 9 a.m. on the 1st.

IX.—DATE OF ENTRY.—The amount measured at 9 a.m. on any day is to be set against the previous one; because the amount registered at 9 a.m of, say, 17th contains the fall during 15 hours of the 16th, and only 9 hours of the 17th. *(This rule has been approved by the Meteorological Societies of England and Scotland, cannot be altered, and is particularly commended to the notice of observers.)*

X.—MODE OF ENTRY.—If less than one-tenth (·10) has fallen, the cypher must *always* be prefixed; thus, if the measure is full up to the seventh line, it must be entered as ·07, that is, no inches, no tenths, and seven hundredths. For the sake of clearness, it has been found necessary to lay down an invariable rule that there shall always be two figures to the right of the decimal point. If there be only one figure, as in the case of one-tenth of an inch (usually written ·1) a cypher must be added, making it ·10. Neglect of this rule causes much inconvenience. All columns should be cast *twice*—once up and once down, so as to avoid the same error being made twice. When there is no rain, a line should be drawn rather than cyphers inserted.

XI.—CAUTION.—The amount should always be written down before the water is thrown away.

XII.—SMALL QUANTITIES.—The unit of measurement being ·01, observers whose gauges are sufficiently delicate to show less than that, are, if the amount is under ·005, to throw it away, if it is ·005 to ·010 inclusive, they are to enter it as ·01.

XIII.—ABSENCE.—Every observer should train some one as an assistant; but where this is not possible, instructions should be given that the gauge should be emptied at 9 a.m. on the 1st of the month, and the water bottled, labelled, and tightly corked, to await the observer's return.

XIV.—HEAVY RAINS.—When very heavy rains occur, it is desirable to measure immediately on their termination, and it will be found a safe plan after measuring to return the water to the gauge, so that the morning registration will not be interfered with. Of course if there is the slightest doubt as to the gauge holding all that falls, it must be emptied, the amount being *previously* written down.

XV.—SNOW.—In snow three methods may be adopted—it is well

to try them all. (1) Melt what is caught in the funnel by adding to the snow a previously ascertained quantity of warm water, and then deducting this quantity from the total measurement, enter the residue as rain. (2) Select a place where the snow has not drifted, invert the funnel, and turning it round, lift and melt what is enclosed. (3) Measure with a rule the average depth of snow, and take one-twelfth as the equivalent of water. This being a very rough method, is not to be adopted if it can be avoided. Some observers use in snowy weather a cylinder of the same diameter as the rain gauge, and of considerable depth. If the wind is at all rough, all the snow is blown out of a flat-funnelled rain gauge. Snowdon pattern gauges are much the best.

XVI.—Overflow.—It would seem needless to caution observers on this head, but as not a year passes in which some of our observers do not allow it to happen, it is necessary to call attention to the fact that there does not seem to be any part of the British Isles where 4 inches may not fall in 24 hours. Therefore it is not desirable to purchase any new gauge of which the capacity is less than four inches.

XVII.—Second Gauges.—It is desirable that observers should have two gauges, and that one of them should be capable of holding eight inches of rain. One of the gauges should be registered daily, the other weekly or monthly as preferred, but always on the 1st of each month. By this means a thorough check is kept on accidental errors in the entries, which is not the case if *both* are read daily.

XVIII.—Dew and Fog.—Small amounts of water are at times deposited in rain gauges by fog and dew, they should be added to the amount of rainfall, because (1) they "tend to water the earth and nourish the streams; and not for that reason only, but (2) because in many cases the rain gauges can only be visited monthly, and it would then obviously be impossible to separate the yield of snow, rain, &c.; therefore, for the sake of uniformity, all must be taken together."

XIX.—Doubtful Entries.—Whenever there is the least doubt respecting the accuracy of any observation, the entry should be marked with a ?, and the reason stated for its being placed there.

XX.—Breakage.—The Editor has no desire to supply rain gauges or glasses, or in any way to undertake, or interfere with, that which is the business of Opticians; but the continuity and permanent accuracy of the records of his correspondents is to him of such importance, that he deems it advisable to announce that any assistance in his power is always at their service.

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