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THREE DAYS ON THE TOP OF MONT BLANC.

(Abridged from *La Nature*, of September 10th, 1887).

It is somewhat late to refer to an expedition carried out in July 1887, but both as regards Meteorology and Physiology, it was of considerable importance.

Our readers know something (not perhaps as much as they should do) of the remarkable series of self-recording meteorological instruments invented and constructed by MM. Richard Frères, of Paris. M. J. Vallot, a member of the Alpine Club, conceived the bold idea of establishing three series of these self-recording instruments in proper screens, one at Chamounix (3,445 ft.), one at the Grands Mulets (10,007 ft.) and one on the summit of Mont Blanc (15,781 ft.), and he not only did this, but much more—as will subsequently appear.

We pass over all preliminaries, though they can neither have been few nor unimportant, and come to July 27th, 1887, when the Chamounix instruments were all in position under the care of M. H. Vallot, who had also a series of instruments for direct observation each hour. The two observers for the summit M. J. Vallot and M. F. M. Richard, (of the firm of Richard Frères) were ready, the baggage, tent, and instruments weighing nearly a quarter of a ton—all which had to be carried up to the Grands Mulets, and very nearly all of which had to be taken up to the summit; no fewer than 24 guides were therefore necessary—indeed, it was asserted at Chamounix that to take all the baggage to the top and to spend three days up there was impossible.

However, the party started at noon on July 27th, reached the Grands Mulets at 10 p.m., went to sleep at 11 p.m., rose on 28th at 3 a.m., and reached the Grand Plateau at 7 a.m., where they rested awhile, but finally reached the summit at 3 p.m. All the guides but two started immediately to return, leaving M.M. Vallot and Richard and the two guides on the summit with all the boxes and baggage deposited on the snow. M. Richard and the two guides began to put up the tent, but soon found themselves exhausted, the former as well as M. Vallot suffering from head-ache and exhaustion. Then

they melted some snow, and with the snow-water and a spirit lamp made some soup, and with boxes for pillows went to sleep. M. Vallot, however, soon recovered, and began erecting the apparatus, but the cold soon drove him into the tent, and everybody, though shivering with cold, went to sleep. About 1 a.m. M. Richard awoke, and fearing that they might all be choked for want of ventilation, they decided on leaving a small opening, and lighting a lantern, supposing that the carbonic acid would cause it to go out before there was serious danger to life. The precaution was needless, as a strong wind arose, and at the same time ventilated the tent, and nearly froze the occupants, and well it might, for when daylight came they found that the minimum on the snow had been $2\frac{1}{2}$ degrees below zero Fahrenheit, *i.e.*, $34\frac{1}{2}$ degrees below freezing.

On the morning of 29th, all four residents were in better health, but M. Richard and Payot (one of the guides) had violent head aches, their pulses beat as if they were in high fever, and the least exertion so fatigued them that they had to go into the tent to sit or lie down. Hourly observations were made regularly all day, synchronously with those at Chamounix, and they had also the variety of a visitor, Baron Munch, who, having come up from Courmayeur, was naturally very much astonished to find an observatory and hot soup on the top of Mont Blanc. Night closed in and passed less painfully than the previous one.

The 30th was again wholly devoted to observations. The party had no appetite and took little except soup with cheese crumbled in it, and hot coffee. This day they had two visitors, one an English tourist, the other a jackdaw, which the guides said was a sign of fine weather. It did not prove so. About 2 p.m. clouds gathered in the valleys, then it began to thunder, and to blow so hard that at 4 p.m. they were driven into the tent. The first idea was to start downwards, but much must have been left behind, so they tightened the tent and heaped up snow to protect it. During the evening M. Vallot took diagrams of the pulses of all the party, and made other physiological observations, which were especially valuable considering the time that all had been on the summit. On going out about 9 p.m., he found himself in an electric cloud, with faint St. Elmo's fire. The storm ceased about 2 a.m., and all slept quietly.

The 31st had been fixed for the return, the hourly observations were continued until 9 a.m., then the greater part of the apparatus was stowed in the tent, a last look was given to the self-recording instruments, and the party was ready to descend, but Payot was so unwell with head ache and fever, that at first it seemed as if a sledge must be made for him, however he rallied, and finally at 7 p.m. all returned safe to Chamounix, having been absent 103 hours, of which 68 had been spent on the summit.

The recording instruments at Chamounix and Grands Mulets were the usual ones constructed to run a week without touching, but those on the summit were made to run 15 days, as ascents are

not always possible even in summer. Subsequently when M. Vallot went up to wind the instruments and put on fresh papers, Madame Vallot went with him.

We have not yet seen any account of the records obtained; when we do, we shall have pleasure in bringing them to the notice of our readers. It is not every day that one can find a man like M. Vallot, willing to defray the cost, and to bear the hardships, of three nights on Mont Blanc.

SOCIÉTÉ MÉTÉOROLOGIQUE DE FRANCE.

PRESIDENTIAL ADDRESS BY M. E. RENOU

GENTLEMEN,—The Meteorological Society of France has just elected me President for the year, I thank you heartily, you have rewarded my devotion to the science which we all love. It is the third time that I have had this honour; the first was in 1858, when our Society was still young, in fact it dates from 1853. In 1852, some eminent men joined in drawing up a circular proposing the formation of the Society and inviting members, of those who signed that invitation, one alone is still with us, M. d'Abbadie; of the 148 who responded to the invitation, 10 only remain.

I will not trace the history of the Society, that has been done by M. Berigny, but it will not be inappropriate to consider what was the state of meteorology then, what it is now, and what it ought to be.

Four years before our Society was organized, a small group of devoted men had collected observations and published four annual volumes which served as models for our own. At that date there were few stations, and owing to the absence of any instructions, and of any supervision the observations were not made under favourable conditions. The thermometers, seldom exact, were all exposed at windows, and therefore could give only erroneous results, the barometers scarcely ever accurate, contained air, and the attached thermometers had rarely been verified. The rain gauges were of all patterns, most of them on roofs, and only collecting part of the snow. The vanes, heavy and inaccurate. The state of the weather only vaguely stated, and no definition of fog, so that little could be gathered from the registers; no definition of what constituted a "rainy day," so that of two observers in the same town, one would report twice as many days as the other.

This is by no means an exaggerated sketch of the state of things 36 years since.

This state of things impressed me from the first, naturally disinclined to accept any thing which was not proved, simply because it always had been, and having a natural antipathy to "about," I devoted all my care to the improvement of observations, and I have demonstrated that meteorology is capable of the same precision as other sciences.

Soon after our Society was founded, weather forecasting attracted

much attention, and with that object efforts were made to cover France with a multitude of stations at a cost little exceeding that of the instruments, and as 1-1000ths of an inch of mercury, and 1-10ths of a degree of temperature are needless for weather forecasting, precision was not aimed at, but it was hoped that the observations would gradually improve, and that eventually accurate climatological data would be obtained.

This was a great mistake. I have always held that nothing would be learned this way, and the result has confirmed my opinion.

Weather forecasting itself has not achieved a very great success, but this is not from want of accuracy in the observations utilized, but rather from the limited area whence reports are received, and deficient rapidity in the despatches. The heads of the services in each country should be in direct and prompt communication, and then bad weather could always be announced. But we ought first to have records from Central Africa, Senegal, the Azores, and America. It will be long before we obtain these valuable helps.

As regards precise, complete, accurate meteorology from 20 to 25 meteorological observatories are needed in France. Then we can utilize volunteers, and establish a great number of secondary stations for the study of the rainfall, storms, snow-storms, inundations, &c., it is also necessary to have mountain stations among which the chief should be Mont Blanc. Nothing is easier than to have at the top of such a mountain an observatory of which the records should be automatically transmitted to the base, and there recorded. It is solely a question of money.

I have often been asked why frequent, and hourly observations are required. They enable us to solve all kinds of questions. They enable comparisons to be made with stations at which observations can be made only three or four times a day, that is especially needed in comparisons with countries far E., or far W., of France. Hourly readings coupled with the sheets from self-recording instruments give us all the details of meteorological phenomena. Is it not painful to see in the records of the Observatory, that many important phenomena are not even mentioned, because they did not occur at the regular hour for observations. In legal cases one of the first things asked a witness is often, "What was the weather?" If our records are vague and incomplete, how can we state what it was at a certain hour on a given day. I have often had to give evidence of this kind.

If in France, proper meteorological arrangements, especially as to thermometer stands have been adopted, it is not so in other countries where the best pattern of stand is still being discussed, whereas in France it is settled. We hope that the Congress to be held in Paris this summer will have the advantage of bringing foreign observers to see us; they will be able to see how the Observatory of Parc St. Maur is organized, and can ascertain for themselves how far we have advanced in the determination of all the phenomena which are dealt with by meteorologists.

REVIEWS.

Results of Meteorological Observations made in New South Wales during 1886, under the direction of H. C. RUSSELL, B.A., F.R.S., Government Astronomer. Charles Potter, Sydney, 1888. 8vo., 186+192 pages, and 15 diagrams.

Results of Rain, River, and Evaporation Observations made in New South Wales during 1887. By H. C. RUSSELL, B.A., F.R.S., 8vo., 100 pages and 3 large maps.

SERIAL publications on Meteorology are so numerous, that it is impossible for us to notice a tithe of them; the only thing to do is to take sometimes one, sometimes another, and so keep our readers acquainted with what is going on.

There are few colonies where better work is being done than in New South Wales. We are not sure that we may not take the steady growth of the meteorological system there, and the very large amount of accurate work published by Mr. Russell, as evidence of the goodness of the climate. It may be that the Colony is wise enough to give him a good staff of assistants; and then good training and a good system will produce a good output of work, provided the head knows what is to be done, and does not waste the mental power placed at his disposal. But there is more than quantity and quality in Mr. Russell's work, there is originality and solidarity, and it seems to us that we can trace in his work the difference between sunny Sydney and, shall we say, foggy London.

It is some years since we last noticed these reports, and the two now before us are substantial evidence of the development of the organization throughout the Colony, for Mr. Russell has now 866 stations, and (most wonderful of all, for it shows how populous the Colony is becoming,) there is only *one square degree* (i.e., 29° to 30° S., and 142° to 143° E.,) *without a rain gauge station*. This is progress indeed, and if we do not secure some fresh observers in Sutherland, we shall have the New South Wales people beating us.

Mr. Russell has for many years given much attention to evaporation, and is now spreading observations of this important element, not broadcast over the Colony, but at typical stations.

It is rather curious that each of three directors of Sydney Observatory designed an evaporator.

Mr. Scott's was the first; a cylindrical glass standing on the ground, about 8 inches high and 8 inches in diameter, containing usually about 6 inches of water. Read by a vernier and ivory point.

Mr. Smalley followed with a tin vessel painted white, standing on the ground, 1 foot high, 8 inches in diameter, and usually containing about 8 inches of water. Amount of evaporation determined by weighing, vessel and contents each day.

Lastly came Mr. Russell's of galvanized iron, 2 ft. 6 in. deep, 4 ft. in diameter, sunk 2 ft. 4 in. in the ground. Read by float and finely divided scale.

It is easy to see that the water in both Scott's and Smalley's would heat far too much if, as we suppose, they were exposed to sun and air. In fact, this seems proved in two ways, first by the very much larger amount which they indicated as compared with Russell's, and secondly, by the fact that their excess over Russell's was roughly proportional to temperature. The nine years 1871-79 give the following values :—

	Evaporation.	
	Inches.	Ratio.
Scott	49·22	156
Smalley	54·83	173
Russell	31·69	100

And this helps us out of a puzzle of which we could not at first guess the solution. At several of the second order stations the amount of evaporation is given, and is followed by the following note, "Evaporation from a bucket, if it is reduced 35 per cent., it equals that from a tank." Now "a bucket" is a bucket all the world over, but a tank—well the name is applied to bodies of water of from 100 to 100,000 gallons or more. Moreover, "a bucket" implies a handle and sloping sides, and is altogether somewhat unscientific. Yet after all the note put into scientific phraseology should, we believe, be, "Evaporation by Smalley's evaporator, if it is reduced 35 per cent., it equals that from Russell's." If we take our nine year means as above, Smalley 54·83 in., Russell 31·69 in., and apply this rule to the value given by Smalley's instrument.

$$\begin{array}{r} \text{then } 54\cdot83 \\ \left(\frac{54\cdot83}{100} \times 35 \right) = - \frac{19\cdot19}{34\cdot64} \end{array}$$

the 35 per cent. would therefore be rather too small, 43 per cent would be the value for our nine years, but doubtless Mr. Russell has good grounds for adopting 35.

It is well known to be wrong to speak disrespectfully of the Equator; we certainly have no reverence for Smalley's evaporator, but it does seem rather hard to call it "a bucket," however much it may resemble one.

Another subject to which Mr. Russell gives special attention is that of underground temperature. The mean values for 1866 were—

Shade temp.	1 in. deep.	2 ft. 6 in. deep.	5 feet deep.	10 feet deep.	19 ft. deep.
63·5	62·7	64·3	64·1	64·0	65·8

As regards this last value, we regret that (we believe) the system of earth thermometers adopted at Sydney does not admit of the thermometers being withdrawn for verification, because we believe that in December, 1886, this thermometer was quite $1\frac{1}{2}$ degrees too high. We have not the volume for 1881, but we think that the value for that year should be 62°·6; if so, it appears that for some

unknown reason that thermometer, which remained steady from 1870 to 1881, has since then risen $0^{\circ}\cdot4$ per annum. We do not want to load this notice with figures, and therefore do not insert the data which have led to this conclusion, being quite sure that it is sufficient to call Mr. Russell's attention to it. The change may be real, may be due to some drainage scheme, or railway cutting for aught we can tell, but there is certainly some change going on at 19 ft. which is not felt at 5 ft. or at 10 ft.

One more grumble. Mr. Russell's work is so good that there is no fear of our conveying any false impression as to our estimate of it, and we can therefore indulge in grumbles without any risk of being misunderstood. But why, oh why, does he print such a remark as this, "A shock of earthquake lasting 2'." Mr. Russell is one of the first astronomers of the day, and yet he prints 2" (for two seconds of time) as if it were either 2 inches, or 2 seconds of arc. He might evidently, with truth, reply that the word "lasting" proves that " must be indicative of time, and not of either arc or length ; but in all probability he will agree with us that while it is bad to use the same symbol for seconds of arc and for inches, it is needless to use it also for time where "s" is the recognized symbol.

And now having found all the fault that we can, let us conclude by congratulating Mr. Russell on the excellency of his organization, the Colony on having so able a director, and the world on the mass of valuable information gradually being stored in that distant Colony.

Ueber eine nahezu 26-tägige Periodicität der Gewittererscheinungen.
VON W. VON BEZOLD. [Excerpt Sitzungsab. der K. Preussischen
Akad. d. Wis.]. 1888. 8vo. 10 pages.

Prof. von Bezold points out that the magnetism of the earth has a periodicity of about 26 days, corresponding therefore closely with that of the rotation of the sun on its axis.

Considering the intimate relation which exists between magnetism and electricity, Prof. von Bezold has tabulated the returns of thunderstorms in Bavaria and in Wurtemberg for eight and seven consecutive years respectively, in order to see if these values showed any analogous periodicity. There is no doubt that they do, and it is therefore obviously desirable that a similar investigation should be made in other parts of the world.

THE FOG, AND GAS CONSUMPTION.

THE *Gas World* gives some figures regarding the quantity of gas sent out by the Gas Light and Coke Company during the recent foggy weather. On Monday December 31st, when the fog was very bad, the output reached the highest point ever recorded, viz., 105,046,000 c. ft. On the corresponding day of last year the output was only 79,978,000 c. ft. The increase is thus at the rate of 23·86 per cent. In the course of the week ended the 7th inst., the output was 627,317,000 c. ft., as against 512,943,000 c. ft. for the corresponding week of 1888, or an increase of 18·23 per cent. The Gas Light and Coke Company has always been prepared to meet a demand for gas, ranging from 50,000,000 to 105,000,000 c. ft. per day. The general public accept the friendly aid of the gas lamps on a foggy day, but they never give a thought to the enormous labour and expense involved in the production of the gas required. They take it as a matter of course, and would no doubt make a great outcry were it withdrawn even for a minute.

Yes, quite true from the manufacturer's point of view. But there are two sides to most things. The Company up to the above date charged 2s. 9d. per 1,000 cubic feet, therefore on December 31st, they charged £14,443 16s. 0d. (about 360,000 francs) for the gas they supplied, and this was £3,446 17s. 0d., more than on the corresponding day of the previous year. Allowing the odd £446 17s. 0d., for natural growth, we have an extra payment to one gas company for one day's fog of £3,000. Add to that payments to other companies; extra electric lighting, lamps, &c., the cost of damaged goods, damaged vehicles, damaged health, and surely for London alone we may put the cost of that one day's fog, at from £6,000 to 10,000. And though that was the worst, we have had quite twenty bad ones—take each of these as only half as bad, and we get a total damage of from £60,000 to £100,000, irrespective of the enormous amount of money taken out of the country by those who rush to the Riviera to escape them, and the thousands kept out of the country by those who do not care to visit us during our foggy season, and we are sure that £120,000 is the minimum damage. And yet not a sixpence is forthcoming to try the experiment mentioned in our last. We are not electricians, and do not for a moment assert that anything can be done—but it does seem strange that with such vast amounts at stake, we drift on without even trying if anything can be done. Suppose £100 or £1,000 was “thrown away” in experiments what would it represent. Six hours fog:- E.D. M.M.]

ROYAL METEOROLOGICAL SOCIETY.

THE anniversary meeting was held on January 16th, at the Institution of Civil Engineers, 25, Great George Street, Westminster, Dr. W. Marcet, F.R.S., President, in the chair. Mr. Maxwell Hall, Mr. G. T. Livesey, M.Inst.C.E., Mr. E. W. Priestley, B.Sc., Mr. J. Radcliffe, and Rev. J. R. Stratton, were elected Fellows of the Society.

The Report of the Council showed that a large amount of work had been done during the past year, and considerable progress made in the investigation of one of the most interesting and hitherto somewhat neglected branches of meteorology—viz., thunderstorms. Forty-nine new Fellows were elected last year, the total number on the books now being 535.

After the Report had been adopted, the President delivered an address on "Fogs," which he illustrated by a number of interesting lantern slides. He considered fogs and clouds as one and the same, and that a cloud is a fog when entered into, and a fog seen from a distance, suspended in the air, becomes a cloud. After describing the various kinds of fog—*e.g.*, river, sea, Newfoundland, radiation, town, &c., fogs—Dr. Marcet referred to London fogs. Dr. Tyndall has accounted for them by assuming each particle of condensed vapour to be covered by coal smoke. These fogs usually accompany a high barometer, and are frequently dry in their character. It is a well-known fact that cold air on the tops of hills being heavier than the air below, slides down the slopes, so that the lower parts of hill sides are actually colder than the plains at some distance from the hills. Now London, in the Thames valley, may be regarded as surrounded by hills—to the north, Highgate, Hampstead, and Harrow; in a westerly direction, Putney and Wimbledon; and in a more southerly direction, Clapham and Sydenham. The air is colder on these hills than in London with its millions of inhabitants, its coal fires and factories, hence it is heavier and will have a great tendency to slide down towards the town and the river. Should the air in town be on the point of saturation, and the cold air from above saturated with vapour, it is obvious that the increased cold from above will produce a precipitation of moisture, and it will come to pass that a fog is produced. If the hill tops be not only colder than the air below, but enveloped in a fog, it stands to reason that the fog below will be all the denser, and especially in the neighbourhood of water, such as the River Thames and the ornamental waters in the parks.

The Officers and Council for the ensuing year were then elected, and the meeting adjourned.

THUNDERSTORM ON FEBRUARY 2ND.

To the Editor of the Meteorological Magazine.

SIR,—On the 2nd inst., at 7.30 p.m., there occurred at this place a thunderstorm of short duration. There were three very bright flashes of lightning, with intervals of about one minute between consecutive flashes, which were followed in each case one second later by a loud clap of thunder. It may be noted that after a long interval of solar inactivity, sun spots, although very minute, have been visible since the beginning of this month.

Yours obediently,
J. PARNELL.

*Hadham House, Upper Clapton, E.
February 5th, 1889.*

GLOBULAR LIGHTNING.

To the Editor of the Electrician.

SIR,—This evening at 7.35 p.m. a fireball about two metres in diameter fell in the direction of Stamford-hill, N. At the same time a fearful explosion took place, lasting some two seconds, and the globe of fire seemed to split into four quarters, showing a bluish fiery light. The explosion was unlike thunder, and was more like a detonation of explosives. A snowstorm of two minutes' duration ensued, leaving $1\frac{1}{2}$ in. of snow on the ground; after which the atmosphere became splendidly clear. It would be interesting to know if this phenomenon has been observed by others in this neighbourhood, and under what conditions. The wind was W.N.W., sky cloudy, and the thermometer stood at 38° F.—Yours, &c.,

ERNST FAHRIG.

Listria Park, Stamford-hill, Feb. 2.

RAINFALL AT HELIGOLAND.

Dr. Hellman recently worked up the observations on the rainfall of Heligoland, and obtained the mean annual rainfall of 72.50 inches, far exceeding the quantity observed at any of the stations on the west coast of Sleswick or the mouth of the Elbe. He explains this excessive rainfall by the circumstance that the steep coast, rising almost perpendicularly to the height of 164 feet above the level of the sea, forced the moist sea winds suddenly upwards, and so caused them to condense very rapidly.—*Athenæum*.

THE OLD BAROMETER IN SALISBURY CATHEDRAL.

Some years since a discussion arose as to when and why the word "Change" on barometers was put against $29\frac{1}{2}$ inches instead of against 30, which is much nearer the real mean pressure. We do not remember that any satisfactory reply was given.

Last autumn we saw in the vestry of Salisbury Cathedral an extremely old barometer—we do not know either the maker or the date—but we will revert to these after giving the barometric scale, which seems designed on the one side for mild, on the other for severe, weather.

Fair if Mercury Rises.		Foul if Mercury Falls.	
Very Dry.....	31	Hard Frost	
Set Fair	30·5	Set Frost	
Fair	30	Frost	
Change	29·5	able	
Rain	29	Snow	
Much Rain	28·5	Much Snow	
Stormy	28	weather	

It is provided with an attached thermometer, and this gives us a rough guide as to date. The scale is a curious one; it reads *downwards* from a point called "Extreme hot." But we give the lettering:—

Extreme hot	0
Sultry	15
Hot	25
Warm air.....	35
Temperate air.....	45
Cold air	55
Frost.....	65
Hard frost	75
Extreme cold	90

An Immisch thermometer placed beside it read 52° when the above thermometer was at 36° .

Now this scale is the one first used in this country, being "made (and commonly very carelessly made) after the standard one kept in the Royal Society,"* and as Fahrenheit's scale was, we believe, in general use by 1730, it seems probable that this Salisbury barometer is at least 160 years, and (considering the history of barometers) not more than 190 years old.

This would carry the placing of the word "Change" opposite $29\frac{1}{2}$ inches back to between 1700 and 1730. Can anyone complete the inquiry?

* Martine, G., M.D. "Essays on the Construction and Graduation of Thermometers." 2nd Edition. Edinburgh, 1772, page 45.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1888.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	72·7	19	42·8	11	67·1	52·3	52·4	82	120·2	41·6	4·91	26	7·7
Malta	102·8	10	63·6	4	89·0	70·8	65·5	65	154·7	56·0	·00	...	0·7
Cape of Good Hope.	67·0	25	35·5	19	59·6	45·7	...	...	...	...	3·77	12	5·4
Mauritius	77·0	7	56·7	18	74·7	63·5	59·4	74	123·0	47·3	1·50	19	4·7
Calcutta	92·5	16 ^a	75·2	31	87·9	78·3	77·8	83	158·5	74·3	12·25	24	9·1
Bombay	87·5	12	73·3	14	84·6	77·8	76·8	86	142·0	70·9	22·47	28	9·5
Ceylon, Colombo	87·4	17	75·6	25	85·9	77·7	72·0	76	143·0	72·2	·98	6	5·8
Melbourne	64·2	1	28·3	27	55·4	41·8	41·2	76	113·4	20·9	1·51	15	6·2
Adelaide	62·3	6	39·7	21	58·2	46·8	46·1	79	119·4	33·5	4·04	26	6·6
Wellington .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Auckland	61·5	25	40·0	19, 30	57·4	46·3	45·4	79	115·0	29·0	3·85	20	6·6
Jamaica, Kingston	94·6	28	70·8	24	90·9	74·2	74·3	73	...	...	1·88	...	...
Barbados	86·0	14 ^b	70·0	2, 18 ^c	83·0	73·0	74·0	85	...	...	...	...	6·0
Toronto	87·7	4	47·3	13	76·6	55·7	53·9	65	...	40·2	·86	9	5·0
New Brunswick, Fredericton	85·7	5	42·0	2	75·7	52·4	54·7	68	...	...	2·12	16	6·2
Manitoba, Winnipeg ...	91·0	28	43·3	7	78·2	53·4	56·2	73	...	...	3·78	13	4·1
British Columbia, Victoria	85·0	17	37·0	7	70·7	46·7	...	...	...	...	·34	5	..

a And 18. b And 15. c And 19, 20.

REMARKS, JULY, 1888.

MALTA.—Mean temp. 78·7; mean hourly velocity of wind 7·9 miles. Sea temp rose from 76°·0 to 82°·8. Temp. in shade above 100° on 3 days. J. SCOLES.

Mauritius.—Mean temp. of air 0°·1 below, mean dew point 0°·1 above, and R ·88 in. below, their respective averages. Mean hourly velocity of wind 11·0 miles, or 0·6 below average; extremes 29·0 miles on 26th and 2·4 on 25th. Prevailing direction E.S.E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·8 above average; dew point 0°·2, humidity 4, mean amount of cloud 0·1, pressure ·092 in., and R ·22 in. below average. Prevailing winds N. and N.W.; strong on 12 days. Heavy dew on 7 days. Ice on 2 days. Dense fog on morning of 6th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure ·054 below the average of 31 years. Mean temp. 0°·8 and rainfall 1·50 in. above average. C. TODD.

Auckland.—Finer and more moderate than usual for July, with very little wind. Rainfall 1·00 in. below the average of 21 years. Mean temp. and pressure close to the average. T. F. CHEESEMAN.

BARBADOS.—Mean temp. (77°·2), 0°·5 above the average. Mean hourly velocity of wind 2 miles below the 15 years' average. Rainfall a trifle above the average. Evaporation 15 per cent. below the average. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
JANUARY, 1889.

[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	1.52	XI.	Castle Malgwyn	2.14
"	Margate, Birchington...	.74	"	Rhayader, Nantgwillt..	2.65
"	Littlehampton .....	.95	"	Carno, Tybrith	2.18
"	Hailsham	1.14	"	Corwen, Rhug	1.53
"	Ryde, Thornbrough	1.13	"	Port Madoc	2.64
"	Alton, Ashdell	1.27	"	I. of Man, Douglas	2.46
III.	Oxford, Magdalen Col...	.66	XII.	Stoneykirk, Ardwell Ho.	2.68
"	Banbury, Bloxham .....	.64	"	New Galloway, Glenlee	4.55
"	Northampton .....	.78	"	Melrose, Abbey Gate...	.66
"	Cambridge, Beech Ho...	.71	XIII.	N. Esk Res. [Penicuik]	1.30
"	Wisbech, Bank House..	.91	XIV.	Ballantrae, Glendrishaig	3.96
IV.	Southend	1.04	"	Glasgow, Queen's Park.	2.04
"	Harlow, Sheering .....	.61	XV.	Islay, Gruinart School..	6.21
"	Rendlesham Hall .....	.77	XVI.	Dollar	2.54
"	Diss .....	.91	"	St. Andrews, Pilmour Cot	1.03
"	Swaffham .....	.74	"	Balquhiddier, Stronvar..	7.30
V.	Salisbury, Alderbury ...	.71	"	Dunkeld, Inver Braan..	2.46
"	Warminster .....	.72	"	Dalnaspidal H.R.S. ...	4.84
"	Bishop's Cannings .....	.84	XVII.	Keith H.R.S.	1.14
"	Ashburton, Holne Vic...	2.49	"	Forres H.R.S. ....	.51
"	Hatherleigh, Winsford.	2.81	XVIII.	Strome Ferry H.R.S....	5.85
"	Lynmouth, Glenthorne.	1.97	"	Fearn, Lower Pitkerrie.	.81
"	Probus, Lamellyn	2.63	"	Loch Shiel, Glenaladale	12.83
"	Launceston, S. Petherwin	1.94	"	N. Uist. Loch Maddy ...	4.73
"	Wincanton, Stowell Rec.	.90	"	Invergarry	6.49
"	Taunton, Lydeard Ho...	.86	"	Loch Ness, Drumnadrochit	1.94
"	Wells, Westbury .....	.54	XIX.	Lairg H.R.S. ....	...
VI.	Bristol, Clifton .....	.84	"	Forsinard H.R.S. ....	...
"	Ross .....	.84	"	Watten H.R.S.	1.45
"	Wem, Clive Vicarage ...	.39	XX.	Dunmanway, Coolkelure	7.12
"	Cheadle, The Heath Ho.	.97	"	Fermoy, Gas Works ...	2.94
"	Worcester, Diglis Lock	.56	"	Tipperary, Henry Street	3.03
"	Coventry, Coundon	1.06	"	Limerick, Kilcornan ...	2.46
VII.	Ketton Hall [Stamford]	1.39	"	Miltown Malbay	4.27
"	Grantham, Stainby	1.56	XXI.	Gorey, Courtown House	2.34
"	Horncastle, Bucknall ...	1.21	"	Navan, Balrath	3.21
"	Mansfield, St. John's St.	1.32	"	Mullingar, Belvedere ...	1.82
VIII.	Neston, Hinderton .....	.55	"	Athlone, Twyford	2.48
"	Knutsford, Heathside ...	1.19	"	Longford, Currygrane...	3.06
"	Lancaster, South Road.	2.49	XXII.	Galway, Queen's Coll...	3.52
"	Broughton-in-Furness ..	3.39	"	Clifden, Kylemore	8.10
IX.	Wakefield Prison	1.22	"	Crossmolina, Enniscoe..	4.36
"	Ripon, Mickley .....	.98	"	Collooney, Markree Obs.	3.40
"	Scarborough, West Bank	1.15	"	Ballinamore, Lawderdale	...
"	East Layton [Darlington]	.67	XXIII.	Warrenpoint	4.53
"	Middleton, Mickleton ..	1.32	"	Seaforde	2.57
X.	Haltwhistle, Unthank...	1.29	"	Belfast, New Barnsley .	3.39
"	Shap, Copy Hill	3.13	"	Bushmills, Dundarave...	2.78
XI.	Llanfrechfa Grange	1.63	"	Stewartstown	2.64
"	Llandovery	3.05	"	Buncrana	2.79

JANUARY, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which .01 or more fell.	TEMPERATURE				No. of Nights below 32°	
		Total Fall.	Difference from average. 1870-9	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth.	Date.	Deg.		Date.	Deg.	Date.			
		inches	inches.	in.								In shade.	On grass.
I.	London (Camden Square) ...	.81	— 1.54	.19	12	10	53.1	31	22.0	7	11	22	
II.	Maidstone (Hunton Court)...	.93	— 1.64	.38	9	8	...	...	...	...	...	...
	Strathfield Turgiss .....	.80	— 1.75	.40	9	11	50.1	18	19.0	6	20	24	
III.	Hitchin .....	.92	— 1.30	.28	9	14	52.0	31	19.0	5	12	...	
	Winslow (Addington) .....	.99	— 1.56	.30	9	12	52.0	31	16.0	6	19	24	
IV.	Bury St. Edmunds (Culford) ..	.60	— 1.24	.35	13	...	46.0	25	12.0	6	...	25	
	Norwich (Cossey) .....	.78	— .92	.20	11	10	...	...	...	...	10	18	
V.	Weymouth (Langton Herring) ..	.68	...	.26	9	11	51.0	31	30.0	2, 6	10	...	
"	Barnstaple	1.19	— 3.07	.30	9	8	53.0	19a	24.0	4	...	...
"	Bodmin	2.89	— 3.62	.80	11	15	50.0	29	30.0	3, 4, 6	7	15	
VI.	Stroud (Upfield) .....	.80	— 2.19	.25	9	15	52.0	29b	22.0	3	17	...	
"	Church Stretton (Woolstaston) ..	.66	— 2.77	.18	9	16	52.5	18c	20.0	6	15	24	
"	Tenbury (Orleton) .....	.59	— 2.40	.24	8	11	54.0	18c	19.3	4	16	19	
VII.	Leicester (Barkby)	1.42	— .58	.51	9	15	54.0	31	19.0	3	21	26	
"	Boston .....	.97	— .75	.24	10	10	50.0	28	15.0	6	18	...	
"	Hesley Hall [Tickhill]	1.58	...	.70	9	13	54.0	31	16.0	6	16	...	
VIII.	Manchester (Ardwick)	1.22	— 2.02	.32	31	11	56.0	18c	30.0	1	5	...	
IX.	Wetherby (Ribston Hall) ..	.99	— 1.23	.34	10	10	...	...	...	...	...	...
"	Skipton (Arnccliffe)	3.25	— 3.68	1.18	29	16	...	...	...	...	...	...
"	Hull (People's Park)	1.38	— .53	.69	9	13	...	...	...	...	...	...
X.	North Shields	1.20	— .64	.35	9	13	56.5	31	26.0	27	13	16	
"	Borrowdale (Seathwaite)	12.36	— 6.39	3.10	29	16	...	...	...	...	...	...
XI.	Cardiff (Ely)	1.89	— 2.82	.73	9	10	...	...	...	...	...	...
"	Haverfordwest	2.65	— 3.62	.49	28	21	51.4	29	23.6	2	12	20	
"	Plinlimmon (Cwmsymlog) ...	3.35	...	1.03	9	11	...	...	...	...	...	...
"	Llandudno	1.21	— 1.75	.39	9	15	53.9	29	31.2	7, 27	2	...	
XII.	Cargen [Dumfries]	2.62	— 3.49	.64	28	14	53.6	31	22.8	27	8	...	
"	Jedburgh (Sunnyside) .....	.54	— 1.51	.13	9	11	52.0	18c	23.0	27	13	...	
XIV.	Old Cumnock	3.14	— 1.50	.59	28	14	53.0	18	20.0	26	10	...	
XV.	Lochgilhead (Kilmory)	8.47	+ .60	1.24	8	21	...	...	...	...	...	...
"	Oban (Craigvarren)	5.87	...	1.08	17	23	53.6	17	29.6	27	3	...	
"	Mull (Quinish)	7.68	...	1.17	15	21	...	...	...	...	...	...
XVI.	Loch Leven Sluices	1.80	— 2.02	.50	18	8	...	...	...	...	...	...
"	Dundee (Eastern Necropolis) ..	1.20	— 1.25	.40	8	11	57.6	31	23.7	2	11	...	
XVII.	Braemar	1.68	— 1.10	.50	8	18	53.3	18	19.3	2	12	28	
"	Aberdeen (Cranford) .....	...	...	...	...	...	...	...	...	...	...	...
XVIII.	Lochbroom	3.45	...	.69	18	18	...	...	...	...	...	...
"	Culloden	2.80	— 1.49	...	...	...	55.0	18	30.0	2, 9	21	...	
XIX.	Dunrobin	1.53	...	.40	9	9	58.0	18	28.0	2	10	...	
"	S. Ronaldsay (Roeberry)	2.37	— .47	.34	15	22	...	...	...	...	...	...
XX.	Cork (Blackrock)	3.40	— 2.62	1.17	15	12	61.0	31	26.0	2	8	...	
"	Dromore Castle	7.28	...	1.36	15	14	54.0	30	28.0	15	...	...
"	Waterford (Brook Lodge) ..	2.51	...	.86	11	13	58.0	31	23.0	3	6	...	
"	O'Briensbridge (Ross)	3.17	...	.67	11	17	54.0	31	25.0	3	...	11	
XXI.	Carlow (Browne's Hill)	2.36	— 1.26	.58	11	22	...	...	...	...	...	...
"	Dublin (Fitz William Square) ..	2.21	— .05	1.22	11	16	56.2	18	27.1	3	3	16	
XXII.	Ballinasloe	2.94	— 1.42	.74	11	23	51.0	31	21.0	2	13	...	
XXIII.	Waringstown	1.97	— 1.44	.47	8	20	54.0	17d	24.0	2, 26	13	18	
"	Londonderry (Creggan Res.) ..	3.27	...	.48	16	25	...	...	...	...	...	...
"	Omagh (Edenfel)	3.37	— .40	.75	11	22	53.0	17	25.0	1	8	18	

a And 29, 30. b And 30. c And 31. d And 18, 31. e And 7, 11, 27.
+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON JANUARY, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—The greater part of the month was mild and free from storms of any serious kind. Agricultural matters were in a very satisfactory condition, and owners of breeding flocks have good reason, so far, to congratulate themselves upon such a favourable season.

WINSLOW, ADDINGTON.—From the first until the 8th very sharp frost prevailed, the max. temp on 5th and 6th being 24° and 25° respectively. Fog was very dense on several days and the trees were beautifully covered with rime. During the remainder of the month there were frequent slight frosts, but none severe. The last day of the month was very mild, max. temp. 52°.

WEYMOUTH, LANGTON HERRING.—On the whole a very fine month; there were a few foggy days and on several a little rain fell, but the total was 2·46 in. below the average. Mean temp. 38°·4, 0°·9 below the average of 17 years. The 5th, 11th, 13th, 14th, and 15th were more or less foggy, but on no day was the fog dense. The month was very calm, no storm occurring.

BODMIN.—A mild month, with high pressure. Mean temp. 39°·5.

UPFIELD, STROUD.—Fog on four days, with an unusual amount of rime. S. W. gale on 29th.

WOOLSTASTON.—An open, spring-like month, with constant slight frosts at night; gale on the 28th. Mean temp. 37°·5.

ORLETON.—A thick fog prevailed for the first seven days, during which time the sun was only visible for a few hours on the mornings of 2nd and 4th. A great rime commenced on the 3rd and lasted until the 8th. The remainder of the month was generally cloudy with occasional frosty nights. The temp. was very variable, but for the whole month the mean was only a trifle less than the average of 23 years. The bar. on the 3rd stood at 30·50, but on the 9th it fell to 29·12, accompanied by violent wind; afterwards it was generally very high and steady, although the sky was very changeable. The R was about two inches below the average and was smaller during the last 58 years only in 1855, 1858, and 1880. No snow fell during the month.

BARKBY.—A lovely rime upwards of an inch deep was on all the trees from 3rd to 7th, looking all the more decorative because of the contrast of the green grass; it was on the S. W. side of the branches, facing the wind. Five days' skating. Mean temp. 35°·1.

MANCHESTER.—A very mild month, with comparatively high temp. There was very little frost and no snow. Fog on the first six days.

HULL.—Fog and hoar frost prevailed during the early part of the month, but afterwards the weather was generally mild and fine, but cloudy.

VALES.

HAVERFORDWEST.—The month commenced densely foggy, with severe frost; the weather changed on the 7th, when R fell, and cold, rainy, foggy weather prevailed, with low night temp., to the end of the month. Mean temp. about the average of 25 years. Very high bar. during the first week.

SCOTLAND.

CARGEN.—The weather during the month was very changeable, and the fluctuations of pressure and temp. were on two or three occasions great and sudden. Frost never continued more than two days at a time. Mean temp. 1°·5 above the average.

JEDBURGH.—The temp. generally was high, but very variable; vegetation progressed much, especially spring flowers; a blackbird's nest with four eggs was found towards the close; agricultural work went on without intermission. The month is said by old people to be the mildest in their recollection.

OBAN, CRAIGVARREN.—An open warm month, with equable temp., growth continuing throughout; at the close only it became stormy; neither H nor S.

BRAEMAR.—A month of excellent and spring-like weather. Blackbirds heard singing on 25th.

LOCHBROOM.—Considering that January is generally the stormiest month of the year, this has been a wonderful one for openness and mildness; only on the 25th did it snow a little on the low ground, and soon melted. It was rather boisterous after the 23rd, but generally so warm that the bees were playing about their hives, and snowdrops and daisies were in full flower.

INVERNESS, CULLODEN.—The month was remarkable for the absence of R, and for high temp. Vegetation advancing rapidly.

ROEBERRY.—From the 1st up till the 18th the weather was settled and mild, but the latter part of the month was very rough and unsettled. Heavy gale from W. to N.W. on 18th.

IRELAND.

CORK.—Dull and foggy, with some frost, during the first two weeks, the remainder mostly fine and mild for the season.

DROMORE.—Weather very mild and open.

WATERFORD.—R greatly below the average. The month generally was very mild, mean temp. $40^{\circ} \cdot 4$.

ROSS.—No severe weather, very mild from 17th to the close, the mean temp. for that fortnight being 44° .

DUBLIN.—Open, but changeable. The mean temp., $42^{\circ} \cdot 4$, was $1^{\circ} \cdot 1$ above the average. The atmosphere was foggy on each of the first six days, and also on 22nd. High winds on eight days, reaching the force of a gale on two days, 11th and 18th. H fell on 9th and 11th, and S and sleet on 11th. Temp. exceeded 50° on eight days, compared with ten days in December, 1888, while it fell to or below 32° on only three nights, compared with five in December. The last five days of the month were chiefly mild, changeable and cloudy, and R fell frequently, although not in large quantities.

EDENFEL, OMAGH.—The month commenced with clear, pleasant, frosty weather, which on the 5th gave place to a continuance of the mild, and generally wet weather that has been so far characteristic of the winter. The ground was not once white with S.

LUNAR RAINBOW.

To the Editor of the Meteorological Magazine.

SIR,—Last night, November 19th, we were favoured with a remarkably fine lunar rainbow here in the W.N.W. When I first saw the bow the arc was perfect without any break; the brightest portion was towards the north, *i.e.*, for about 70° from the northern extremity, this part having the faintest blue tinge, the remainder being a misty white. A friend, with whom I had been conversing about a lunar rainbow some days previously, called at my house to tell me of it at 8 o'clock. I went out immediately, and watched it until its disappearance at 8h. 11m. The moon, full the previous day, rose at at 5h. 1m., and was therefore well above the horizon, and shining very brightly through the gaps in the heavy clouds. My friend assured me that he had seen the bow at intervals for fully an hour.

Yours truly,

WALTER E. STEWART.

Croft-on-Tees, Darlington, November 20th, 1888.

S Y M O N S ' S
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A COLD PERIOD.

Two able men have recently and almost simultaneously drawn attention to a long period of cold which has prevailed over some parts of Europe.

M. Lancaster, of Brussels, in his article on the climate of Belgium during 1888, in the *Annuaire de l'Observatoire Royal de Bruxelles* for 1889, begins with the following remarks:—

“The year 1888, like its predecessor 1887, has been very cold. It has even been colder than 1887.

“For nearly four years the temperature has been almost constantly below the average. The persistency of this extraordinary state of things is a fact without precedent.

“From January, 1885, to November, 1888, there have been 35 months, out of 47, in which the temperature has been below the average.

“In 1888 every month up to November was below the average, the deficiency in February being as much as $8^{\circ}3$.

“Only three years (since the establishment of the Observatory in 1833) have been colder than 1888, viz., 1879, $47^{\circ}2$; 1845, $47^{\circ}9$; 1855, $47^{\circ}9$; 1888, $48^{\circ}0$. The mean for 1887 was $48^{\circ}4$, therefore these two years may be regarded as amongst the coldest of the century.”

M. Flammarion's note was, we believe, originally published in the *Petit Journal*; we, however, have only the note as quoted in *Le Figaro*, which is to the following effect:—

“As the result of comparing meteorological observations made in France and abroad, M. Camille Flammarion states that during four years the temperature of our climates has fallen considerably. It is therefore certain that we are passing through a period of cooling. Almost all the months are below their average, and the fall in February and March is striking. The fall on the average of the whole year is from $2^{\circ}7$ to $3^{\circ}6$ for France and Belgium, so that, for example, at Paris, instead of $51^{\circ}4$ it has been $48^{\circ}0$, and at Brussels instead of $50^{\circ}5$ it has been $48^{\circ}0$.”

In the foregoing extracts the old-fashioned year, beginning with December and ending with November, has, we believe, been taken, hence the above values differ slightly from those for the civil year given further on.

Moreover, Mr. Renou calls attention to the fact that the temperature assigned to Paris by M. Flammarion ($51^{\circ}4$) is too high by about $1^{\circ}4$.

We ought also to mention two papers upon the subject read by Mr. C. Harding before the Royal Meteorological Society and reported on pages 86 and 179 of our last volume.

It is obviously of much interest to know the area over which this cooling has prevailed and its relative intensity. At present we have only had time to collect returns from a few stations just as an illustration of what is wanted. The Greenwich values are taken from Mr. Glaisher's tables, those for Paris have been kindly furnished by Mr. Renou from the Observatory Parc St. Maur, those from Brussels by M. Lancaster, of the Observatoire Royal, and those from Toronto are taken from the *Canadian Monthly Weather Review*. The following little table epitomizes the results, whence it will be seen that the effect has certainly been much more marked at Brussels than in this country.

	Greenwich.		Paris.		Brussels.		Toronto.
1885.	·0	-	·5	-	1·1	-	2·6
1886.	+ ·1	+	·6	-	·1	-	·5
1887.	- ·8	-	2·1	-	2·2	+	·0
1888.	- 1·0	-	1·9	-	2·2		

On considering the above facts, it occurred to us that we had heard of some change in the position of the thermometers at Brussels, and we asked M. Lancaster about it. From his reply, it appears that the values for 1885 to 1888 are from thermometers in a Stevenson screen, whereas up to 1887 the exposure was at a N. window; the yearly mean in the screen is $0^{\circ}5$ lower than at the window, but as the correction for individual months is not accurately known, no corrections have been applied.

If now we apply this correction to the annual values, the above table will become

	Greenwich.		Paris.		Brussels.		Toronto.
1885.	·0	-	·5	-	·6	-	2·6
1886.	+ 0·1	+	·6	+	·4	-	·5
1887.	- ·8	-	2·1	-	1·7	+	·0
1888.	- 1·0	-	1·9	-	1·7		
Mean	- ·4		- 1·0		- ·9		

We do not think that it is necessary to pursue the subject further, as all these values are within the limits of variation of mean annual temperature.

	GREENWICH.			PARIS.			BRUSSELS.			TORONTO.		
	Monthly Mean Temp.	Diff. from Aver.		Monthly Mean Temp.	Diff. from Aver.		Monthly Mean Temp.	Diff. from Aver.		Monthly Mean Temp.	Diff. from Aver.	
		Monthly.	Qrtly.		Monthly.	Qrtly.		Monthly.	Qrtly.		Monthly.	Qrtly.
1885	Jan...	36.6	+ .1		31.6	- 3.2		32.4	- 3.9		18.0	- 4.6
	Feb...	43.9	+ 5.2	+ 1.5	44.8	+ 6.3	+ .7	44.8	+ 6.0	+ 0.1	11.1	- 11.8
	Mar...	40.3	- .8		41.3	- 1.0		40.5	- 1.9		18.5	- 10.6
	April	47.7	+ 1.6		50.2	+ 1.1		51.1	+ 1.8		37.7	- 3.1
	May...	49.9	- 2.6	+ .1	52.2	- 3.8	+ .1	51.8	- 4.1	- 0.5	51.7	- .3
	June...	59.5	+ 1.3		64.5	+ 3.1		63.3	+ 0.7		60.6	- 1.3
	July...	63.8	+ 2.1		65.3	+ .7		64.8	- .4		68.3	+ .7
	Aug...	58.5	- 2.4	- .6	61.1	- 3.0	- 1.3	61.2	- 3.2	- 1.7	63.5	- 3.0
	Sept...	55.1	- 1.4		57.4	- 1.5		57.6	- 1.6		57.0	- 1.5
	Oct...	46.1	- 3.7		47.4	- 3.5		48.0	- 3.6		45.8	- .4
	Nov...	43.3	+ 1.0	- 1.0	43.2	+ .7	- 1.3	41.0	- 2.0	- 2.3	38.6	+ 2.6
	Dec...	38.9	- .2		35.9	- 1.1		36.8	- 1.3		28.2	+ 2.3
1886	Jan...	36.1	- .4		36.0	+ 1.1		34.8	- 1.4		19.2	- 3.4
	Feb...	33.7	- 5.0	- 2.3	34.1	- 4.3	- 1.3	32.4	- 6.5	- 3.3	19.0	- 3.8
	Mar...	39.6	- 1.5		41.5	- .7		40.5	- 2.0		30.2	+ 1.1
	April	46.4	+ .3		50.9	+ 1.8		49.8	+ .5		44.9	+ 4.1
	May...	53.3	+ .8	+ .2	57.5	+ 1.6	+ .4	57.6	+ 1.7	- .1	53.2	+ 1.2
	June...	57.8	- .4		59.3	- 2.1		60.2	- 2.4		60.9	- 1.1
	July...	63.0	+ 1.3		64.9	+ .4		65.5	+ .3		66.8	- .8
	Aug...	62.6	+ 1.1	+ 1.5	64.3	+ .2	+ 1.3	64.3	- .1	+ 1.3	65.7	- .8
	Sept...	58.7	+ 2.1		62.3	+ 3.4		62.8	+ 3.7		58.9	+ .3
	Oct...	53.3	+ 3.8		54.3	+ 3.4		54.5	+ 2.8		48.5	+ 2.1
	Nov...	44.0	+ 1.6	+ .9	44.3	+ 1.9	+ 1.9	45.7	+ 2.7	+ 1.6	35.6	- .3
	Dec...	36.5	- 2.6		37.4	+ .3		37.2	- .7		21.6	- 4.4
1887	Jan...	35.6	- 1.0		31.6	- 3.2		33.2	- 2.9		18.1	- 4.4
	Feb...	38.8	0	- 1.5	35.9	- 2.5	- 3.3	36.8	- 2.2	- 3.4	21.7	- .8
	Mar...	37.6	- 3.5		38.2	- 4.1		37.4	- 5.0		24.8	- 4.1
	April	44.1	- 2.0		46.8	- 2.3		46.4	- 2.9		39.4	- 1.5
	May...	49.8	- 2.7	- .7	52.5	- 3.5	- 1.3	52.5	- 3.4	- 2.1	58.5	+ 6.5
	June...	60.9	+ 2.6		63.2	+ 1.8		62.6	0		63.9	+ 1.9
	July...	66.5	+ 4.8		66.8	+ 2.3		67.5	+ 2.3		73.1	+ 5.6
	Aug...	62.5	+ 1.6	+ 1.3	63.1	- .9	- .9	63.3	- 1.1	- .5	66.2	- .2
	Sept...	54.0	- 2.6		54.9	- 4.0		56.4	- 2.7		56.4	- 2.1
	Oct...	45.0	- 4.6		44.0	- 6.9		46.5	- 5.2		44.2	- 2.2
	Nov...	40.8	- 1.6	- 2.4	41.0	- 1.4	- 3.0	41.6	- 1.4	- 2.9	35.1	- 0.9
	Dec...	38.1	- 1.0		36.2	- .8		35.8	- 2.2		28.4	+ 2.6
1888	Jan...	37.8	+ 1.2		33.7	- 1.1		33.6	- 2.5		15.0	- 7.4
	Feb...	35.0	- 3.8	- 1.9	31.8	- 6.6	- 3.7	30.6	- 8.3	- 4.9	21.9	- .6
	Mar...	38.0	- 3.1		38.9	- 3.3		38.5	- 4.0		22.4	- 6.3
	April	43.4	- 2.7		45.5	- 3.6		45.1	- 4.1		38.9	- 1.9
	May...	53.0	+ .5	- 0.7	56.0	+ .1	- 1.2	55.5	- .5	- 1.6	50.6	- 1.6
	June...	58.3	0.0		61.4	0		62.5	- .2		64.4	+ 2.4
	July...	57.9	- 3.8		60.3	- 4.3		60.5	- 4.7		66.2	- 1.5
	Aug...	59.1	- 1.8	- 2.1	61.5	- 2.5	- 2.5	62.1	- 2.3	- 2.8	66.0	- .3
	Sept...	55.7	- 0.8		58.2	- .7		57.7	- 1.4		56.5	- 1.9
	Oct...	46.0	- 3.5		45.7	- 5.2		48.3	- 3.4		43.4	- 3.0
	Nov...	47.0	+ 4.6	+ 0.9	46.6	+ 4.1	- .1	45.5	+ 2.5	+ 0.7	37.4	+ 1.4
	Dec...	40.8	+ 1.7		37.7	+ .7		40.8	+ 2.9			
1889	Jan...				33.9	- .9		34.3	- 2.0			
	Feb...				36.3	- 2.2		35.1	- 3.7			

THE FLOODS OF MARCH 8TH--9TH.

THERE is not time to treat this subject fully in the present number, but we can give a brief outline of the principal injury, and treat the subject fully on a subsequent occasion.

DAMAGE.

Oxford.—Although the rainfall here was continuous, it was not exceptional, but we have had the highest flood for ten years, owing to the enormous quantity of water coming down from Lechlade and the west.

Taunton.—This is one of the towns which generally suffers in time of heavy rain, but as far as we know does nothing towards protecting itself against the floods of the Tone. The water rose to 5 ft. in the main thoroughfares, and near the river to 6 ft., doing of course much damage both to property and to health. Between Taunton and Bridgewater, the main line of the Great Western Railway was 3 or 4 ft. under water, and therefore impassable.

Bath.—The Avon rose 15 ft. above its usual level, and the streets in the lower part of the City became flooded, and of course the houses on each side suffered likewise.

Bristol.—Here a large area has been covered with houses which ought not to have been built upon until proper engineering works were carried out for its protection from floods. Whenever there is a flood at or near Bristol, we always hear of the distress of the poor people in the Baptist Mills district, and we wonder who is responsible for covering that area with "hundreds of houses filled with water to the second storey?" Bristol is not the only place where the greed of some, has led to houses being built upon land which has at intervals been flooded, from time immemorial. This time, however, the flood was not confined to the Baptist Mills district, but invaded the centre of trade and commerce. The damage to property alone is put at £40,000 to £50,000, and to this what is to be added for chills, damp and muddy houses, illness and death?

Stratford-on-Avon.—Much ground and some roads under water; one hotel in the town so flooded that the ground floor could not be used.

Evesham.—Some of the streets 2 ft. to 3 ft. under water, and the basements of houses flooded.

Nuneaton.—Mills by the side of the river had to be closed as the ground floors were flooded and the engine fires extinguished.

Tamworth.—Water 3 ft. deep in many of the streets, and the farmers up all night moving their stock to high land; some hay ricks washed away by the floods.

Worcester.—Much damage, manufactories flooded, cattle drowned, and thousands of acres of land submerged.

Leicester.—This is another town in which much land very slightly above the ordinary level of the river Soar has been built upon, with

the natural result of frequent complaints as to floods. It appears from the newspapers that important works for facilitating the passage of storm waters, and thereby diminishing the liability to flooding were in progress, and that the contractors' plant, worth £2,000 or £3,000, was carried away and blocked up a bridge lower down, thus throttling the river and compelling it to rise higher than it would otherwise have done. As to the truth of this story we know nothing at present, but it seems probable as the damage in Leicester appears exceptional considering the rainfall which produced it. Whole streets are said to have been submerged, many factories flooded and the hands thrown out of work, the Great Northern Goods station was flooded, the horses being rescued only when the water had reached 3 ft. in their stalls. At Knight's Shoe Factory, some of the workrooms were said to have had in them 14 ft. of water.

Nottingham.—This town on the River Trent generally suffers when Leicester does so, because (1) the Trent receives the Soar, and also the (Derbyshire) Derwent a very few miles W. of Nottingham; and (2) from Nottingham to the sea the Trent has a long and devious course with a very slight fall. Hundreds of houses are stated to have been flooded, for an immense volume of water poured down from the high grounds, and the flood level rose to the same height as in 1877, that is to say (with three exceptions) to the greatest height this century.

Chester.—It is many years since the Chester Post-office officials experienced such a destructive storm as that which concluded early on Saturday morning. Snow fell continuously for 12 hours, but towards Friday midnight it gave up, and rain descended in torrents for some hours. Telegraphic communication was cut off between Chester and Cholmondeley, Malpas, Tattenhall, and Farndon, while a great number of wires were broken connecting Chester with Manchester, Liverpool and Shrewsbury. On the hills the snow lies a foot in depth.

GROUND ICE, OR ANCHOR ICE.

To the Editor of the Meteorological Magazine.

SIR,—Can you explain the cause of what we call "Anchor Frosts?" They occur only occasionally, sometimes years between. There was a remarkable one yesterday. Ice looking like congealed snow comes up from the *bottom* of the river, which is covered over with it. As the mill was not going it was not affected by it, but I have known it so troublesome in preventing the water coming on the wheel, that the mill had to be stopped.—I remain, yours very truly,

JAS. NUTTER.

[This phenomenon is, we believe, rather rare, and the explanation is not generally known; we therefore use Mr. Nutter's letter as a

nucleus around which to collect a short series of descriptions and explanations, which we will give in chronological order.—ED. M.M.]

METEOROLOGY, BY G. HARVEY, F.R.S., 4to, 1849, p. 144.

“The phenomenon of ice at the bottom of rivers is of very great interest. Mr. Knight discovered some in the river Teme, in Herefordshire, which he has described in the *Philosophical Transactions* for 1816. On a morning succeeding an intensely cold night, the rocky bed of the river appeared covered with frozen matter, which reflected a kind of silvery whiteness, and which upon examination was found to consist of numerous frozen spiculæ, intersecting each other in every direction, but not assuming anywhere, excepting near the shore, the state of firm compact ice.

“Many opinions have been advanced respecting the origin of ice in a situation so different from its ordinary state, and so contrary to what might be anticipated from its known specific gravity. The ordinary laws of radiation, joined to the eddies and gyrations of the running streams to which it is peculiar, seem adequate, however, to account for its formation. On the occasion which afforded Mr. Knight the opportunity of examining this phenomenon, the temperature of the surface water was just at freezing point, small pieces of ice being everywhere formed upon its more stagnant parts near the shores; and upon a millpond just above the shallow streams, in the bottom of which the ice had been formed, millions of frozen spiculæ were floating. At the end of this pond, the water fell over a low weir, and entered a narrow channel, in which its course was obstructed by points of rocks and large stones. Here numerous eddies were formed, which drew the frozen spiculæ under the water, as in a vortex. Mr. Knight found these frozen spiculæ to accumulate most abundantly upon such parts of the stones as stood opposed to the current, wherever it was not very rapid, below the little falls, or most rapid parts of the river. Upon some large stones near the shore, of which parts were out of the water, and upon pieces of native rock, under similar circumstances, the ice beneath the water had acquired a firmer texture, but appeared, from its whiteness, to have been first formed of congregated spiculæ, and to have subsequently frozen into a firm mass, owing to the temperature of the stone or rock. Ice of this kind extended in a few places eighteen inches from the shore, and lay three or four inches below the level of the surface of the water, and did not dissolve nearly so rapidly as that deposited upon stones more distant from the shore.”

PHYSICAL GEOGRAPHY, BY PROF. J. YOUNG, M.D., 8vo., 1874, p. 235.

“*Ground Ice.*—Ground ice, or ice formed at the bottom of rivers, is, in some of the American streams, of considerable importance as a geological agent. The sheet, whose formation is determined by the contact of water with the stones at the bottom, which have become chilled by radiation in clear water under a cloudless sky, rises and

carries with it the fragments among which it was formed, conveying them down the stream into the open sea, and as the ice melts, distributing them over the floor of the ocean."

PHYSICAL GEOGRAPHY, BY W. D. COOLEY, 8vo., 1876, p. 328.

"The existence of what is called ground ice was long doubted; but careful observation has established the fact that at the bottom of rivers, lakes and other shallow waters ice is often formed before it begins to appear at the surface. It may be presumed that in these cases the ground is colder than the water; but the circumstance that seems to give to the bottom of the river the priority in congelation is, that there, under the edge of the stones, and averted from the current, may be found at once the vibration and the perfect shelter required for the formation of the first crystals. The ground ice thus formed grows in vertical flakes, grouped together so as to resemble some kinds of sponge. It often breaks off and floats on the surface, where it promotes congelation. In harbours on the shores of the Baltic Sea large stones, ropes, iron chains, and even anchors have occasionally been raised to the surface, by the luxuriant growth of the ground ice attached to them."

PHYSIOGRAPHY, BY PROF. HUXLEY, F.R.S., 8vo. 1882, p. 152.

"Yet there are certain conditions under which ice may be actually formed at the bottom of a stream, and remain there for some time. This formation of *ground-ice* is occasionally seen in parts of the Thames.

"Dr. Plot, the first keeper of the Ashmolean Museum at Oxford, published in the year 1677 a famous work on the Natural History of Oxfordshire, in which he refers to the freezing of the Thames in the following words:—'I find it the joint agreement of all the watermen hereabout that I have yet talked with that the congelation of our river is always begun at the bottom, which, however surprising it may seem to the reader, is neither unintelligible nor ridiculous. They all consent that they frequently meet the *ice meers* (for so they call the cakes of ice thus coming from the bottom) in their very rise, and sometimes in the underside including stones and gravel.'

"To explain the formation of such ground-ice, it has been suggested that the action of the running stream mechanically mixes the cold surface-water with the warmer water below until the temperature becomes uniform throughout; and when the air is very cold the whole mass may thus be reduced to the freezing point. The formation of ice will then be determined at the bottom, in consequence of the greater tranquillity of the water and the contact of cold stones and other objects which have become chilled by free radiation. This ground-ice is generally found in little masses clinging to stones and weeds; and when the temperature rises after sunrise, the loose bodies are lifted to the surface by the ice, just as if buoyed up with corks. The ice then floats down the river, bearing its little

freight of gravel, which is dropped on the bed of the river when the ice is broken up or melted. The Rev. J. C. Clutterbuck, who has paid great attention to the study of the Thames, tells us that he has seen 'pieces of rock, eight pounds in weight, raised by a mass from the bottom and carried down the river.*' Here then is a geological agent not to be neglected, since it assists the transporting power of streams in carrying solid matter from the land seawards."

THE RAINFALL OF HELIGOLAND.

To the Editor of the Meteorological Magazine.

SIR,—I beg to state that the notice on the rainfall of Heligoland reprinted from the "Athenæum," in the last number of the *Meteorological Magazine* (p. 10), contains some errors. The mean annual rainfall of this island does not amount to 72·50 in., but only to 30·38 in., there having been committed a constant error in the reduction of Parisian cubic inches, read off on the measuring glass, into millimeters published in the reports of the "Kieler Commission zur Erforschung der Deutschen Meere," which established the meteorological station on the upper-land ("Oberland") of Heligoland in 1873.

Inspecting this station, which reports also to the Meteorological Institute at Berlin, in 1884, I placed a new gauge quite near to the old one standing on the little square before the school-house, and found afterwards that the quantities of rain measured in the new and in the old gauge were in the relation of 1 : 2·28. Reducing by this factor the old observations and adding the new and correct ones till the end of 1888, I obtain a mean annual rainfall of 30·38 in., *i.e.*, a little less than on the West-coast of Sleswick-Holstein, as may be seen by the following comparison :—

	HELIGOLAND.		MELDORF.
	in.		in.
1885	26·85	.....	34·17
1886	26·66	.....	32·18
1887	22·14	.....	26·56
1888	29·43	.....	36·28

In order to know the influence exercised on the quantity of rainfall by the peculiar form of the island rising almost perpendicularly on all sides to a mean height of 150 ft., and therefore forcing the moist sea winds suddenly upwards, I placed another gauge on the down ("Düne") at the height of 8 ft. above the level of the sea. This little flat and sandy island (with an excellent beach for bathing) lies eastward, at the distance of three-quarters of a mile. The observations could only be made there in the months of June till September, because in the remaining part of the year nobody inhabits the down, which is almost inaccessible during rough weather.

* Report of the Thames Commissioners ; appendix 1, 1866.

The simultaneous observations made in the years 1885-87, give the result that on the upper-land falls 13·4 per cent. more rain than on the down; but I am (doubtful) not sure if a great deal of this difference may not be due to the disturbing influence of the wind, which is much stronger on the open and flat down than on the "Oberland," where the raingauge, in spite of the greater height above mean sea-level, is somewhat sheltered by the little town.

Thus, the *amount* of rainfall at Heligoland offers nothing remarkable; but an interesting feature of it is to be found in the fact, that the month of heaviest rainfall is November, whereas on the German coast of the "Nordsee" (German Ocean), this maximum occurs in September. The distribution on the months expressed in per cent. of the yearly total at Heligoland may be seen by the following table:—

January	8	May	5	September	11
February	6	June	6	October	12
March	7	July	8	November	14
April	3	August	11	December	9

It is my opinion, that this peculiarity—for the most part—can be accounted for by the difference of the temperature of the sea and of the air, this being greatest just in November. Indeed, from ten years' observations I obtain the following differences:—

January	3·6	May	—2·0	September	3·4
February	2·0	June	—2·2	October	5·6
March	1·3	July	—0·9	November	6·8
April	—1·3	August	1·4	December	6·1

i.e., in November the mean temperature of the surface of the sea is 6·8° Fahr. higher than that of the air in about 160 ft. above the level of the sea.

G. HELLMANN.

Berlin, March 5th, 1889.

ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting of the Royal Meteorological Society was held on February 20th, at the Institution of Civil Engineers, 25, Great George-street, Westminster, Dr. W. Marcet, F.R.S., president, in the chair. Mr. H. D. Richmond, F.C.S., and Dr. F. G. Smart, M.A., F.L.S., were elected Fellows of the Society. The following papers were read:—1. "Report on the Helm Wind Inquiry," by Mr. W. Marriott, F.R.Met.Soc. The term "helm wind" is applied to a strong wind coming westwards from the Cross Fell range of mountains in Cumberland, which runs from north-north-west to south-south-east. The range is high and continuous, and is not cut through by any valley. Cross Fell is 2,900 feet above sea level. From the top of the mountains to the plain on the west there is a fall of from 1,000 to 1,500 feet in about a mile and a half

At times when the wind is from some easterly point a helm cloud forms over this district, the chief features of the phenomenon being as follows :—A heavy bank of cloud rests along the Cross Fell range, at times reaching some distance down the western slope, and at others hovering just above the summit, while at a distance of two to six miles west from the foot of the Fell a slender roll of dark cloud appears in mid-air and parallel with the helm cloud : this is the helm bar. The space between the helm cloud and the bar is usually quite clear, while to the westward the sky is generally completely covered with cloud. A cold wind rushes down the sides of the Fell and blows violently till it reaches a spot nearly underneath the helm bar, when it suddenly ceases. The observations that have been made in the district during the past three or four years show that the helm wind is not such a rare occurrence as it was popularly supposed to be, the bar having been observed on forty-one occasions in 1885, on sixty-three in 1886, and nineteen in 1887. 2. "An Atmospheric Sketch," by Mr. F. A. Velschow, F.R.Met.Soc. 3. "The Drought in New South Wales in 1883-4, and Rainfall at Corella, 1879-88," by the Ven. Archdeacon Wynne, F.R.Met.Soc.

SNOWSTORM AT TORQUAY.

To the Editor of the Meteorological Magazine.

SIR,—We have just experienced (from 2nd to 5th inst.) some of the severest snowstorms ever known here, the depth on the ground at 11 p.m. on the 3rd, viz. 7 in., having been only once equalled (on January 19th and 21st, 1881), and never exceeded since the observations were begun in August, 1876. Snow fell from 7.50 to 10 p.m. and at 11 p.m. on Saturday, 2nd (with an E.S.E. breeze); on the 3rd from the early morning up to 10.30 p.m. (with the exception of half-an-hour from 10.30 to 11 a.m.), with an Easterly breeze veering to S.S.W. at 7 p.m. and backing to S.E. at 9 p.m.; on the 4th from 7.50 to 9.45 a.m., 10.25 a.m., at times to 3.20, and from 3.30 p.m. to the early morning of the 5th, accompanied by a strong S.S.E. wind, backing in the evening of the 4th to E. The amount in the rain-gauge (melted) was 0.32 in. on the 2nd, 0.46 in. on 3rd, and 0.38 on 4th. The ground was covered with snow from 9 p.m. on the 2nd up to to-day, the max depth being 7 in. at 11 p.m. on 3rd; in spite of the thaw on 4th and 5th it was $1\frac{1}{2}$ in. deep this morning. Bar. was about the average height till yesterday, when it rose above it.—Yours truly,

EDWIN E. GLYDE.

Kirkham, Babbacombe, Torquay, March 6th, 1889.

FORMS OF SNOW AS INDICATIVE OF COMING WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—It does not seem to be generally known that the form and character of snow flakes are sure forecasters of coming weather. This fact was mentioned to me more than 30 years ago by Mr. E. T. Loseby, of Leicester, and we have observed and verified it ever since, and it has been verified by very many others to whom it has been shown. It may be relied on most thoroughly; so that the clouds themselves send us true telegrams of the coming weather, and if the rain drops had a form that we could note, no doubt they would do the same.

If snow falls in thin small spikes, like Epsom salts, it will soon pass away, and the weather become milder; but if the flakes be like stars, or asterisks with 6 radii ✱, there is a certainty of cold weather to follow for two and perhaps six weeks. Hard bally flakes have much the same force as forecasters of severe weather. They are whiter, harder, and fall to the ground much more rapidly than other snow, and sometimes in a short shower of less than half-a-minute; shining very markedly on the surface of the main body of fallen snow. On Sunday and Monday, February 24th and 25th, they fell copiously, both stars and balls, and the cold weather which will certainly follow and has followed so far, will confirm the truth of these observations. The larger and harder the stars, the colder will be the weather which follows.

EDWARD N. POCHIN.

Barkby Vicarage, Leicester, Feb. 6th, 1889.

SALT SNOW.

To the Editor of the Meteorological Magazine.

SIR,—During severe squalls from the NN.W. and N., with snow on February 8th, it was noticed by persons exposed to the squalls that the driving snow had a distinctly saline taste, and the following day it was noticed that leaves of evergreens, &c., were encrusted with a very slight film of saline matter; on testing some of the snow it was found that the quantity of salt (Na Cl) contained in a gallon of melted snow was 3·83 grains—the salts of Magnesium and Calcium, always present in sea water were not determined, they would amount to over a grain in the gallon of the snow water, this though by no means a large amount of solid matter in water, is a remarkable amount in snow, considering that the nearest sea coast to this in a NN.W. direction is quite 60 miles distant, from whence the sea water mingled with the snow must have been carried across the country by the squalls.

Yours truly,
P. DUDGEON.

Cargen, Dumfries, N.B.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1888.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	84·6	10	43·9	19	69·3	52·1	52·2	79	126·6	38·4	3·61	14	5·9
Malta	97·4	17	64·0	21	85·1	69·8	63·3	65	146·5	56·9	·08	1	1·0
Cape of Good Hope. ...	88·0	23	38·5	12	62·3	48·1	...	...	...	...	2·90	9	5·5
Mauritius	77·5	30	57·0	7	74·8	64·5	59·9	74	124·5	48·1	2·87	20	5·0
Calcutta	92·5	3	73·8	24	86·5	77·8	77·5	85	156·5	15·7	26·02	26	9·2
Bombay	86·4	9	74·8	2	83·5	76·6	75·4	86	138·6	73·8	11·43	30	9·3
Ceylon, Colombo	87·7	25	73·8	3	85·9	76·4	71·9	78	144·5	70·0	1·10	11	6·4
Melbourne	67·1	30	30·0	5	56·7	40·1	41·0	75	115·5	23·4	·99	12	6·0
Adelaide	70·7	30	33·7	7	59·6	44·6	43·8	74	127·5	23·5	2·39	20	6·3
Wellington	62·0	20	40·0	1	55·6	44·8	44·6	82	120·0	29·0	5·29	21	4·5
Auckland	63·0	15	43·0	2	59·2	47·9	47·2	79	122·0	35·0	3·40	21	7·0
Jamaica, Kingston	92·9	22	68·8	28	90·4	73·3	72·6	77	...	...	2·44	...	...
Barbados .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	84·9	16	47·3	23	76·1	56·5	55·9	69	...	40·8	2·91	13	5·5
New Brunswick, Fredericton	78·7	10	43·5	21	69·3	52·5	54·1	77	...	...	4·20	21	6·8
Manitoba, Winnipeg ...	97·0	23	30·3	31	75·0	46·5	52·0	73	...	...	1·13	13	3·5
British Columbia, Victoria	81·0	30	43·0	21, 27	72·5	49·4	...	...	...	...	·42	2	..

REMARKS, AUGUST, 1888.

MALTA.—Mean temp. 76°·4 ; mean hourly velocity of wind 8·7 miles. Sea temp. fell from 79°·9 to 76°·4. L seen on 26th and 27th. J. SCOLES.

Mauritius.—Mean temp. of air 0°·4, of dew point 1°·2, and R 1·02 in. above their respective averages. Mean hourly velocity of wind 11·7 miles, or 1·2 below average ; extremes 27·8 on 5th and 1·7 on 22nd. Prevailing direction, E.S.E.

C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·8, and of dew point 1°·1 below average ; humidity and mean amount of cloud very near the average ; R ·87 in. below average. Prevailing winds N. and N.W. ; strong on 8 days. Heavy dew on 9 days. Hoar frost on 9 days. Fogs on 5 days. Ice on 5th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure ·056 in. above average. Mean temp. 2°·0 below average. Sky considerably more clouded than usual, but rainfall only slightly higher than the average for previous 31 years. C. TODD.

Wellington.—Generally showery. Prevailing winds S. and S.E. Hail on 30th and 31st. Slight earthquakes on 16th and 17th. Mean temp. 2°·2 above the average. Rainfall slightly, and wet days considerably, more than the average. R. B. GORE.

Auckland.—A warm, mild month. Rainfall nearly an inch below the average, mean temp. considerably above the average, and barometric pressure slightly above.

T. F. CHEESEMAM.

SUPPLEMENTARY TABLE OF RAINFALL,
FEBRUARY, 1889.

[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	2·91	XI.	Castle Malgwyn	2·37
„	Margate, Birchington...	2·14	„	Rhayader, Nantgwillt..	5·67
„	Littlehampton	2·00	„	Carno, Tybrith	3·03
„	Hailsham	2·62	„	Corwen, Rhug	1·65
„	Ryde, Thornbrough	1·82	„	Port Madoc	4·44
„	Alton, Ashdell.....	2·31	„	I. of Man, Douglas	3·08
III.	Oxford, Magdalen Col...	1·82	XII.	Stoneykirk, Ardwell Ho.	3·09
„	Banbury, Bloxham	1·91	„	New Galloway, Glenlee	4·01
„	Northampton	1·75	„	Melrose, Abbey Gate...	2·20
„	Cambridge, Beech Ho...	1·52	XIII.	N. Esk Res. [Penicuik]	2·00
„	Wisbech, Bank House..	1·89	XIV.	Ballantrae, Glendrisaig	2·74
IV.	Southend	1·71	„	Glasgow, Queen's Park.	2·55
„	Harlow, Sheering	1·90	XV.	Islay, Gruinart School..	2·98
„	Rendlesham Hall	2·25	XVI.	Dollar.....	2·41
„	Diss	2·66	„	St. Andrews, Pilmour Cot	1·04
„	Swaffham	1·65	„	Balquhider, Stronvar..	4·73
V.	Salisbury, Alderbury ...	1·65	„	Dunkeld, Inver Braan..	1·30
„	Warminster	2·28	„	Dalnaspidal H.R.S. ...	5·37
„	Bishop's Cannings	1·90	XVII.	Keith H.R.S.	2·67
„	Ashburton, Holne Vic....	3·90	„	Forres H.R.S.	2·89
„	Hatherleigh, Winsford.	4·39	XVIII.	Strome Ferry H.R.S....	5·12
„	Lymouth, Glenthorne.	3·58	„	Fearn, Lower Pitkerrie.	2·34
„	Probus, Lamellyn	3·05	„	Loch Shiel, Glenaladale	10·51
„	Launceston, S. Petherwin	3·50	„	N. Uist, Loch Maddy ...	3·24
„	Wincanton, Stowell Rec.	2·28	„	Invergarry	4·49
„	Taunton, Lydeard Ho...	2·26	„	Loch Ness, Drumnadrochit	4·14
„	Wells, Westbury	2·17	XIX.	Lairg H.R.S. ....	...
VI.	Bristol, Clifton	1·54	„	Forsnard H.R.S. ....	...
„	Ross	1·29	„	Watten H.R.S.	2·73
„	Wem, Clive Vicarage ...	1·32	XX.	Dunmanway, Coolkelure	4·26
„	Cheadle, The Heath Ho.	2·48	„	Fermoy, Gas Works ...	2·85
„	Worcester, Diglis Lock	1·50	„	Tipperary, Henry Street	3·35
„	Coventry, Coundon	2·00	„	Limerick, Kilcornan ...	3·09
VII.	Ketton Hall [Stamford]	2·10	„	Miltown Malbay.....	2·93
„	Grantham, Stainby	1·81	XXI.	G ore, Courtown House	2·32
„	Horncastle, Bucknall ...	1·87	„	Navan, Balrath	2·35
„	Mansfield, St. John's St.	1·98	„	Mullingar, Belvedere...	2·59
VIII.	Neston, Hinderton	1·72	„	Athlone, Twyford	2·31
„	Knutsford, Heathside ...	1·99	„	Longford, Currygrane...	1·89
„	Lancaster, South Road.	2·73	XXII.	Galway, Queen's Coll...	4·07
„	Broughton-in-Furness ..	...	„	Clifden, Kylesmore ...	3·53
IX.	Wakefield Prison	1·68	„	Crossmolina, Enniscoe..	4·83
„	Ripon, Mickley	1·40	„	Collooney, Markree Obs.	3·43
„	Scarborough, West Bank	1·76	„	Ballinamore, Lawderdale	...
„	East Layton [Darlington]	1·25	XXIII.	Warrenpoint	2·57
„	Middleton, Mickleton ..	1·57	„	Seaforde	2·88
X.	Haltwhistle, Unthank..	2·25	„	Belfast, New Barnsley..	3·71
„	Shap, Copy Hill	1·94	„	Bushmills, Dundarave...	3·24
XI.	Llanfrehfa Grange	1·23	„	Stewartstown	2·36
„	Llandovery	4·02	„	Buncrana	3·57

FEBRUARY, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which .01 or more fell.	TEMPERATURE				No. of Nights below 32°
		Total Fall.	Difference from average. 1870-9	Greatest Fall in 24 hours.		Deg.	Date		Deg.	Date			
				Dpth	Date.								
		inches	inches.	in.								In shade.	On grass.
I.	London (Camden Square) ...	2.28	+ .64	.63	10	18	58.1	17	20.4	13	18	22	
II.	Maidstone (Hunton Court)...	2.43	+ .81	.85	10	20	...	...	...	...	...	...
III.	Strathfield Turgiss	1.86	+ .11	.54	10	15	56.3	17	13.5	13	18	23	
III.	Hitchin	1.63	+ .03	.42	6, 10	17	54.0	17	16.0	12	23	...	
IV.	Winslow (Addington)	2.29	+ .48	.59	10	17	54.0	17	12.0	12a	18	23	
IV.	Bury St. Edmunds (Culford) ..	1.29	— .48	.50	9	...	46.0?	28	11.0	9	...	...
V.	Norwich (Cossey)	1.37	— .38	.20	11a	18	...	...	...	...	...	...
V.	Weymouth (Langton Herring) ..	2.04	...	.44	10	12	52.0	17b	24.0	10	16	...	
"	Barnstaple	2.58	— .61	.82	13	12	60.0	20c	28.0	10	...	...
"	Bodmin	3.04	— 1.83	.58	13	22	50.0	1, 17	27.0	28	11	15	
VI.	Stroud (Upfield)	1.58	— .67	.51	10	17	54.0	18b	21.0	11	20	...	
"	Church Stretton (Woolstaston) ..	1.27	— 1.23	.23	10	15	54.5	17	18.5	11	19	22	
"	Tenbury (Orleton)	1.62	— .85	.51	10	16	58.8	17	16.2	12	15	17	
VII.	Leicester (Barkby)	1.89	+ .25	.46	6	16	56.0	1	8.0	12	24	27	
"	Boston	2.01	+ .23	.45	10	17	55.0	1	11.0	12	18	...	
"	Hesley Hall [Tickhill]	1.51	...	.36	10	18	58.0	1	21.0	13	18	...	
VIII.	Manchester (Ardwick)	2.26	+ .07	.52	13	15	59.0	17	29.0	10g	4	...	
IX.	Wetherby (Ribston Hall) ...	1.67	— .48	.54	3	14	...	...	...	...	...	...
"	Skipton (Arnccliffe)	4.55	— .09	1.76	12	13	...	...	...	...	...	...
"	Hull (People's Park)	1.65	— .60	.25	10	22	...	...	...	...	...	...
X.	North Shields	1.31	— .53	.26	11	19	57.0	1, 18	19.5	10	18	20	
XI.	Borrowdale (Seathwaite)	9.53	— 1.92	3.12	13	17	...	...	...	...	...	...
XI.	Cardiff (Ely)	2.22	— 1.44	.55	10	17	...	...	...	...	...	...
"	Haverfordwest	3.40	— 1.05	.70	13	21	51.7	17d	25.4	25	13	21	
"	Plinlimmon (Cwmsymlog) ...	4.50	...	.85	6	18	...	...	...	...	...	...
"	Llandudno	1.94	— .35	.58	6	16	54.0	1	27.5	11	6	...	
XII.	Cargen [Dumfries]	1.68	— 2.13	.38	13	12	52.8	1	20.8	10	19	...	
"	Jedburgh (Sunnyside)	1.35	— .41	.28	12	10	54.0	1e	18.0	10	21	...	
XIV.	Old Cumnock	3.17	+ .31	.49	12	16	52.0	1, 18	12.0	11h	22	...	
XV.	Lochgilphhead (Kilmory)	4.81	+ .42	.82	13	17	...	...	...	...	...	...
"	Oban (Craigvarren)	4.03	...	.65	12	20	51.3	18	21.6	10	9	...	
"	Mull (Quinish)	4.42	...	1.04	13	21	...	...	...	...	...	...
XVI.	Loch Leven Sluices	1.90	— 1.06	.30	14	11	...	...	...	...	...	...
"	Dundee (Eastern Necropolis) ..	1.40	— 1.15	.35	25	13	53.9	18	19.9	10	20	...	
XVII.	Braemar	2.60	— .07	.74	8	19	50.8	1	17.3	10	20	26	
"	Aberdeen (Cranford)	2.40	...	.40	25	24	56.0	1	22.0	9	14	...	
VIII.	Lochbroom	5.70	...	1.16	18	23	...	...	...	...	...	...
"	Culloden	2.53	+ 1.48	...	...	...	55.0	1	18.0	10	14	25	
XIX.	Dunrobin .....	...	...	...	...	...	...	...	...	...	...	...
"	S. Ronaldsay (Roeberry)	3.95	+ 1.96	.49	16	22	...	...	...	...	...	...
XX.	Cork (Blackrock)	2.71	— 1.88	.68	2	15	...	...	...	...	...	...
"	Dromore Castle	4.87	...	1.15	13	14	56.0	7	27.0	23	...	...
"	Waterford (Brook Lodge) ...	2.41	...	.45	12	18	57.0	1	25.0	11	11	...	
"	O'Briensbridge (Ross)	4.46	...	1.03	10	18	53.0	20	25.0	17	15	...	
XXI.	Carlow (Browne's Hill)	2.09	— .83	.54	10	22	...	...	...	...	...	...
"	Dublin (Fitz William Square) ..	2.45	+ .29	.74	10	20	55.0	1	21.7	11	4	21	
XXII.	Ballinasloe	2.55	+ .04	.57	10	21	50.0	1f	20.0	11	16	...	
XXIII.	Waringstown	2.23	— .02	.31	6	19	55.0	16	8.0	10	18	21	
"	Londonderry (Creggan Res.) ..	4.26	...	.45	2	24	...	...	...	...	...	...
"	Omagh (Edenfel)	2.65	+ .37	.58	13	27	51.0	17	18.0	10	16	...	

α And 13. b And 20. c And 21. d And 18. e And 17, 18. f And 16, 17. g And 12, 13. h And 12.

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

METEOROLOGICAL NOTES ON FEBRUARY, 1889.

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 chief characteristic of this month was that no kind of weather lasted long together. Frosts of great severity ($10^{\circ}8$ on grass on 13th) were followed immediately by mild weather. Even the deep S of the 10th was of short duration. The end of the month was cold and winterly. Gale on 3rd.

HITCHIN.—A most winterly month; amongst the coldest Februaries in our record. Very deep snow on the 10th.

WINSLOW, ADDINGTON.—The first day of February was very mild, with a max. temp. of 53° and a min. of 45° , but from that date until the 17th it was cold and unsettled, particularly cold on the 12th and 13th. From 17th to 20th was much milder again, and the remainder of the month was cold and comfortable. On the 14th a large flood occurred, caused by the rapid melting of the snow that fell on the 10th.

WEYMOUTH, LANGTON HERRING.—R or S fell on no less than 20 days, but on 8 of these days less than $\cdot 01$ fell, mostly as S; total fall $\cdot 65$ in. below the average. Mean temp. ($37^{\circ}8$) $2^{\circ}3$ below the average. The fluctuations of the bar. on the first 16 days of the month was exceptionally great. During the last 6 days the temp. never reached 40° .

BODMIN.—Mean temp. for the month $39^{\circ}1$.

UPFIELD, STROUD.—Snow on the 10th, about five inches in depth.

WOOLSTASTON.—The first 12 days were bitterly cold, S falling on five days; on the 13th a rapid thaw set in, but cold weather returned during the last week and S again fell on the last two days. There was a violent gale on the 3rd. Mean temp. $36^{\circ}2$.

ORLETON.—With the exception of a warmer period from 13th to 22nd, the month was generally cloudy, gloomy, and cold, with severe frosts and a mean temp. $1^{\circ}8$ below the average of 28 years. S fell on the 10th, covering the land to the depth of about 7 inches, which cleared off again on the 14th. Before and after that time it was frequently lightly covered with S. The fall of R and S was nearly an inch below the average, but pressure was subject to frequent sudden, but not great fluctuations, and there was consequently a prevalence of rough winds, chiefly from the N. and N.W. There was distant L on the night of the 2nd, with S and a great wind for several days.

BARKBY.—A cloudy month. Mean temp. $35^{\circ}3$. Gale on 3rd. Snow fell to the depth of about 9 inches on 10th.

BOSTON.—Temperature of the month two degrees below the average. Heavy gales on the 8th and 9th.

MANCHESTER.—The month was rather unpleasant, with cold east wind, R and S at intervals, and some fair days. The temp. was not low, except early in the month.

HULL.—The weather during the month was remarkable for the frequent, though generally slight, falls of H, sleet, and S. The H stones were often exceeding small and always soft.

WALES.

HAVERFORDWEST.—The first week was very cold, and it continued cold up to the 15th. It was then rather milder and very wet up to the 23rd, from which date sharp frosts prevailed to the end of the month.

SCOTLAND.

CARGEN.—The first half of the month was very unsettled, the fluctuations both of the bar. and ther. being sudden and great. Severe squalls from the N.N.W. and N. with S occurred on the 8th. Mean temp. $2^{\circ}4$ below the average.

JEDBURGH.—The weather was cold and ungenial with frequent showers of S, which was melted quickly by the sun. Vegetation has been still, but country work has not been stayed much, and land is in good order for seed.

OBAN, CRAIGVARREN.—Rainfall was pretty general throughout the month, and several severe gales were experienced. The temp. was normal, but very little S fell.

MULL, QUINISH.—A cold wet month, the first half being unusually stormy. A tremendous gale from N.W. on the 8th.

LOCHBROOM.—The bad weather that began on the 22nd of January continued without interruption until the 22nd of February with varying rigour, but at times with great storms, especially on 18th, when we had a terrific gale and an unusually high flood. Seldom were our small rivulets seen in such force.

CULLODEN.—The month was free from heavy S storms; frost, however, prevailed, all through the month. Labour well forward.

ROEBERRY.—Very rough from 1st to 19th; gales from S. to N.E. The remainder of the month had moderate winds but was cold. On the whole a very unsettled month.

IRELAND.

CORK.—Cold and at times stormy, with frequent showers and a few slight falls of S.

WATERFORD.—Mean temp. $41^{\circ}1$. R nearly an inch below the average.

DUBLIN.—An unsettled, windy, wet and cold month, with N.W. wind preponderating. A severe snowstorm on the 10th, and on the 1st a fresh gale from W. Very changeable weather prevailed during greater part of week ending 16th, which began with a snowstorm and ended with warmth and squalls; the third week, at first mild, soft and cloudy, became cooler, drier and brighter, and for the remainder of the month the weather was very inclement. S or sleet fell on 8 days, H on 7 days, fogs on 4 days, high winds on 13 days reaching the force of a gale on 5 days. The temp. exceeded 50° in the screen on 8 days, and on 7 days did not rise to 40° .

EDENFEL, OMAGH.—The month commenced with the mild and rainy weather which has been characteristic of the winter, but on the 7th gave place to violent snow squalls, followed on the 10th by a steady snow fall, averaging 6 inches in depth, with a temp. of 18° . On the 13th a thaw with heavy rain again set in, and the remainder of the month was generally wet and unsettled, with a tendency to dry polar winds and light snow on 27th and 28th.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCLXXIX.]

APRIL, 1889.

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THE FLOODS OF MARCH 8TH AND 9TH.

(Concluded from p. 21.)

WE add a few more general notes upon these floods, and shall then proceed to consider the numerical data with which we have been favoured.

Taunton, Halse House.—On the 8th, over two inches of rain fell. The water was 4 ft. deep down at Halse Water, and the road quite impassable on Friday afternoon. At Mr. Pratt's the water stood 6 in. deep in the bakehouse. Mrs. Pratt said that she had known the house for 60 years, and never saw water in it before. At Bishop's Lydeard the flood was very bad. Mr. Smith and Dr. Mead went about putting food into the bedroom windows to the people, as all the lower rooms were flooded. There were no trains on the Bishop's Lydeard branch on Saturday, the 9th, and none below Bridgewater for 24 hours. The water was so deep that it put out the engine fires.

Bath Literary Institution.—Nine inches of snow fell on the 4th, and much of this was still unmelted on the 6th. The river was about 6 ft. above its ordinary level on Friday, but by the following morning it had risen 8 or 9 ft. higher. The stand containing the instruments was surrounded with about 3 ft. of water, and the observer had to be carried there on a man's shoulders, who waded in up to his waist. The height of the flood varied in different places; here, in the Institution Gardens, it was about 22 in. below the unprecedented one of 1882; about a half-mile lower down, it was said to be 16 in. below the corresponding point; and in other places the difference was reported as more than 2 ft.

Bristol, Bishopston.—The exceptionally heavy rainfall deserves special record, the more particularly so, as it occurred in what is usually the driest season of the year. The fall was continuous during the 34 hours preceding midnight on March 8th, and during this interval the depth measured reached 2.91 in. Very disastrous floods resulted from this enormous downpour and were much more extensive than those of October, 1882, and do not appear to

have been equalled since April, 1809. There was a heavy snow-storm here throughout Monday, March 4th, which covered the ground to the depth of 6 in. ; and the thaw which occurred on the 5th and 6th, served to intensify the effect of the heavy rain which fell on succeeding days.

Ross, The Graig.—I find no record for this district, and have no register of my own, of more than about half as much at this period of the year. Probably March 14th-15th, 1851, would be the largest previous fall approaching in amount. We have had no flood on the river Wye, and no serious one on smaller streams.

Cardiff, Llwynarthen.—Snow fell on 3rd and 4th together to a depth of 9 in. Some roads were submerged for a day or so, but no great damage was done here.

Woolstaston Rectory.—There was a slight fall of snow (·01) on the 1st and 3rd, but none was left when it began again on the 6th. The great fall on the 8th was perfectly even, and measured almost exactly 1 ft. in depth here ; but a little higher up on the Longmynd it was much deeper, about 1½ ft.

Coventry, Priory Row.—No snow was on the ground on the evening of March the 6th. Early on the morning of the 7th it was snowing heavily—dry snow. At 9 a.m. it was beginning to thaw, and soon changed to rain. About 11 at night of the 8th, it again turned to snow, which was perhaps an inch deep in the morning of the 9th, but soon melted away. The total fall (2·43) occupied less than 48 hours. The fall was greater on the west side of Coventry, and smaller at Stoke, to the east.

Leicester, Rotherby Hall.—Very large floods all along the valley of the Wreake.

In the following table we give the daily fall on each of the three days, March 6th, 7th and 8th, and the total for the three at all stations from which we have yet heard, and at which the total exceeded 2 inches.

It will simplify matters if, in the first place, we select those at which the fall exceeded 3 inches. They are—

Holne Vicarage.....	4·25	Bishopston.....	3·34
Lydeard Ho....	3·67	Llanfrechfa ...	3·08
Radstock	3·74	Wickwar	3·26
Clifton	3·20	Upfield ...	3·63

The first of these has little connection with the inquiry. Holne Vicarage is on Dartmoor, with a mean rainfall of 70 or 80 inches a year, therefore a fall of 4·25 inches in three days is not very exceptional, and as the rivers ordinarily have to carry off heavy falls, no serious damage ensued. Damage occurs only where the volume of the rainfall water is unusual, or where human beings (more foolish than beavers) have built upon lands liable to flooding. The high figures from Lydeard and Radstock explain the flooding at Taunton, and the five other returns explain that produced at Bristol by the

overflow of the (Gloucestershire) Frome. But most undoubtedly the terrible loss at Bristol (put at £100,000) is due to neglect of reasonable supervision of the watercourses, and to building where houses should not have been placed until the watercourses had been entirely reorganized. It is a fine of £100,000 for neglect. But we fear that few towns will profit by the lesson; most of them will wait for a lesson at their own expense.

The Leicester floods were apparently due to accident, the rains, though heavy, not being what can be called exceptional.

Rainfall, March 6th—8th, 1889.

Counties.	Stations.	6th.	7th.	8th.	Total, 6th-8th.
		in.	in.	in.	in.
Devon	Torquay (Babbacome)	1·26	·73	·51	2·50
„	Ashburton (Holne Vicarage) ..	1·23	1·81	1·21	4·25
„	Teignmouth (Woodway) ..	·77	·76	·55	2·08
„	Okehampton	·42	·94	1·27	2·63
„	Hartland Abbey	·57	·65	1·20	2·42
„	Barnstaple	·50	·84	1·00	2·34
„	Lynmouth (Glenthorpe).....	·35	·72	1·70	2·77
Dorset.....	Beaminster	·82	·72	·49	2·03
„	Sturminster (Haselbury) ..	·87	·91	·54	2·32
Somerset.....	Taunton (Lydeard Ho.)... ..	·40	·76	2·51	3·67
„	Wells (Westbury)	·40	·52	1·13	2·05
„	Radstock	1·33	1·03	1·38	3·74
„	Bath	·63	·74	1·20	2·57
Gloucester ..	Bristol (Clifton)	·46	·91	1·83	3·20
„ ..	„ (Bishopston)	·43	·96	1·95	3·34
Glamorgan ..	Cardiff (Ely).....	·40	·97	·93	2·30
Monmouth ..	Marshfield (Llwynarthan)...	·43	·90	1·14	2·47
„ ..	Llanfrechfa	·48	1·18	1·42	3·08
„ ..	Monmouth (Hendre)	·19	·84	1·69	2·72
Hereford ..	Ross	·15	·90	1·53	2·58
Gloucester ..	Wickwar	·42	1·00	1·84	3·26
„ ..	Cirencester(Further Barton)	·42	·89	1·04	2·35
„ ..	Stroud (Upfield)	·43	1·10	2·10	3·63
Worcester ..	Evesham (Lansdowne)	·15	·75	1·63	2·53
„ ..	Worcester (Diglis Lock) ..	·15	·62	1·24	2·01
Warwick ..	Nuneaton (Bedworth)	·21	·85	1·29	2·35
„ ..	Coventry (Coundon)	·14	1·13	1·47	2·74
„ ..	„ (Priory Row).....	·18	·85	1·40	2·43
Leicester ..	Barkby Vicarage.....	·09	·85	1·94	2·88
„ ..	Ratcliffe College ..	·00	·83	1·91	2·74
„ ..	Rotherby Hall.....	·02	·76	2·04	2·82
„ ..	Loughborough ..	·06	·75	2·06	2·87
Derby	Belper	·12	·39	1·53	2·04
Nottingham ..	Mansfield	·10	·40	1·75	2·25

REVIEWS.

The Great Storm off the Atlantic Coast of the United States, March 11th to 14th, 1888. By EVERETT HAYDEN. Hydrographic Office, U.S.A. Nautical Monograph No. 5. Government Printing Office, Washington, 1888. 4to, 66 pages, 6 plates.

THIS monograph would have greatly delighted Admiral FitzRoy, for the charts are tinted in red (for warmth) and blue (for cold), just as he loved to have them, and all through, the author shows more sympathy with the Admiral's habits and thoughts than has been shown in any English work that we have seen.

The storm is the one which produced the "Blizzard in New York, March 12th," which was described in the *Meteorological Magazine* for April last, p. 34. The work is illustrated by a synoptic chart of the Eastern portion of the United States and of Canada, and of the Western Atlantic for 7 a.m. of each day from March 11th to 14th, both inclusive, also by a track chart and a barometer diagram. The text gives a history of the principal events of each day in a series of chapters, which may almost be regarded as diaries. These are followed by others on the use of oil in stilling waves, on the wreckage along the coast, and by various appendices giving the original statements as sent by the observers.

We notice in the preface some remarks in apology for delay in publication. No such apology is needed; there are few establishments in the world which would have issued a work so promptly. We could quote many offices which have not issued their reports for 1887, some which have not yet issued 1886, and at least one which has not yet finished 1885.

Jahrbuch der Meteorologischen Beobachtungen der Wetterwarte der Magdeburgischen Zeitung. By A. W. GRUETZMACHER. Jahrgang V., 1886. Faber'sche Buchdruckerei, Magdeburg 1888. 4to, 40 pages. 14 plates.

THE high level of excellence at which this publication was fixed by Dr. Assmann is being maintained by his successor, and as we have on a previous occasion fully described the publication, we need only chronicle the above fact, and note one or two changes.

The excellent plan of reproducing the barograph traces for such periods only as show sudden and marked changes is continued.

All the daily records of the Jordan sunlight recorder are reproduced on their natural size, and they are most interesting. It seems to us also to be a better plan to give the total duration of sunshine in minutes, instead of in hours and minutes as has hitherto been the practice. A curve representing the total sunlight of each month might with advantage be added on page 32, but on the whole the work reflects much credit upon the editor, and on the proprietors of the *Magdeburgischen Zeitung*, who we believe bear the entire cost.

Studi sulla comparazione degli Anemometri. PROF. DOMENICO RAGONA. Estratto dagli Annali della Meteorologia Italiana Pt. 1, 1886. Metastasio, Roma 1888, fol. 16 pages, 1 plate.

NOTHING is so hard to kill as error. About forty years since, our dear old friend Dr. Robinson stated that anemometer cups moved with one third of the velocity of the wind. He, Dohrandt and others have since shown that the rule was wrong, and that the factor is never 3 to 1, but is variable, but probably not far from 2·3 to 1 ; papers on the subject have appeared in many of the leading publications of Europe, and yet here on the very first page of his memoir Prof. Ragona says :—

“I centri degli emisferi percorrono una circonferenza uguale a metri 3,333 e in conseguenza, giusta la ben nota *convenzione fondamentale*, una rotazione del mulinello corrisponde a 10 metri della velocità del vento.”

It is quite possible that in the words which we have put in italics, he is firing a sly shot at the many important offices, the English one among them, which go on using the factor of 3 to 1 when they know that it is incorrect.

As regards the present paper (which is a comparison of two anemometers each driven by Robinson's cups) the factor employed is of no importance, and therefore, we can pass on to state briefly the object of the memoir. It describes the pattern of anemometer made by Brassart and adopted by the Italian Meteorological Office,* and explains comparisons made between it and a small one by Salleron ; the results are we think very similar to those which have been obtained in this country, and not less unsatisfactory.

Vero andamento diurno della Temperatura. PROF. D. RAGONA. Società Tipografica, Modena, 1889, 4to, 27 pages.

THIS is a discussion of two years' records (June 1869 to May 1871), from the self-recording metallic thermometer at Modena, made by Salleron, of Paris. The period is of course too short to give absolute values, but the tables show clearly how much later in the day the maximum temperature occurs in Modena than in this country.

Climatology of New Jersey. By J. C. SMOCK. [From the final report of the State Geologist, Vol. I.] Murphy, Trenton, New Jersey, U.S.A., 1888, 8vo. 96 pages.

SOMETIMES those who come fresh to a subject treat it better than those whose whole lives have been devoted to it. Mr. Smock, is, we believe, a geologist, and we have no recollection of meeting with his

* We venture to suggest that it would be improved if the velocity of rotation of the communicating rod were lessened, by the wheel *p* being decreased in size, and *q* increased.

name in connection with meteorology, and yet here is a memoir which we can describe as aggravatingly good—aggravatingly, because we cannot afford space for the many quotations which we should like to make.

New Jersey is slightly larger than Wales, and in about the same latitude as Madrid and Constantinople, yet its mean temperature is scarcely equal to that of London, while its vicissitudes are extreme. An interesting plate gives the monthly mean temperature for four districts, and shows that even on the sea coast the monthly means for July and January differ by 41° , while at Greenwich the corresponding difference is 25° or not much more than half. This variability comes out even more markedly in the table of extremes, where among the maxima there are several between 100° and 104° , and the mildest minimum is -7° or 39° below freezing.

The author has been persevering and fortunate in hunting up much collateral information, which not only checks the meteorological records, but makes the paper most interesting. For instance, on p. 345, he gives the earliest and latest frost of each year, from 1865 to 1887, the records being based not upon thermometers, but upon damage to tender plants. The values are—

Last in Spring.	Earliest in Autumn.	Duration of Season.
Earliest, April 9.	October 5.	Longest, 203 days.
Average, April 25.	October 22.	Average, 180 ,,
Latest, May 15.	November 8.	Shortest, 143 ,,

On pages 413 to 416, we have a list of the dates of the opening and closing of the Hudson river at Albany, for every year from 1789 to 1888, and shorter lists are given for the Delaware river and for two canals.

There is but one table which we miss, viz., one of the yearly totals of rainfall at each station, so that we might have had some information as to its fluctuation from year to year. Mr. Smock gives us a pretty looking table of mean monthly rainfall at 74 stations, but, as he himself partly hints, it is very unsatisfactory, some of the means (?) being based upon only *one* year—while perhaps the very next line of figures embodies the valuable result of twenty or thirty years' work. If the short period observations had been omitted, the table would have been half the size, and incomparably better.

Among the many interesting features of the book, we had nearly forgotten to mention a list of chronological notes on the weather from 1607 to 1887.

ANCHOR ICE.

To the Editor of the Meteorological Magazine.

SIR,—Seeing in your last number the question about “Anchor” or “Ground Ice” mentioned, I thought you might like to see a short paper I wrote on the subject. Anchor ice often occurs in great quantities in the river Ouse, and in the year 1887 was very marked, more particularly as to the great quantity of *débris* brought from the river bottom, and carried often a long distance, a heavy striking hammer, lost when a bridge was making over the river was brought up, as well as heavy stones, bricks, coals, chains, knives, pottery, the zebra mussel (*dreissena polymorpha*) in great quantities, bones, &c. As our river is thick when in flood, as was the case in point, I do not think that radiation has much, if anything, to do with it ; still I should not like to say it has not, when others, wiser than myself, think it is one of the factors when “Anchor ice” is formed.

Yours truly,

JOHN BROWN.

Earlth, near St. Ives, Hunts., 19th March, 1889.

[We are glad of the opportunity of laying Mr. Brown's excellent paper before our readers. It seems to us that his stricture on the radiation theory has considerable weight].—ED. *M.M.*

ANCHOR ICE.

IT will help in the explanation of this phenomenon if we consider what crystallization is, and how surface ice is formed. Crystallization is the spontaneous collecting or grouping together of certain regular forms known as crystals when fluids assume the solid state. This can take place only under certain favourable conditions, the principal of which are temperature, chemical action, electricity, evaporation, and the presence of suitable points for the crystals to form upon. The conditions under which water will form into ice crystals are these:—The water must be cooled down to 32° Fahr., freezing point ; there must also exist some starting points for the crystals to form upon and aggregate round each other. Surface ice is formed upon rivers, ponds, and lakes when the water on the surface has been cooled down to 32° Fahr. This has been promoted by the body of the water having been cooled below 39° Fahr. by the law of circulation which always asserts itself when there exists a difference of temperature in the same fluid. The water on the surface having been cooled by contact with the frosty air, sinks down, its place being taken by a stratum of water of higher temperature. Which in its turn is in like manner cooled and sinks ; the process is thus repeated, until a uniform temperature is produced 39° Fahr. At this temperature water having acquired its greatest density, the action of the law of circulation is reversed, the coldest water being now the lightest is found at the surface.

The ice crystals then begin to form, using the edges of the river

pond, or lake, as their necessary starting points ; from which, veins of crystals are seen to shoot out resembling the back of a leaf ; upon these veins more crystals form, filling in from vein to vein, the surface is thus rapidly covered. The crystallization is now continued on the underside adding thickness to the ice as long as the same conditions are maintained. The veins described are well seen in what is usually known as cat's ice. Surface ice, when formed upon running water, is formed in the same way as upon ponds or other still waters, but as the tendency of running water is to retard the formation of ice crystals, and also to disperse them when formed, it requires more frost before the ice crystals can form with sufficient rapidity to overcome these unfavourable conditions and spread over the surface. As a rule when rivers in this country are above their usual height the current is too strong for them to get frozen over. It is only when the water is at, or below, its normal height that surface ice is formed upon them.

The formation of anchor ice can take place only in running water, when the thermometer is below the freezing point ; and the phenomenon may be thus explained. Independently of the circulation already described arising from difference of temperature, but acting in conjunction with it, is the mechanical circulation of running water ; this dual, yet combined, action leads to the entire mass of water being cooled down to 32 deg. Fahr. This point of temperature being reached, the ice crystals, obedient to law, begin to form. But the current being too strong for them to do this upon the surface as upon still water, the asperities at the bottom (where the current is less rapid), supply the needed starting points round which the ice crystals rapidly group themselves. These asperities consist of stones, weeds, broken vessels, bricks, coal, shells, sticks &c. The cooling down of the water of a river to 32 deg. Fahr. by circulation is not the only effect produced ; the asperities at the bottom are in like manner cooled down by the refrigerated water running over them, abstracting such heat as may be in excess of 32 deg. Fahr., reducing them to this temperature, and thus conducing to the formation of the ice crystals upon them. After the ice crystals have thus formed in masses, and when these masses, augmented by more ice crystals, have gained sufficient buoyancy to lift the substances to which they are attached, they rise to the surface, bringing with them the weeds, stones, coal, bricks, &c., round which they have grouped themselves. These masses of anchor ice are not firm and solid like surface ice, being a collection of ice crystals somewhat loosely bonded together. It is only after having formed into a larger mass on the surface, or collected into a sheet of drift ice, that it assumes the hard and compact nature of ordinary ice, having always a very rough surface. The lifting of heavy substances by anchor ice is not so difficult as it first appears. Ice having a less specific gravity than water does, as we know, float, and it has a lifting power equal to the difference between the weight of a

given quantity of ice and of the water displaced by it. From the fact that the stones, shells, and other substances are in water, all there is to be raised by the ice when lifting these substances is the difference of the weight between the substance lifted and an equal bulk of water, and not the gross weight.

The temperature of running water when anchor ice is forming has been made a matter of experiment here. The result was found to be 32° Fahr. from the bottom of the river to the top. This year a large quantity of anchor ice has formed in the river Ouse, and was seen floating down for several days together, until in some places the river became quite blocked with it. As it melts where left upon the banks, it leaves quantities of *débris* brought from the bottom of the river, sometimes bringing to light interesting relics of bygone times.*

J. B.

Earlth, January, 1887.

ROOKS AS WEATHER INDICATORS.

To the Editor of the Meteorological Magazine.

SIR,—If it please you to insert this letter in a future issue of your *Meteorological Magazine*, it gives you another sure indicator of weather.

In bright, fine weather we may often notice the rooks whirling in circles at a great height in the air, from which height (upwards of $\frac{1}{4}$ mile sometimes), they will pitch down at a great pace one after another, as if they would fall on the ground, and kill themselves. But no : rooks are wise birds, and never do anything without *cause* ; it is merely a little game of their own (called “break-neck” in these parts), in which they indulge whilst the weather is fine ; for no doubt they know full well that *in three or four days* there will be stormy weather, which surely enough comes to pass in the district, and generally in the place. On March 3rd, I noticed the rooks at this break-neck game, and pointed it out to a neighbour with whom I was, remarking, “See if we do not have stormy weather in a few days.” On the following Thursday and Friday, 7th and 8th, we had 2·79 in. of rainfall in 41 hours as the rook-prophetic fulfilment.—Yours faithfully,

E. N. POCHIN.

Barkby Vicarage, Leicester, March 12th, 1889.

* “Sinkers” or stones with holes bored in them, formerly used by fishermen for weighting their nets ; also Roman pottery.

GERMAN METEOROLOGICAL SOCIETY.

This society met at Berlin on March 12th, Prof. von Bezold, president, in the chair.—Dr. Wagner spoke on the connection between cosmic and meteorological phenomena. After a short review of the earlier attempts to connect meteorological phenomena with the rotation of the sun or with the phases of the moon, he passed on to a consideration of Prof. von Bezold's recently published work, in which it is shown that the storms in Bavaria and Würtemberg have a distinctly recurrent periodicity of 26 days, corresponding to the period (25·84 days) of the sun's rotation. In opposition to this, Köppen had found from his own calculations, based on more extensive data, that the storms are recurrent with a periodicity of 29 and not 26 days, thus corresponding to the synodical period of the moon. The speaker himself had investigated the periodicity of storms, not only in Bavaria and Würtemberg, but also in Baden, keeping the observations of lightning separate from those of mere rain-storms; this seemed to be necessary, not only inasmuch as von Bezold did not take any account of lightning, but also because the occurrence of lightning at the time of new moon, or during the last quarter of the moon, might give rise to apparent maxima resulting from purely optical causes. He found that the storms possess a periodicity of 29 days, which include three maxima, the chief of these being in the last half-quarter, the next at new moon, and the least at full moon. No physical explanation, or even any idea of any connection between the storms and the phases of the moon, can at present be given.—Dr. Assmann gave an account of a phenomenon which had been observed on the trees in the Thiergarten as a result of the recent heavy snow-fall. The masses of snow which were piled up high on the branches of the trees had slipped down round their sides and hung down like curtains; they possessed a not inconsiderable consistency and glacier-like structure. The superficial thawing which occurred daily about midday had contributed largely to bring about the modification which the snow had undergone.

ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting of this Society was held on Wednesday evening, March 20th, at the Institution of Civil Engineers, Dr. W. Marcet, F.R.S., President, in the Chair.

Messrs. A. J. Hands, F.S.A., J. Jackson, S. A. Jones, J. E. Middlehurst, and L. Sutton, F.R.G.S., were elected Fellows of the Society.

Dr. Marcet delivered an address on "The Sun—its Heat and Light," in which he explained the composite nature of the solar beam, and the modifications which it undergoes in passing through

our atmosphere. He thus laid the foundation for subsequent remarks on the fine collection of Actinometers and Sunshine Recorders which the Society had collected for its exhibition.

The meeting was then adjourned in order to afford the Fellows and their friends an opportunity of inspecting the exhibition which was devoted principally to Actinometers, Solar Radiation Apparatus, and Sunshine Recorders, but included several new instruments, and many photographs of meteorological interest.

Among the instruments shown for ascertaining the absolute heating effect of the sun's rays, were Herschel's, Hodgkinson's, and Stewart's Actinometers, Pouillet's and Angstrom's Pyrheliometers, and Secchi's Solar Intensity Apparatus. There were also Luvini's Dietheroscope for observing optically the changes of atmospheric refraction, Bellani's Lucimeter as used in Italy, and Crookes' Radiometer, in which the arms rotate with more or less velocity under the action of radiation.

An interesting collection of Sunshine Recorders also was exhibited, among which were the Campbell-Stokes and Whipple-Casella burning Recorders, and the Jordan and McLeod Photographic Recorders.

Several new Barometers, Anemometers, Nephoscopes, &c., also were shown, as well as the stephanome, which is used at the Ben Nevis Observatory for measuring the angular size of halos, fog-bows and glories.

Mr. Clayden showed an ingenious working model of the Atlantic Ocean, illustrating the formation of ocean currents in general, and of the Gulf Stream in particular. Models of very large hailstones, 7 inches in circumference, which fell near Montereau, France, on August 15th last, were also exhibited.

The exhibition included a very interesting collection of photographs of flashes of lightning, of clouds taken in various parts of the world, and of views taken on the summit of Ben Nevis.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPTEMBER, 1888.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	72·7	15	42·4	1	65·2	50·0	50·1	80	116·3	36·3	1·43	14	6·0
Malta	91·1	9	64·0	30	84·0	69·7	67·9	76	143·3	57·2	·63	2	2·6
Cape of Good Hope. ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	79·5	12	60·4	6,13,27	75·8	64·1	59·4	72	128·6	52·7	1·03	16	5·9
Calcutta	91·3	15	75·2	18	87·7	77·8	77·0	80	159·0	72·9	9·97	16	6·5
Bombay	86·8	18	74·8	12	85·8	77·2	75·0	80	144·3	70·2	4·92	14	5·6
Ceylon, Colombo	87·2	15	73·8	21	86·0	76·4	71·2	73	147·0	70·0	3·26	16	6·0
Melbourne	80·1	14	34·4	5	62·5	45·8	46·0	75	128·8	28·1	1·28	8	6·1
Adelaide	84·7	18	38·7	5	69·3	50·1	46·8	62	139·8	31·9	1·19	13	5·7
Wellington	64·0	29	37·0	7, 14	57·5	44·6	43·7	72	121·0	28·0	1·81	10	3·6
Auckland	67·0	30	40·0	13	59·8	47·5	45·8	75	135·0	36·0	·91	10	6·5
Jamaica, Kingston	93·3	16	70·6	5	90·1	73·2	74·3	78	...	...	6·67	...	...
Barbados .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	77·6	9	32·1	30	65·7	47·6	49·5	78	...	25·0	3·29	14	4·4
New Brunswick, Fredericton	75·8	25	30·0	30	63·3	44·7	49·0	80	...	...	4·44	15	6·4
Manitoba, Winnipeg ...	82·8	2	23·3	12	66·7	41·2	45·7	77	...	...	1·53	14	4·7
British Columbia, Victoria	79·0	1	38·0	10	69·0	45·2	...	...	...	...	1·01	7	...

REMARKS, SEPTEMBER, 1888.

MALTA.—Mean temp. 76°·0; mean hourly velocity of wind 6·7 miles. Sea temp. nearly stationary at 78°·9. TS on 18th. L on 19th, 27th, and 28th. Wind velocity much below average. J. SCOLES.

Mauritius.—Mean temp. of air 0°·4, of dew point 0°·1, and R ·54 in. below their respective averages. Mean hourly velocity of wind 10·3 miles, or 1·7 below average; extremes 24·6 on 1st and 2·2 on 6th and 13th. Prevailing direction, S.E. by E. to E.S.E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·0, of dew point 2°·4 and humidity 4 above the average; mean amount of cloud same as 30 years' average; R 1·03 in. below average. Prevailing winds N. and S.; strong on 8 days. Heavy dew on 5 days. Hoar frost on 9th. Fogs on 2 days; L on 3 days. Lunar rainbows on 21st and 22nd. R. L. J. ELLERY, F.R.S.

Adelaide.—Remarkably Warm. Mean temp. nearly 3° above the average of 31 years. Unusually long spell of warm weather in the middle of the month. R two-thirds of the average. C. TODD.

Wellington.—Fine, with a small rainfall. Prevailing wind N.W. and moderate, except fresh on 3 days, hail squalls on 11th and 12th. Earthquakes on 1st and 5th. R B. GORE.

Auckland.—An unusually fine and dry month, the R being less than one-third of the average and the smallest ever recorded in September. Mean temp. slightly below average, barometric pressure considerably above. T. F. CHEESEMAN.

VICTORIA.—A lovely month, with very little fog.

SUPPLEMENTARY TABLE OF RAINFALL, MARCH, 1889.

[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 Hall.	2·89	XI.	Castle Malgwyn	2·72
"	Margate, Birchington...	1·24	"	Rhayader, Nantgwillt..	4·82
"	Littlehampton	1·46	"	Carno, Tybrith ...	3·96
"	Hailsham	1·70	"	Corwen, Rhug	2·29
"	Ryde, Thornbrough	2·35	"	Port Madoc	4·04
"	Alton, Ashdell.....	3·13	"	I. of Man, Douglas	2·36
III.	Oxford, Magdalen Col...	1·69	XII.	Stoneykirk, Ardwell Ho.	2·94
"	Banbury, Bloxham	2·69	"	New Galloway, Glenlee	3·25
"	Northampton	2·09	"	Melrose, Abbey Gate...	2·50
"	Cambridge, Beech Ho...	1·12	XIII.	N. Esk Res. [Penicuick]	2·45
"	Wisbech, Bank House..	1·81	XIV.	Ballantrae, Glendrisaig	2·54
IV.	Southend	·93	"	Glasgow, Queen's Park.	1·26
"	Harlow, Sheering ...	1·41	XV.	Islay, Gruinart School..	2·73
"	Rendlesham Hall	·62	XVI.	Dollar.....	·83
"	Diss	1·33	"	St. Andrews, Pilmour Cot	1·47
"	Swaffham	1·10	"	Balquhiddier, Stronvar..	2·77
V.	Salisbury, Alderbury...	2·11	"	Dunkeld, Inver Braan..	1·59
"	Warminster	2·82	"	Dalnaspidal H.R.S. ...	3·22
"	Bishop's Cannings	2·42	XVII.	Keith H.R.S.	1·96
"	Ashburton, Holne Vic...	7·37	"	Forres H.R.S.	1·10
"	Hatherleigh, Winsford.	3·01	XVIII.	Strome Ferry H.R.S....	6·22
"	Lynmouth, Glenthorne.	4·31	"	Fearn, Lower Pitkerrie.	1·19
"	Probus, Lamellyn	4·45	"	Loch Shiel, Glenaladale	9·77
"	Launceston, S. Petherwin	3·88	"	N. Uist. Loch Maddy ...	3·33
"	Wincanton, Stowell Rec.	2·48	"	Invergarry	4·14
"	Taunton, Lydeard Ho...	4·75	"	Loch Ness, Drumnadrochit	2·44
"	Wells, Westbury.....	3·59	XIX.	Lairg H.R.S.	3·22
VI.	Bristol, Clifton	4·38	"	Forsinard H.R.S. ....	..
"	Ross	3·28	"	Watten H.R.S.	1·68
"	Wem, Clive Vicarage ...	2·51	XX.	Dunmanway, Coolkelure	3·77
"	Cheadle, The Heath Ho.	3·31	"	Fermoy, Gas Works ...	1·32
"	Worcester, Diglis Lock	2·61	"	Tipperary, Henry Street	1·04
"	Coventry, Coundon	4·05	"	Limerick, Kilcornan ...	1·41
VII.	Ketton Hall [Stamford]	2·36	"	Miltown Malbay.....	2·00
"	Grantham, Stainby	2·48	XXI.	Gorey, Courtown House	1·08
"	Horncastle, Bucknall ...	2·39	"	Navan, Balrath	1·90
"	Mansfield, St. John's St.	4·08	"	Mullingar, Belvedere...	1·92
VIII.	Neston, Hinderton	2·36	"	Athlone, Twyford	2·11
"	Knutsford, Heathside ...	3·30	"	Longford, Currygrane...	1·66
"	Lancaster, South Road...	3·00	XXII.	Galway, Queen's Coll...	1·51
"	Broughton-in-Furness ..	4·38	"	Clifden, Kylemore	5·58
IX.	Wakefield Prison	3·16	"	Crossmolina, Ennisiscoe..	2·50
"	Ripon, Mickley	2·93	"	Collooney, Markree Obs.	2·39
"	Scarborough, West Bank	2·37	"	Ballinamore, Lawderdale	1·80
"	East Layton [Darlington]	2·08	XXIII.	Warrenpoint	3·09
"	Middleton, Mickleton..	1·73	"	Seaforde	4·07
X.	Haltwhistle, Unthank..	2·62	"	Belfast, New Barnsley..	3·48
"	Shap, Copy Hill	2·67	"	Bushmills, Dundarave...	2·28
XI.	Llanfrecfa Grange	4·53	"	Stewartstown	1·38
"	Llandovery	3·66	"	Buncrana	2·71

MARCH, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which ·01 or more fell.	TEMPERATURE				No. of Nights below 32°	
		Total Fall.	Differ- ence from average. 1870-9	Greatest Fall in 24 hours.		Max.		Min.					
				In.	Dpth.			Deg.	Date.	Deg.	Date.		
		inches.	inches.	in.				Deg.	Date.	Deg.	Date.	Inshade.	On grass.
I.	London (Camden Square) ...	1·36	—	·25	·37	7	13	59·6	24	19·2	4	12	21
II.	Maidstone (Hunton Court)...	1·85	+	·27	·55	7	15	...	...	...	...	...	...
III.	Strathfield Turgiss	1·91	+	·51	·33	7	17	62·3	29	20·4	4	15	23
III.	Hitchin	1·40	—	·08	·32	20	13	59·0	24 ^b	16·0	3	14	...
IV.	Winslow (Addington)	1·95	+	·19	·38	19	11	63·0	24	18·0	4	15	20
IV.	Bury St. Edmunds (Culford)	1·71	+	·15	·62	8	6	50·0	13 ^c	10·0	3, 4	17	...
V.	Norwich (Cossey)	·83	—	·86	·40	7	7	63·0	25	12·0	5	4	13
V.	Weymouth (Langton Herring)	1·57	...	...	·60	6	14	59·0	29	25·0	2	12	...
"	Barnstaple	3·43	+	·94	1·00	8	13	54·0	14	26·0	2	...	...
"	Bodmin	5·50	+	2·34	1·92	4	18	53·0	29	25·0	2	9	14
VI.	Stroud (Upfield)	4·80	+	2·99	2·10	8	16	60·0	24 ^b	25·0	4, 15	16	...
"	Church Stretton (Woolstaston)	2·37	+	·21	1·01	8	16	59·0	29	22·5	4	16	19
"	Tenbury (Orleton)	2·80	+	·93	1·14	8	18	63·5	29	21·7	4	13	18
VII.	Leicester (Barkby)	4·08	+	2·81	1·94	8	14	63·0	29	15·0	3	17	22
"	Boston	2·03	+	·74	·68	7	12	64·0	24	24·0	4	12	...
"	Hesley Hall [Tickhill]	3·47	...	...	1·40	8	11	62·0	24	19·0	4	12	...
VIII.	Manchester (Ardwick)	2·64	+	·19	·90	8	14	64·0	24	34·0	4	0	...
IX.	Wetherby (Ribston Hall) ...	1·35	—	·78	·54	21	7	...	...	...	...	...	...
"	Skipton (Arncliffe)	5·70	+	·94	1·27	24	17	...	...	...	...	...	...
"	Hull (People's Park)	2·33	+	·52	1·35	8	16	...	...	...	...	...	...
X.	North Shields	2·57	+	1·12	·90	19	15	61·5	24	11·5	4	15	19
"	Borrowdale (Seathwaite)	8·88	—	1·01	2·70	24	19	...	...	...	...	...	...
XI.	Cardiff (Ely)	3·85	+	1·16	·97	7	15	...	...	...	...	...	...
"	Haverfordwest	2·29	—	·90	·26	23	18	54·8	24	24·0	2	9	20
"	Plinlimmon (Cwmsymlog) ...	5·23	...	...	1·07	23	15	...	...	...	...	...	...
"	Llandudno	1·72	—	·16	·76	19	18	51·5	25	25·5	4, 5	5	...
XII.	Cargen [Dumfries]	3·12	+	·34	1·78	6	11	55·8	16	19·0	4	15	...
"	Jedburgh (Sunnyside)	2·83	+	1·26	·93	19	9	55·0	29	19·0	4	15	...
XIV.	Old Cumnock	2·56	—	·37	·50	24	19	53·0	29	15·0	2	14	...
XV.	Lochgilhead (Kilmory)	2·78	—	1·83	·48	23	20	...	...	...	...	...	...
"	Oban (Craigvarren)	3·97	...	...	·92	23	23	53·0	24	25·6	3	8	...
"	Mull (Quinish)	4·04	...	...	1·10	7	14	...	...	...	...	...	...
XVI.	Loch Leven Sluices	1·40	—	·72	·30	7, 18	9	...	...	...	...	...	...
"	Dundee (Eastern Necropolis)	1·70	—	·06	·65	2	11	60·6	24	19·4	4	13	...
XVII.	Braemar	·99	—	1·20	·20	18	17	60·0	28	8·0	2	16	24
"	Aberdeen (Cranford)	2·35	...	...	·57	19	20	64·0	24	8·0	4	11	...
VIII.	Lochbroom	4·40	...	...	·61	23	26	...	...	...	...	...	...
"	Culloden	1·12	—	·63	...	...	...	57·0	24 ^d	20·0	4	8	21
XIX.	Dunrobin	1·68	...	...	·36	19	11	59·8	29	25·0	2	13	...
"	S. Ronaldsay (Roeberry)	2·41	+	·26	·39	12	23	...	...	...	...	...	...
XX.	Cork (Blackrock)	1·64	—	1·12	·44	3	10	61·0	14	27·0	4, 9	10	...
"	Dromore Castle	3·78	...	...	·60	23 ^a	14	64·0	15	29·0	3	...	...
"	Waterford (Brook Lodge) ...	1·33	...	...	·42	18	18	59·0	13	25·0	10	11	...
"	O'Briensbridge (Ross)	2·04	...	...	·68	6	14	60·0	28 ^b	26·0	11	7	...
XXI.	Carlow (Browne's Hill)	1·23	—	·88	·47	18	15	...	...	...	...	...	...
"	Dublin (FitzWilliam Square)	1·08	—	·65	·38	19	17	58·3	28	31·0	3	5	14
XXII.	Ballinasloe	1·97	—	·41	·53	6	16	54·0	29	22·0	2	15	...
XXIII.	Waringstown	2·38	+	·32	·55	27	20	58·0	29	25·0	1	11	14
"	Londonderry (Creggan Res.) ..	2·87	...	...	·84	27	23	...	...	...	...	...	...
"	Omagh (Edenfel)	2·31	+	·22	·58	19	22	53·0	14 ^d	27·0	1	10	14

^a And 24. ^b And 29. ^c And 24, 25. ^d And 28, 29.

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

METEOROLOGICAL NOTES ON MARCH, 1889.

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 generally cloudy and unsettled, with temp. below the average. A good deal of rain fell locally, with H on 31st. Towards the end of the month there was a considerable depression of the bar., with strong winds from N.W. Snowdrops in flower on 1st; blackbird's nest and eggs found on the 17th; thrush's nest and eggs on the 22nd.

HITCHIN.—One of the driest quarters ever experienced; after two very dry years.

WINSLOW, ADDINGTON.—Frosts frequent during the month, very sharp on the 3rd and 4th: from 19th to 21st stormy, with pressure at 9 a.m. on the 20th 28·919 in. (corr.) Altogether a favourable time for the land, which was in capital order for receiving seeds.

WEYMOUTH, LANGTON HERRING.—R 29 in. below the average; mean temp. (41°·3) 0°·3 below the average. There was a heavy storm on 8th, preceded by a foggy day. The wind was high on 26th, and on 29th the weather was sultry and thundery.

BODMIN.—A very genial month. Mean temp. 41°·2.

WOOLSTASTON.—The month opened with 12 days of very severe weather, S falling on the 1st, 3rd, 7th, and 8th; on the latter day there was an even fall 1 ft. deep, which broke down the trees in all directions. The latter half of the month was warmer, though S fell on 20th and there were many severe frosts at night. Mean temp. 38°·9.

ORLETON.—The first 12 days were cold and frosty, with a temp. 5° below the average, frost every night and frequent light falls of S. S mixed with R set in before 6 a.m. on the 7th and continued till 10 p.m. on the 8th, and during this time the ground was covered with wet snow often 2 inches deep, but on the hills it was more than 12 inches deep. The S melted gradually on the hills and the river was not flooded, though 1·79 in. was measured in the rain gauge for the two days. The remainder of the month was variable, with several severe frosts at night and a few warm days. Pressure variable, but generally high. Prevailing wind N., frequently very rough. Mean temp. 0°·3 below the average of 28 years.

BARKBY.—Great floods on the 8th. Mean temp. 40°·3.

ARDWICK, MANCHESTER.—This month was fairly mild, with a few bright spring days. Very dark and stormy on 20th. S fell on 8th, but did not remain on the ground more than a few hours.

HULL.—The weather during the first eight days was cold, with frequent showers of H, sleet, S and E, sometimes with mist or fog; from that date to the 18th fine weather prevailed generally, with light clouds, but from the 18th to the end it was showery, and sometimes stormy.

WALES.

HAVERFORDWEST.—The month commenced with severe weather, S and violent winds from N.N.E. to E.; it continued very cold up to the 11th, with S on the ground for some days, and the Precelly range white. Changeable, wet and cold weather prevailed throughout the remainder of the month, though in the last week it improved a little. Mean temp. about the average.

SCOTLAND.

CARGEN.—The first 11 days were unusually cold, and considerably more than half the total R of the month fell on the 6th.

JEDBURGH.—The weather was generally dry, but cold and ungenial, with low temp. at night, and keen winds, which kept the soil dry for seed sowing. Spring flowers in bloom. S on 19th, 20th, and 21st.

LOCHBROOM.—An unusually open month, with very little S and no frost, but a good deal of warm weather, with almost constant mild R or showers. A splendid month for the farmers.

ROEBERRY.—From the 1st to the 5th, S storms, afterwards rough and squally weather generally. Winds mostly from S.W. to N.

IRELAND.

CORK.—Generally fine and often bright. T on 11th, with a slight fall of H.

DROMORE.—A very fine month, and vegetation made fair progress. Spring work well advanced.

WATERFORD.—R 1.59 in. below the average. S on 1st and 2nd; H on 30th and 31st. Mean temp. 42° 9.

ROSS, O'BRIENSBRIDGE.—A most favourable month for agricultural work. Some sharp frosts, but no excessive cold or violent wind; more than the average amount of sunshine, and no fog.

DUBLIN.—A moderately favourable month, with N.W. and W. winds. The beginning of the month was cold, but genial weather was experienced from time to time. Fogs on four days; high winds on nine days; gales on four days; S or sleet on two days; H on five days.

OMAGH EDENFEL.—The month had but few characteristics of March. Hardly any E. wind, and but the sign of S on one occasion. The absence of drying winds, with a R more persistent than heavy, occasioned a late seed time, but vegetation was otherwise in advance of the average.

PRACTICAL USE OF THE EARTH'S INTERNAL HEAT.

According to the *American Meteorological Journal* an attempt is about to be made at St. Augustine, Flo., to sink a 12-inch artesian well to a depth sufficient to obtain water hot enough to heat buildings, pure enough for domestic purposes, and with pressure enough to run heavy machinery. Water can be found in Florida by boring 250 feet; and it is known that the artesian wells in that State have considerable pressure, and from a depth of 600 feet send water of warm temperature to a height of 45 feet when piped. The earth's internal heat is already forced into practical service at Pesth, where the deepest artesian well in the world is being sunk to supply hot water for public baths and other purposes. This well supplies daily 176,000 gallons of water heated to 158 deg. Fahrenheit, and the boring is to be continued until the temperature of the water is raised to 176 deg. Heavy machinery is run by artesian well power in many parts of France, and the experience of the French shows that the deeper the well the greater the pressure and the higher the temperature. At Grenelle, a well sunk to the depth of 1802 feet, and flowing daily 500,000 gallons, has a pressure of 60 lbs. to the square inch, and the water from this well is so hot that it is used for heating the hospitals in the vicinity.

---*Nature*.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCLXXX.]

MAY, 1889.

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METEOROLOGICAL BIBLIOGRAPHY.*

FOR the first time in history, the Congress of the United States has been stingy. Hitherto that great country has been conspicuous for greater excellence in its official publications, and for greater liberality in distributing them, than any country in the world. But for some reason, of which we on this side of the Atlantic know nothing, General Greely has been refused authority to print the Bibliography which meteorologists throughout the world are waiting for.

Probably in this case (as in other countries), those who have been elected to Congress do not understand the details of scientific work, and think that they are stopping a waste of money by refusing to order the printing to be undertaken. We know that the contrary is the truth; and that nothing will tend more towards assuring that every dollar expended upon meteorology will obtain a dollar's worth of progress, than the publication of this work. Perhaps it may be well to give a homely illustration from the last few numbers of this magazine. In the March number appeared a letter upon the subject of Anchor Ice. We turned up such notices of it as we remembered, or could find, but there were but four, and a fifth was given in the April number. But on turning to the work now before us, we find four quarto pages of titles of papers upon the subject—the total number being not five, but sixty-two. Let some one read up these sixty-two memoirs, work them into a single monograph, and the whole subject will probably be completely elucidated and disposed of, so that further time need never be spent upon it.

We cannot believe that Congress will, when the subject is clearly

* BIBLIOGRAPHY OF METEOROLOGY.—A classed catalogue of the printed literature of meteorology from the origin of printing to the close of 1881; with a Supplement to the close of 1887, and an Author Index. Prepared under the direction of General Greely, edited by Oliver L. Fassig, Bibliographer and Librarian, Signal Office. Part I., Temperature. Washington Signal Office, 1889, 4to, 381 pages.

placed before it, refuse to do that which (1) it, by its officer,* undertook to do, and (2) which would confer a benefit not only upon their own Signal service, but on every meteorological organization in the world.

Still, we all know that good comes out of evil; and this obstruction has compelled General Greely, for the needs of his own office, to get the material into shape; and he seems to have produced the invaluable work before us by a type writer with lithographic ink, and he has been good enough to pull a few extra copies and send them to some of those who, about seven years ago, did what they could to help the Signal office when under the direction of his predecessor.

This volume deals with only one subject, Temperature, yet it contains about 5,000 entries of separate books and papers, or about one-tenth of the whole bibliography. The sub-division was originally arranged by Dr. Lancaster, of Brussels, and subsequently modified by Mr. Sawyer, the former librarian of the Signal Office. It is so good, and will give so thorough an indication of the character of the work, that we print it, and against each heading the number of pages occupied by the titles in each section.

Temperature in general	12	Vertical distribution of temperature	18
Solar radiation	28	Horizontal distribution of temperature	38
Terrestrial radiation	8	Temperature of the earth	44
Periodic variations of temperature	22	Temperature of the ocean	36
Non-periodic variations of temperature—		Temperature of lakes and rivers	12
(a) General questions	14	Temperature of springs	7
(b) Annual temperature	16	Ground ice.....	4
(c) Fall and winter temperature	39	Calculation of mean temperature	2
(d) Spring temperature	8	Temperature of space	1
(e) Summer temperature	12	Index to authors	55
(f) Frosts	6		

As specimens of the entries, we give the first, and the last of the first section.

Redi F. Della natura del caldo e del freddo lettera. 2 ed. 4to, Firenze, 1590.

Influence des forêts sur la température de l'air et du sol. *Ciel et terre*, Brux. III., 1887-88, 149, 151.

We said that good had come out of evil; and it is in this way:—Those of us who can spare time can treat these copies as proofs, and mark down every imperfection and addition, and then when Congress eventually realizes the position and authorizes the final printing, if

* Extract from letter dated November 4th, 1881, addressed by General Hazen, Chief Signal Officer to Mr. G. J. Symons:—"The great advantage to all interested in meteorology that would result from having a complete bibliography of the literature of this subject is acknowledged on all sides, and I shall be pleased to accept your offer, and will print, with full recognition, the card catalogue of 20,000 titles already compiled by you, in connection with that compiled by Professor Abbe."

these copies be returned to Washington, and all the notes be incorporated, the final work will be far better than it would have been without; and though many of us sadly grudge the years we have had to wait, future generations will profit by our loss.

MR. WHIPPLE ON LIGHTNING PHOTOGRAPHS.

AT a recent meeting of the Physical Society, Mr. Whipple read a paper in which he dealt with two of the many interesting questions, raised by the rapidly spreading practice of photographing lightning. The paper and the discussion were reported in *Industries* as follows:

THE DARK FLASH SEEN IN SOME LIGHTNING PHOTOGRAPHS.

The author referred to the fact that some two years ago the Meteorological Society issued a circular asking for photographs of lightning flashes, and in reply to this circular a large number were received from different parts of the world, but chiefly from France and Belgium. Prints from these photographs have been pretty widely distributed, and have attracted a great deal of attention. Our readers may remember that much interest was excited by the ribbon-like character of the markings observed in the photographs of some of the flashes, and still more by the so-called "dark flash," viz., a dark mark on the surface of the photograph, having all the characteristics of a lightning flash except in its being dark instead of light. Professor Stokes had suggested that the dark flash might be caused by one flash following exactly the same path as another immediately preceding it, and having some of its light cut off, more especially the highly refrangible rays, which would mainly affect the photographic plate, by having to traverse the nitrous oxide gas, formed by the decomposition of ammonia during the passage of the first flash. With respect to the ribbon markings, it occurred to the author that they might be due to the photographs having been taken through the glass of a window. He had not yet had the opportunity of testing this, by actually taking photographs of lightning flashes through interposed sheets of glass; but he had endeavoured to get an effect somewhat similar to that of a flash, by drawing a wavy chalk line on a black board, and photographing it after having previously interposed a sheet of plate or window glass slightly deviating from the plane perpendicular to the axis of the lens. These photographs, which were exhibited to the Society, showed a remarkable likeness to the ribbon markings observed in the photographs of the lightning flashes, and it seems probable that this may be the true explanation of them. It occurred to the author that the dark flash observed on some of the prints might have been due to a somewhat similar cause, viz., to internal reflection within the glass of the negative plate, and he pointed out how such an effect might be produced if the printing was effected by means of sunlight fall-

ing somewhat obliquely upon the negative. He had tried to test this by means of photographs of the chalk lines drawn upon the black board ; but he had been unable to make many experiments, owing to the recent weather having been unsuitable for printing. He showed, however, a photograph which exhibited, though not very perfectly, an effect of the kind.

In the course of the discussion which followed, Dr. Gladstone said that though he naturally hesitated to criticise anything that Professor Stokes had suggested as an explanation of an optical phenomenon, yet he found it very difficult to imagine that one flash should follow so exactly the same path as one which had just preceded it, and it also appeared difficult to believe that a sufficient quantity of nitrous oxide could be produced to show the observed effect. Some of the photographs which showed the dark flash very clearly had been taken by a Mr. Shepherd at Westbourne-grove, so that the negatives would probably be available, and an examination of them would decide between the two explanations ; for if Mr. Whipple's explanation was the true one, the dark flash would not be shown upon the negative.

Mr. Boys stated that he always made a point of observing a lightning flash whenever possible, and that he had often observed a series of flashes following immediately one after the other in exactly the same path, every turn and twist in one flash being observed in those which followed it, and the whole series occurring in a fraction of a second.

Since writing the above we hear that a writer in the *Bayswater Chronicle* says, speaking from personal knowledge, that the "ribbon" lightning photograph was taken in the open air, and not through a window, and that the dark flash is not a reversion of any other flash shown in the same plate. The only theory which so far explains the curious phenomenon, of a dark flash of lightning being seen amongst the ordinary white flashes in a photograph, seems to be that which has been offered by Prof. Stokes, F.R.S., and Prof. Curtis, of Harvard University. Both these authorities arrived independently at the conclusion that the dark flash shown is really the path of a dead flash—that is, a vanished flash which has left a track of heavy nitrous oxide gas behind it in the atmosphere, impervious to the light of the flashes immediately following, and thus appearing opaque in the picture. We understand that Prof. Stokes's suggestion for charging a camera in the daytime during a thunderstorm, and taking off the cap just after a flash has disappeared, will be adopted, inasmuch as according to the theory, a dead flash should certainly then record itself on the plate.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on the 17th ult., at the Institution of Civil Engineers, 25, Great George-street, Westminster, Dr. W. Marcet, F.R.S., President, in the chair.

Mr. R. C. Mossman and Mr. E. H. Ryan-Tenison, M.R.C.S., were elected Fellows of the Society.

The following papers were read :—

1. "On the Deaths caused by Lightning in England and Wales from 1852 to 1880, as recorded in the returns of the Registrar-General," by Inspector-General R. Lawson, LL.D. The total number of deaths from lightning during the 29 years amounted to 546, of which 442 were of males, and 104 of females. In consequence of their greater exposure, the inhabitants of rural districts suffer more from lightning than those of towns. It appears also that proximity to the west and south coasts reduces the chances of injury by lightning, and that elevation and distance from the coast seem to increase them.

2. "The Diurnal Range of the Barometer in Great Britain and Ireland," by Mr. F. C. Bayard, F.R. Met.Soc. The author has reduced the hourly records of the barometer at the nine observatories, Aberdeen, Armagh, Bidston, Falmouth, Glasgow, Greenwich, Kew, Stonyhurst and Valencia, during the years 1876-1880. The curves for inland places are smoother than those for places on the sea coast, and the curves for places to the westward and southward are more irregular than those for places to the eastward and northward.

3. "Note on a Working Model of the Gulf Stream," by Mr. A.W. Clayden, M.A., F.R. Met.Soc. The author showed this interesting model (which has been constructed to illustrate the formation of ocean currents in general, and of the Gulf Stream in particular) and explained how the currents were produced.

4. "On the Rime-frost of January 6th and 7th, 1889," by Mr. C. B. Plowright, F.L.S. The author sent an account of the very heavy rime which occurred in the neighbourhood of King's Lynn on the above days, when the fringe of crystals upon twigs and branches of trees was about two inches in length. The weight was so great that nearly all the telegraph wires were snapped, and many branches of trees were broken off.

LONDON FOG AND ITS EFFECTS ON PLANTS.

The Royal Horticultural Society has lately been giving much attention to the above subject, and has resolved upon collecting and publishing such information as may be forthcoming. This course has been resolved upon in accordance with a suggestion, made at the Scientific Committee's meeting by Mr. Thiselton Dyer, F.R.S., the Director of the Royal Gardens at Kew, who said that they had not much ground for complaint at Kew until the winter of 1887-1888.

The fog proved injurious in two ways. First, in forming an oily deposit of dirt which was left on all the glass houses. This was so thick, and of so intractable a character that every pane had to be washed by hand. The houses looked as if they had slate roofs instead of being glazed. The same result occurred in the winter of 1888-1889. Secondly, with regard to the injury to plants, it seemed out of all proportion to the nature of the fog, especially so on Orchids. Thus, *e.g.*, when a fog comes on, the inflorescence of species of *Phalænopsis* breaks up, and the flowers disarticulating fall off. Many plants suffer more or less, and especially such as have a more tender foliage. Mr. Dyer remarked that the young foliage of a *Carpenteria* growing on a south wall did not suffer, while another plant under glass, with possibly tenderer foliage, was severely injured. The fogs extended even as far as Dorking, for Sir Trevor Lawrence lost a large number of flowers in a few hours. Mr. Veitch remarked that he found injurious effects to follow the two kinds of fogs, those caused by London smoke, and the ordinary country white fogs. In the dull weather accompanying the latter, flowers would not expand properly, as was particularly the case with early varieties of *Lælia anceps*. The yellow fogs of London had been getting steadily worse for the last twenty years. Camellias frequently lost their buds, especially certain kinds, as double whites. A peculiar feature observed by Mr. Veitch was, that the fog seemed to gum up the buds at a certain stage of development, though either before or after that particular period of growth the buds were unaffected by the fog. He mentioned that 1000 flowers of *Cattleyas* were lost in three weeks.

THE PROPOSED BERMUDA-HALIFAX CABLE: ITS USEFULNESS FOR WEATHER PREDICTIONS.

The announcement made by the British Postmaster-General (says the *New York Herald*), that the Government intended to lay a submarine cable between Bermuda and Halifax, will be good news to all Atlantic seamen and all American and European meteorologists. Bermuda is a natural observatory for watching hurricanes emerging from the tropical ocean and threatening to assail the United States, or to advance north-eastwardly from the Gulf Stream into the transatlantic steamer tracks, and subsequently to burst upon the shores of Europe. Of course an observer at Bermuda cannot see with the naked eye what a Gulf Stream storm is doing, or determine by ocular demonstration what its course will be. But by watching the fluctuations of the barometer at this mid-Atlantic station, and by reporting them by cable to America and Europe, meteorologists on either continent will be enabled to feel the pulse of the storm and to determine more accurately its intensity and its future movements. For purposes of weather and storm forecasting in our Atlantic States, therefore, weather cablegrams from Bermuda will be invaluable.

REVIEWS.

Egeson's Weather System of Sunspot Causality, being original researches in solar and terrestrial meteorology. By CHARLES EGESON, Weather Map Compiler, Sydney Observatory, New South Wales. Turner and Henderson, Sydney, 1889. 8vo., ix., 63 pages. 5 folding plates.

It is of course very rash for a reviewer to presume to question a dictum by Herbert Spencer, but we hold that the following lines from Chapter V. of the work before us are untrue, and are libellous of meteorology.

"Herbert Spencer has told us that the object of all science is to enable us to predict phenomena. Meteorology has no other object."

We do not produce arguments against these statements, because we believe that they will occur to every reader. But we have quoted these lines, because, although we cannot go the length which Mr. Egeson does, and say that meteorology has no other object than prediction, we desire to assure him that our strongest sympathies are with him, and with all who honestly try to detect the basis on which long period predictions can be established. We know that some leading British meteorologists have declared it to be impossible to predict more than a day or two in advance. If that were certain, and if Mr. Herbert Spencer's dictum were true, we suppose that every meteorological observatory ought to be dismantled. But it is not our view, we cling to the hope that, complex as is the problem, it will eventually be solved, therefore it is, that we have no sympathy with those who scoff at honest attempts to pierce the mystery, and that is why nothing would give us greater pleasure than to express our conviction that Mr. Egeson had proved his case, and that a triple sunspot, or 33 year, period was the solution of the whole question. There is one charm about Mr. Egeson's book, he has done what Fullbrook did in his *Wet and Dry Seasons in England*, carried his curves four years into the future, so that all can compare the forecasts with the facts.

Now that we are being told that Nebulæ, if not also stars, are merely colliding meteors, we must not speak disrespectfully of them, but really we scarcely know how to believe that sunspots (large enough for a dozen worlds as large as the one we inhabit to be dropped through simultaneously and side by side), are produced by the impact of meteors. How many hundred millions would be required? Although the author quotes this theory, he seems to feel that it is hardly safe to trust to it, and so he wisely comes back to the sunspots themselves and leaves their production alone.

In such work as the author has here undertaken, the great danger is that of deceiving one's self. Every step in the process of investigation should be fixed rigorously; if not, one is sure to fall into the temptation of tossing in the direction one wishes, and a multitude of little tossings produces a sensible effect. We notice

two weaknesses of this kind on page 14, in the first and second line Mr. Egeson writes, "where seven days intervene, give three to one and four to the other indiscriminately." For "indiscriminately," he should have said "alternately." The other case is more complicated, the author has worked out, for what we may perhaps be permitted to describe as lunar weeks, their relative wetness and he gets the following values :—

1, 2, 5, 4, 3, 7, 3, 5, 2, 2, 0, 4, 2, 1, 1, 2, 1, 3, 0, then he says, "When projected, these give a better idea of mutual relation than their appearance here; but this must appear to every one, that the increase from 1 to 2 and 5 forms a rising slope, and the falling slope is represented by the figures 5, 4, 3. This I call a period. The number 5 represents the maximum, and 1 and 3 are two minima. Thus the max. in the series are (5) 7, 5, 4, 2 and 3." The author has forgotten to insert in this little list the first max. of 5, so we put it in (). But we have a serious question to ask. Why do we find in the list of max. such very low values as 2 and 3? Within two lines we are told that "1 and 3 are the two minima," and that "the max. in the series are . . . 2 and 3."

A very similar series of anomalies occurs on page 44, where the author applies some curious method and picks out min. which are not min., and max. which are not max., because rather high or rather low values occur in the years in which his theory requires them. Considering that his book reached England early in April we may surely assume that it was printed not later than February 1889. Here then is a droll sentence.

"The extreme maxima of 1857 and 1888-90, representative of our local thirty-three year cycle, is (sic.) marked with double asterisks" — a double ? would surely be more appropriate. April 1889 had not commenced when the book was printed, far less had April 1890. April 1888 had a high mean pressure, the highest since April 1857, but that was 31 years not 33, and that is the only explanation which occurs to us for the remarkable bracketing of prophetic values for 1889 and 1890, along with the real one in 1888, which seems to have come two years too soon.

By a mysterious process of which we cannot approve, Mr. Egeson evolves the depth of rain at Sydney, when there was no gauge, from the number of entries of rainy days, and jumps at values for Sydney by adding 10 (which he afterwards says should be 12) inches to each year at Parramatta (or Paramatta he spells it both ways). We say jumps because evidently the quantity to be added varies with the total; suppose the mean at Parramatta to be 36 in., and at Sydney 48, then when the Parramatta fall was 24, only 8 should be added, and when at Parramatta it was 48, the addition should be 16. And yet after this loose way of making up returns, Mr. Egeson has the assurance to write.

"This then ($45\frac{1}{2}$ in.) is Sydney's mean annual rainfall, and not

49½ in. as published in official returns, and deduced from the records since 1840."

The author has worked at his subject as only those work whose hearts are in it—but he is not methodical, and, therefore, has not afforded the demonstrations which perhaps he could. For instance the diagrams facing page 20 are most aggravating. We have four diagrams, one pair showing sunspot area for two years, and the other pair, rainfall for two years—but when one begins to compare them, one finds that the first pair are for 1882 and 1887, the other pair for 1887 and 1888.

Untersuchungen ueber die tägliche Oscillation des Barometers. VON J. HANN, W.M.K. Akad. [Excerpt "Denks. der Math. Naturwissen. classe der K. Akad."] Tempsky, Vienna, 1889, 4to., 73 pages.

THE interest taken in the small daily oscillations of the barometer is rather remarkable. It almost seems as if every meteorologist who reached the front rank felt it obligatory upon him to write a memoir upon the daily range of the barometer; indeed, Dr. Hann in this very paper remarks that the literature upon the subject is already sufficient to fill a small library. A short paper upon it, by Mr. Bayard, is mentioned on p. 53 of this number; another and elaborate investigation, by Dr. Buchan, is, we believe, in a forward state; in France, M. Angot has one either in MS. or in the printer's hands, but as the above title shows Dr. Hann is the first of the present group to have his paper completed and published.

It is evident that he who publishes first has an advantage and a disadvantage over his successors—an advantage in that he has priority for any discoveries that he may have made, a disadvantage in that those who come after can profit by his labours, and learn by his mistakes, if he makes any.

Until the American Government print their promised Meteorological catalogue, the labour of every worker in the subject is seriously impeded and injured. Dr. Hann has given the constants for about 120 stations, but we do not think that he has exhausted existing materials, and, much as we admire them, we should not have accepted the indications of Richard's and Höttinger's Barographs for such delicate work. Another matter in which we should have acted differently from Dr. Hann, is in accepting observations made during extremely short periods; out of the 100 in his principal table, there are 28 based upon one year or less, 10 of them being for less than four months. This to us seems hazardous, but Dr. Hann is not one to do things without good warrant, and therefore we do not venture to say that it is unwise. He has doubtless applied the very simple test of trying whether the two halves of these short records, when compared, give nearly identical values.

In considering the influence of altitude above sea level on the

amplitude of the barometric oscillations, Dr. Hann takes up also that of height above ground, and suggests that the Eiffel tower might be utilized for that purpose.

The whole work has been done with that thoroughness and care which characterize the author; he has contributed one more treatise to the existing small library, but one which no student of the subject can afford to ignore.

A List of the More Remarkable Earthquakes in Great Britain and Ireland during the Christian Era, compiled by WILLIAM ROPER, F.S.S., F.R.Met.Soc. Lancaster: T. Bell, 8vo, 46 pages.

It was our painful duty last year to include the name of our worthy Lancaster observer in the obituary in *British Rainfall*, a section which it is always saddening to prepare, and sometimes especially so when we know that the work of those who are taken from us will be abruptly stopped, no relative taking any interest in it. We had the pleasure during Mr. Roper's lifetime of calling attention to more than one privately printed paper issued by him, and we are glad to recognize in the pamphlet before us the best list of British Earthquakes, and a memorial to a Father's memory better, more useful, and more lasting than marble or granite. For good paper, as we all know, will stand for three or four hundred years without a sign of age—and this pamphlet must be secured for all libraries which pretend to completeness in physical geography, seismology, or geology—and with modern precautions against damp and against fire, we see no reason why the last copy should disappear for many hundred years to come, unless, indeed, the world itself should go also.

Mr. Roper has searched nearly all the old chroniclers, such as Matthew of Paris, Roger de Hoveden, William of Malmesbury, Florence of Worcester, several of the County Histories, O'Reilly's Catalogues in the *Trans. Roy. Irish Acad.*, Mallet's great Catalogue, Meldola's Report on the Essex Earthquake, the *Phil. Trans.*, *Annual Register*, *Gentleman's Magazine*, &c. And though, of course, neither he nor anyone else could sift the wheat of truth from the chaff of fiction, with which a thousand years since it was considered imperative to mingle every statement, still we believe that he has done all that can be done. Mr. W. O. Roper quite rightly points out that it is exceptionally difficult to avoid errors in such a work as this—but it may be well for us to mention something bearing on the other side of the question, viz., that in many works wrong dates are given, owing to the old plan of writing the date double (e.g., 1615/16), when the year instead of beginning with January, began in the spring, and that Mr. Roper spent much time in comparing the older records, and trying to assign the shocks to the proper year—so that his dates must not be lightly impugned.

The list is chronological, starting with the year 10 and coming

down to 1889, but a complete alphabetical index to localities is given at the end, and alongside of every statement is given the short title of the book, and the volume, and page whence it has been quoted.

ROYAL SOCIETY SOIRÉE.

Meteorology was not strongly represented this year, there being only two exhibits.

(1) *A Model illustrating the formation of Ocean Currents* by Mr. A. W. Clayden, M.A., F.G.S.

This consisted of a map of the Atlantic, on Mercator's projection, in which the seas were represented by the surface of some water over which Lycopodium powder had been scattered.

A foot blower was attached, and when it was worked a gentle blast of air was delivered from a number of tubes, in such a way as to set up a circulation of air resembling that of the atmosphere over the real ocean. These imitation prevalent winds acted upon the water, and created a system of currents resembling those of nature.

Special attention was directed to the Gulf Stream, issuing from the Gulf of Mexico, to the return current flowing eastwards between the two great equatorial currents, and to the Labrador current flowing from Baffin's Bay.

Portions of Central America were made removable, and when they were taken out it was noticed how the water of the Gulf Stream fails to reach our shores.

(2) *Air Meter for registering high velocities* exhibited by Mr. W. H. Dines, B.A.

ANCHOR ICE ON THE SEVERN.

This description of ice, locally called stock or frodge ice, is not uncommon on the Severn in frosty weather, between Stourport and Gloucester.

In severe frosts, the lampern wheels and putcheons (wicker-work constructions for catching lamperns and eels) are lifted from the bottom of the river, dragging their anchor stones, bricks, &c., with them, the wheels and putcheons being then double their ordinary size from the ice coated upon them.

Ice also at such times frequently rises from the bottom of the river, especially in the neighbourhood of fords or other shallow places.

It also sometimes accumulates on the weirs—as in January, 1881—to such an extent as, if not removed, to raise the water in the river several feet. It must be cleared away before the floating ice comes down or a block would ensue.

This anchor ice will sometimes freeze on the walling and stones of the weirs completely down to the bottom.

H. J. M.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCTOBER, 1888.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	68·8	27	28·2	8	55·4	38·9	41·1	84	99·3	21·3	1·23	7	5·5
Malta	88·8	5	52·0	22	74·5	62·4	58·6	74	135·8	47·4	4·06	7	3·7
<i>Cape of Good Hope.</i> ...	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Mauritius</i>	82·7	31	62·0	17	78·4	65·7	63·0	76	133·3	54·3	1·60	14	6·0
Calcutta	91·4	2	66·9	21	87·1	72·9	70·9	66	153·7	59·1	2·51	4	2·6
Bombay	94·5	19	74·4	4	90·1	77·3	74·0	73	144·4	62·8	·11	1	1·8
Ceylon, Colombo	88·7	10	72·0	20	86·4	74·6	71·8	78	145·5	69·3	15·77	23	7·3
<i>Melbourne</i>	86·0	13	35·1	9	65·1	46·7	43·8	64	145·0	27·7	1·35	8	5·0
<i>Adelaide</i>	91·9	22	41·5	8	73·8	51·7	44·0	50	146·9	30·7	·31	5	3·8
<i>Wellington</i>	67·0	28	39·5	3	60·3	47·3	45·3	73	135·0	34·0	3·37	13	3·6
<i>Auckland</i> .....	...	..	...	...	...	...	...	...	...	..	...	...	...
Jamaica, Kingston	94·4	21	64·7	26	90·8	71·6	73·4	76	...	...	1·83	...	...
Barbados .....	...	...	...	...	..	...	...	...	...	...	...	...	...
Toronto	62·2	31	28·3	21	50·0	36·4	37·5	78	...	19·0	2·65	20	7·3
New Brunswick, Fredericton	63·7	7	26·0	1	48·9	33·8	35·6	79	...	...	9·99	20	6·9
Manitoba, Winnipeg ...	71·2	6, 7	20·3	5	49·0	36·0	34·8	82	...	...	2·71	13	6·8
British Columbia, Victoria	69·0	4	31·0	30	57·6	44·7	...	...	...	...	3·35	14	...

REMARKS, OCTOBER, 1888.

MALTA.—Mean temp. 67°·5 ; mean hourly velocity of wind 10·7 miles. Sea temp fell from 77°·9 to 69°·0. TSS on 8th, 10th, and 12th. L on 17th. J. SCOLES.

Mauritius.—Mean temp. of air 0°·1 below, of dew point 1°·7 above, and R ·02 in. below average. Mean hourly velocity of wind 9·2 miles, or 2·5 below average ; extremes 26·2 miles on 7th and 0·0 on 28th. Prevailing direction, E.S.E.

C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·7, of dew point 2°·5 humidity 6, mean amount of cloud 1·0, and R 1·50 in. below the average. Pressure ·160 in. above the average. Prevailing wind S.W. and S. ; strong on 11 days. Heavy dew on the 2nd. T and L on the 14th.

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

Adelaide.—The driest October on record, the R being 1·5 in. below the average of 31 years. Mean temp. 1° above the average. C. TODD.

Wellington.—Showery, with intervals of fine weather. Prevailing wind N.W., strong or stormy on 13 days. Distant T on 24th. Hail on night of 21st. Earthquakes on 23rd and 26th. Mean temp. average ; R 1·46 in below average. R. B. GORE.

FREDERICTON.—6·81 in. of R in the first 8 days ; water in the river as high as an ordinary spring freshet.

VICTORIA.—Unusually dull and overcast.

SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1889.

[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 Hall.	2·63	XI.	Castle Malgwyn	2·53
„	Margate, Birchington...	2·01	„	Rhayader, Nantgwillt..	6·36
„	Littlehampton	2·08	„	Carno, Tybrith	4·69
„	Hailsham	2·06	„	Corwen, Rhug	4·93
„	Ryde, Thornbrough	2·26	„	Port Madoc	4·35
„	Alton, Ashdell	2·54	„	I. of Man, Douglas	3·52
III.	Oxford, Magdalen Col...	2·51	XII.	Stoneykirk, Ardwell Ho.	2·14
„	Banbury, Bloxham	2·84	„	New Galloway, Glenlee	3·30
„	Northampton	1·69	„	Melrose, Abbey Gate ...	3·32
„	Cambridge, Beech Ho...	2·10	XIII.	N. Esk Res. [Penicuick]	3·40
„	Wisbech, Bank House..	2·17	XIV.	Ballantrae, Glendrishaig	2·71
IV.	Southend	2·02	„	Glasgow, Queen's Park.	1·29
„	Harlow, Sheering	1·92	XV.	Islay, Gruinart School..	2·36
„	Rendlesham Hall	1·69	XVI.	Dollar	3·85
„	Diss	2·03	„	St. Andrews, Pilmour Cot	3·03
„	Swaffham	2·15	„	Balquhiddy, Stronvar..	4·90
V.	Salisbury, Alderbury ...	2·16	„	Dunkeld, Inver Braan..	4·41
„	Warminster	3·09	„	Dalnaspidal H.R.S. ...	5·31
„	Bishop's Cannings	3·24	XVII.	Keith H.R.S.	4·07
„	Ashburton, Holne Vic...	2·61	„	Forres H.R.S.	2·18
„	Hatherleigh, Winsford.	1·41	XVIII.	Strome Ferry H.R.S....	2·21
„	Lynmouth, Glenthorne.	2·16	„	Fearn, Lower Pitkerrie.	1·72
„	Probus, Lamellyn	2·87	„	Loch Shiel, Glenaladale	4·18
„	Launceston, S. Petherwin	1·93	„	N. Uist, Loch Maddy ...	1·79
„	Wincanton, Stowell Rec.	3·92	„	Invergarry	3·78
„	Taunton, Lydeard Ho...	2·52	„	Loch Ness, Drumnadrochit	2·07
„	Wells, Westbury	3·54	XIX.	Lairg H.R.S.	2·71
VI.	Bristol, Clifton	4·77	„	Forsinard H.R.S. ....	...
„	Ross	5·64	„	Watten H.R.S.	2·69
„	Wem, Clive Vicarage ...	4·62	XX.	Dunmanway, Coolkelure	4·93
„	Cheadle, The Heath Ho.	2·69	„	Fermoy, Gas Works ...	3·00
„	Worcester, Diglis Lock	3·41	„	Tipperary, Henry Street	3·31
„	Coventry, Coundon	3·57	„	Limerick, Kilcornan ...	2·15
VII.	Ketton Hall [Stamford]	2·88	„	Miltown Malbay	2·73
„	Grantham, Stainby	3·32	XXI.	Gorey, Courtown House	1·93
„	Horncastle, Bucknall ...	2·05	„	Navan, Balrath	2·52
„	Mansfield, St. John's St.	3·55	„	Mullingar, Belvedere ...	2·56
VIII.	Neston, Hinderton	2·85	„	Athlone, Twyford	2·57
„	Knutsford, Heathside ...	2·57	„	Longford, Currygrane ...	2·72
„	Lancaster, South Road.	2·31	XXII.	Galway, Queen's Coll...	2·03
„	Broughton-in-Furness ..	2·97	„	Clifden, Kylemore	3·24
IX.	Wakefield Prison	3·18	„	Crossmolina, Enniscoe..	3·03
„	Ripon, Mickley	3·12	„	Collonee, Markree Obs.	3·31
„	Scarborough, West Bank	3·41	„	Ballinamore, Lawderdale	...
„	East Layton [Darlington]	3·60	XXIII.	Warrenpoint	3·72
„	Middleton, Mickleton ..	2·85	„	Seaford	4·25
X.	Haltwhistle, Unthank...	2·88	„	Belfast, New Barnsley .	3·57
„	Shap, Copy Hill	3·17	„	Bushmills, Dundarave...	3·06
XI.	Llanfrechfa Grange	4·53	„	Stewartstown	3·32
„	Llandovery	3·68	„	Buncrana	3·14

APRIL, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which -01 or more fell.	TEMPERATURE				No. of Nights below 32°		
		Total Fall.	Differ- ence from average. 1870-9	Greatest Fall in 24 hours.		Dpth		Date.	Max.		Min.		In shade.	On grass.
				Deg	Date				Deg	Date				
I.	London (Camden Square) ...	2.06	+ .04	.35	23	20	63.9	19	32.4	16	0	5		
II.	Maidstone (Hunton Court)...	2.59	+ .74	.48	25	17	...	...	...	...	...	...
III.	Strathfield Turgiss	2.30	+ .39	.46	6	21	62.8	18	31.8	1	1	13		
III.	Hitchin	2.30	+ .35	.35	10a	19	62.0	18	32.0	15	0	...		
IV.	Winslow (Addington)	2.61	+ .30	.37	23	22	65.0	18	30.0	16e	2	8		
IV.	Bury St. Edmunds (Culford)	...	...	...	...	...	...	...	...	...	...	...
V.	Norwich (Cossey)	1.96	+ .10	.32	13	19	...	...	...	...	...	...
V.	Weymouth (Langton Herring)	1.82	...	.66	7	14	60.0	18b	35.0	6, 16	0	...
"	Barnstaple	1.09	- 1.29	.30	23	11	58.0	19	32.0	10	0	...		
"	Bodmin	1.74	- 1.59	.29	27	15	58.0	18	34.0	8	0	6		
VI.	Stroud (Upfield)	4.69	+ 2.24	1.00	8	22	65.0	18	34.0	15	0	...		
"	Churchstretton (Woolstaston)	5.75	+ 3.43	.67	8	24	63.0	18	30.0	15	0	311		
"	Tenbury (Orleton)	4.67	+ 2.50	.92	8	21	66.2	18	30.0	26	6	9		
VII.	Leicester (Barkby)	3.18	+ 1.30	.81	10	20	65.0	28	31.0	15	2	10		
"	Boston	2.34	+ .45	.44	28	22	68.0	19	30.0	3	3	...		
"	Hesley Hall [Tickhill]	2.43	...	.40	6	20	63.0	27	31.0	15	1	...
VIII.	Manchester (Ardwick)	2.08	+ .05	.34	10	16	64.0	27	34.0	15	0	...		
IX.	Wetherby (Ribston Hall) ...	2.02	- .49	.42	7	13	...	...	...	...	...	...
"	Skipton (Arncliffe)	3.84	+ .78	.60	23	20	61.0	17	32.0	14	0	...		
"	Hull (People's Park)	2.35	+ .62	.45	28	21	...	...	...	...	...	...
X.	North Shields	2.19	+ .19	.41	30	21	63.0	20	30.0	2	3	6		
"	Borrowdale (Seathwaite)	5.64	+ .70	.74	22	20	...	...	...	...	...	...
XI.	Cardiff (Ely)	3.19	+ .85	.45	30	21	...	...	...	...	...	...
"	Haverfordwest	2.67	- .15	.40	23	18	60.0	19	31.0	10	2	11		
"	Plinlimmon (Cwmsymlog) ...	5.16	...	.78	23	17	...	...	...	...	...	...
"	Llandudno	4.72	+ 2.84	.80	8	20	55.8	28	33.0	15	2	...		
XII.	Cargen [Dumfries]	2.69	+ .40	.53	3	16	60.0	17	30.0	15	4	...		
"	Jedburgh (Sunnyside)	2.55	+ .85	.35	28	21	59.0	17c	30.0	3	2	...		
XIV.	Old Cumnock	1.84	+ .18	.28	3	18	60.0	28	27.0	14f	9	...		
XV.	Lochgilhead (Kilmory)	3.28	+ .65	.59	19	14	...	...	...	...	...	...
"	Oban (Craigvarren)	2.54	...	.77	19	16	57.8	28	30.2	14	1	...
"	Mull (Quinish)	2.52	...	.43	3	15	...	...	...	...	...	...
XVI.	Loch Leven Sluices	3.80	+ 1.59	.80	14	9	...	...	...	...	...	...
"	Dundee (Eastern Necropolis)	3.65	+ 1.53	.65	30	19	65.2	17	30.8	2, 3	2	...		
XVII.	Braemar	4.09	+ 2.01	.76	30	23	61.2	17	28.0	3, 26	7	22		
"	Aberdeen (Cranford)	3.49	...	.43	3	25	66.0	18	32.0	2	0	...
XVIII.	Lochbroom	2.24	...	.44	23	20	...	...	...	...	...	...
"	Culloden	1.22	- .13	...	...	...	59.0	17	32.0	3, 26	0	22
XIX.	Dunrobin	3.11	...	.90	3	15	59.5	18	29.0	3	3	...
"	S. Ronaldsay (Roeberry)	2.38	+ .53	.58	10	23	...	...	...	...	...	...
XX.	Cork (Blackrock)	3.45	+ .35	1.06	27	18	60.0	17	30.0	12	4	...		
"	Dromore Castle	3.56	...	.80	29	18	61.0	26	32.0	8	0	...
"	Waterford (Brook Lodge) ...	1.91	...	.23	21	19	63.0	17	27.0	15	2	...
"	O'Briensbridge (Ross)	2.86	...	1.17	27	16	60.0	*	34.0	1	0	...		
XXI.	Carlow (Browne's Hill)	2.01	- .56	.30	3	20	...	...	...	...	...	...
"	Dublin (FitzWilliam Square)	2.61	+ .50	.42	11	21	59.7	20	33.1	15	0	8		
XXII.	Ballinasloe	2.35	+ .09	.76	27	18	57.0	19	28.0	12	4	...		
XXIII.	Waringstown	4.11	+ 2.22	1.12	8	17	64.0	18	30.0	14	1	13		
"	Londonderry (Creggan Res.) ..	3.14	...	.91	3	19	...	...	...	...	...	...
"	Omagh (Edenfel)	3.09	+ 1.09	.53	3	21	55.0	17d	34.0	3, 14	0	...		

a And 29. b And 20, 21. c And 19. d And 18, 19, 20. e And 26. f And 25. * Several days.
+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON APRIL, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—The month commenced with rainy and unsettled weather, and with a low temp. Crops generally looking well at the close. T on 5th, 23rd and 30th; H on 5th and 23rd.

WINSLOW, ADDINGTON.—Greater amounts of R have been recorded in April, but never such a number of rainy days. The nights were cold throughout, but there was very little frost. Swallows arrived on 16th, and the cuckoo on 22nd, its time of arriving varies very little, no matter what the weather may be. T on 5th, 11, 12th, 23rd and 30th; H on 4th, 11th, 23rd and 28th. Some S on 3rd.

WEYMOUTH, LANGTON HERRING.—A typical April. R \cdot 49 below the average. Mean temp. 0° ·6 above the average of 17 years. Heavy TS on 12th, and a slight one on 24th. Well defined solar halo on 27th.

BODMIN.—A cold April, but the temp. very similar to that of the five previous Aprils. Mean temp. 45° ·8.

WOOLSTASTON.—A cold, ungenial month, the first fortnight being specially inclement and very dark, with constant fog and R. S fell heavily on 6th, 7th and 10th, and again more lightly on 12th. T on 6th, 8th and 24th. Mean temp. 43° ·2.

ORLETON.—The first 14 days were very cold, with R every day, and generally a cloudy sky. The remainder of the month was warmer and drier, but the mean temp. of the whole month was about 3° lower than the average of 28 years, although it was nearly 1° higher than that of April, 1888. The R was the largest in April for 58 years, except 1858. On the 8th R set in and continued more or less till the 11th, when about 2·25 in. had fallen, which produced great and long-continued floods in the rivers Teme and Severn. Distant T on 6th, 8th, 23rd, 24th and 30th, and on the 8th, 24th and 30th there were heavy storms within 20 miles. On the morning of the 11th, the hills were covered with S. Cuckoo heard on 21st; chiff-chaff seen about the 6th; and the small summer birds about the 25th, but the swallow has rarely been seen.

BARBY.—The total R for the first four months this year is 10·57 in., as against 5·57 in. in 1888, or nearly double. First swallow seen on 6th; cuckoo heard on 11th. Mean temp. 45° ·6. Vegetation some 10 days backward. T, with heavy H, on 4 days.

HULL.—The month was generally cold, wet, and overcast.

WALES.

HAVERFORDWEST.—The weather was most variable throughout the month, very showery, changeable, and at times very cold, especially from the 5th to the 16th, though there were very few frosts. Although the total R was small, the general character of the month was rainy throughout. Mean temp. rather above the average. Plenty of grass and crops looking well. Blackthorn in flower on 11th; horse chestnut in leaf on 25th. Cuckoo heard on 25th.

SCOTLAND.

CARGEN.—A cold, gloomy month, temp. 2° ·6 below the average. Easterly winds prevailed for 17 days, and the duration of sunshine was 53 hours below the average. Vegetation backward.

JEDBURGH.—The weather was cold and ungenial, with much R; still, vegetation progressed fairly. Swallows not yet arrived.

CRAIGVAREN, OBAN.—The month was decidedly warmer than usual, and the **R** moderate; growth was abundant, and early flowers made a good appearance.

QUINISH, MULL.—A showery, unsettled, and rather cold month, but on the whole very favourable to spring vegetation; hardly any frost at night.

LOCHBROOM.—Upon the whole a capital working month. Very little snow or storm, or anything to retard farming, while sunshine and showers were prevalent, causing green pastures.

CULLODEN, INVERNESS.—The weather generally was cold and the spring late. A fall of about 4 inches of **S** on the night of the 10th.

IRELAND.

CORK.—The month was mostly fine, but the winds were cold, and there were a few slight **H** showers. The spring is considered to be backward. Mean temp. 46°.

DROMORE.—Very little progress in vegetation until the last week of the month.

WATERFORD.—**R** '62 in. below the average. Mean temp. 45°·4.

ROSS, O'BRIENSBRIDGE.—Splendid weather until the 27th, but on the morning of the 28th the hills were white with **S**. Swallows late; cuckoo reported himself only on the 1st May.

DUBLIN.—The month was generally cold, cloudy, changeable and showery, with low pressure, and a preponderance of polar winds. Gale on 28th and 30th; **S** or sleet on 4th; **H** on 21st, 22nd, 23rd and 24th. Temp. below the average, having been lower in only three Aprils since the observations commenced in 1860. **T** on 30th.

OMAGH, EDENFEL.—With the exception of a short interval from 13th to 18th, the weather was cold, wet, and gloomy, and bore the character of October, rather than April. Sowing and farming operations generally were much retarded, but although there was no warmth, there was no frost, so that ordinary vegetation is not backward. The early summer migrants arrived about a week late.

TERRIBLE THUNDERSTORM AT BOULOGNE, MAY 6TH.

AN extraordinary thunderstorm visited Boulogne on Monday evening. It was not discovered until some time after the storm how disastrous had been its effects. The town presents an extraordinary appearance, the extent of the destruction being almost beyond description, fissures having been cut in the streets eight or ten feet deep, and so terrible was the force of the torrent that huge paving and curb stones, some of them weighing from two to four hundred-weight, were torn up and hurled along by it for great distances. Openings were made sufficiently large to engulf a horse and cart; trees were in many cases torn up, and gardens washed away; while the basements in the lower part of the town were under water. The whole of the inhabitants were in a great state of terror, and it will take some time to restore the damage which has been caused. Subscriptions have been opened for the sufferers. Several persons had narrow escapes. One man was carried a considerable distance by the torrent and was much bruised. Two horses were killed by the lightning, and a man and woman were also struck.—*Daily News*.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCLXXXI.]

JUNE, 1889.

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THE NEW ENGLAND METEOROLOGICAL SOCIETY.

[THE demands on our space are such that we are frequently obliged to omit notice of good work. Hence alone it has been that we have not oftener reported the proceedings of the above-named Society. But its First Annual Exhibition has been such a success, and so many instruments not previously described in these pages were shown, that we reprint, with slight alterations, the account as given in the *Meteorological Journal*, omitting such parts as refer to instruments, &c., well known in this country. We have been favoured by Mr. Lawrence Rotch with a photograph of the exhibition, which is at once very acceptable and very tantalizing. One regrets the impossibility of having been there.—ED.]

THE EXHIBITION OF THE NEW ENGLAND METEOROLOGICAL SOCIETY.

SEVERAL months since, the New England Meteorological Society, following the annual custom of the Royal Meteorological Society of London, decided to hold a loan exhibition in Boston in connection with its fourteenth regular meeting. Accordingly a circular was issued, which was printed in the November issue of this Journal, requesting contributions of meteorological apparatus, photographs, charts and specimens. The exhibition was opened in the Physical Laboratory of the Massachusetts Institute of Technology, January 15, and was continued seven days.

The Blue Hill Meteorological Observatory displayed instruments used in its regular and experimental work. In the latter class were the registering aneroid barometer, wind-vane and thermometers, used by Professor Upton and Mr. Rotch during the late total solar eclipse in California, besides the registering actinometer put in action probably for the first time during a total solar eclipse. This instrument, which was made by Richard Brothers of Paris, has a bright and a black globe, in each of which is a thermometer, whose indications are registered on a drum, an ingenious device correcting the influence of changes of temperature upon the transmitting medium of the solar thermometers.

There were the Watkin and Hottinger aneroid barometers, the first being intended for mountain use without thereby sacrificing an open scale. To accomplish this, the needle travels three times around the dial in its passage from 23 inches to 31 inches, and an index, actuated from the axis of the needle, shows which of the concentric circles should be read.

In the Hottinger instrument the expansion and contraction of the vacuum box is measured by a micrometer and vernier to the thousandth of an inch. This instrument is the property of the U.S. Signal office. There was also the *thermomètre à marteau* made by Baudin. This is an alcohol minimum, but can be placed vertical, unlike any other, and its index is not subject to displacement by wind. A spring attached to the index keeps it in a fixed position, but is not strong enough to prevent the film of alcohol from drawing the index downward when the temperature falls. The thermometer is set by turning it bulb upward when an enamel rod in the bulb descends the bore, and, acting as a hammer, forces the index to the end of the column.

A simple portable anemometer is the one made by Hicks for the London Meteorological Office. In it the Robinson cups are geared to a dial, but can be disconnected by inverting a sand-glass. To determine the velocity of the wind, the cups are allowed to acquire the normal velocity before the sand-glass is turned over and the registration commenced. At the expiration of two minutes, when the sand has ceased to flow, the glass is reversed and the wind's velocity, in miles per hour, read off at leisure from the dial. This instrument costs in London £5, and if it could be manufactured cheaply in this country it would be a valuable adjunct to the equipment of the stations of our State Weather Services.

Among the new apparatus was the recording rain and snow gauge devised by S. P. Fergusson, and described in the November Journal.

A seismograph made from designs of Professor Ewing, of Dundee, Scotland, was also shown, in which a heavy disk is suspended by three wires, and below it is a vertical weighted rod in unstable equilibrium. A rod fulcrumed above the disk carries a lever with a pen which inscribes upon a smoked glass plate the direction and intensity of the horizontal components of the earthquake shock. The English instrument cost £15, but it is manufactured in San Francisco for £3.

The Harvard College Observatory showed a seismoscope, in which the time of the earthquake is obtained by having a pendulum break an electric current and start or stop a clock. Some tracings obtained by a pendulum seismograph of Prof. Ewing in Tokio, Japan, were loaned by Prof. Rockwood.

A form of the Jordan sunshine-recorder, modified by Prof. Pickering, was shown by the Harvard College Observatory. It is often difficult to find a position with exposure to both morning and afternoon sun. Accordingly the apparatus is made in two parts—

each being the half of a cylinder with its axis parallel to the earth's axis. These half cylinders contain blue print paper, which is acted upon by the sun shining through holes in the flat sides of the cylinders. These holes are moved down a notch each day, so that one sheet of paper lasts a week. One of the cylinders gives a record of the morning sun, the other of the afternoon sun, and the cylinders may be placed on opposite sides of a house, if necessary.

Another ingenious instrument devised by Prof. Pickering is the pole-star recorder. In this, a telescope and camera are combined so that the trail of the pole-star, as it describes a circle in the heavens, is photographed on the sensitized plate, if the sky be clear. Passing clouds cause the trail to be broken. An alarm clock closes the shutter of the camera at dawn, and can be made also to open it after dark. From these records the amount of cloudiness is obtained at night as it is obtained in the daytime from the sunshine recorder.

The aspiration psychrometer, invented by Dr. Assmann, of Berlin, for obtaining the temperature and humidity of the air under all circumstances, was shown by Mr. Rotch. The wet and dry bulbs of the thermometer are surrounded by a polished metal casing through which air is drawn by bellows at a uniform rate. For use in rain there is a second case to enclose the first.

The Fineman nephoscope, or cloud mirror, was recommended by the International Meteorological Committee. It has a black reflecting surface with means for orienting it and sighting the cloud image by which the direction of motion, and the relative velocity, of clouds can be determined.

Prof. Marvin, of the Chief Signal Office, exhibited a very delicate anemometer with conical cups made of aluminium, used to determine the constants of the anemometers of the Service.

The Signal Service exhibited much new apparatus, including the triple self-register for wind direction and velocity and rainfall. For obtaining the latter the gauge invented by Prof. Marvin is employed. A float in a tube makes an electric contact by means similar to those in the anemometer, for each five-hundredths of an inch of rainfall.

One of the new thermometers for registering electrically at a distance, made by Richard Brothers, of Paris, and just imported by the Signal Service for use at certain of its stations, was shown.

The Signal Service also showed the apparatus used by Sergeant Park Morrill in his study of atmospheric electricity. This included the gas-flame and mechanical collectors invented by Sergeant Morrill, the Trowbridge, Mascart and Mendenhall quadrant electrometers, and the Mascart photographic register. The Physical Department of the Institute of Technology also added to this collection the Clifton and Thomson portable electrometers and the Thomson electrostatic voltmeter.

To the Physical Department of the Institute belonged the thermometer comparators shown. One of these was for making com-

parisons of a mercurial with an air thermometer, the other for comparing the thermometers used by the Society's observers with a standard instrument, all being immersed in water for the purpose.

The Draper Manufacturing Co. sent from New York a beautifully finished recording barometer and some thermometers, and the Standard Thermometer Co., of Peabody, Massachusetts, exhibited a tele-thermometer, metallic thermometers and thermostats.

Among the curiosities of the exhibition were a bottle and a saucer fused together by lightning, and a piece of window glass which had been ground translucent by the sand-bearing winds of Cape Cod.

Professor Abbe sent his printed weather bulletins, first issued in September, 1869, at the Cincinnati Observatory. Soon after commencing, telegraphic reports were received from fifteen stations, and on October 6, predictions for Cincinnati and vicinity were begun.

Owing to the generous response to the circular requesting the loan of articles, particularly by the U.S. Signal Service, the exhibition was a success, and was so well attended by visitors that it was continued three days longer than was originally intended. Now that the feasibility of such an exhibition has been demonstrated, it is to be hoped that others will follow, as there can be no doubt of their effect in stimulating the study of meteorology.

THE THUNDERSTORMS OF MAY AND JUNE.

THE Royal Meteorological Society will have its hands full. It has been inviting information respecting thunderstorms, and has come upon a year in which they seem to be exceptionally numerous and destructive. It would be waste of labour, of time, and of money, for us to deal fully with the mass of material with which we have been favoured; it is far better to give here only some brief notes, and to pass on the information *in extenso* to the Thunderstorm Committee of the Royal Meteorological Society, who are the proper persons to deal with it.

MAY 23RD.

Hampstead.—Sharp TS in afternoon, with H as large as marbles; .68 in. of R, and one or two accidents by L.—B. WOODD SMITH.

Hadham House, Upper Clapton.—Very large H; 12 weighed exactly 12 grammes (185 grains), but they were not dense, and therefore out of the hundreds of square feet of glass in my garden not one pane was broken. Between 3.22 and 4.2 p.m. excessive R, during which 40 minutes nearly 2 inches fell, as there was only moderate R from 4.2 to 5.30, at which time 2.07 inches was measured.—J. PARNELL.

Warwick Road, Upper Clapton.—R during TS quite phenomenal = 2.65 in.—W. HAYWARD.

Enfield.—Violent TS, 1.15 p.m. to 4 p.m.; H 1 inch long; R 2.10 in.; tree struck close to house.—T. PAULIN.

Tottenham.—TS 3.15 to 5.15 p.m., with large H, and 1.45 in. of R in the 2 hours.—J. E. WORTH.

TSS and damage by L and by local floods in *Northampton, Rutland, and Lincoln*. *Barrowden* Church spire seriously damaged.

Walton, Wakefield.—TS between 1 and 2 p.m., yielding 1.15 in., the most in so short a time that I have registered during 14 years.—E. SIMPSON.

Doncaster.—TS in afternoon; house struck by L.

Normanton.—TS in afternoon; offices of the Local Board struck by L, also a house in *Altofts*.

N. Riding of Yorkshire.—Severe TSS, and much damage both by L and by H.

MAY 24TH.

Worcestershire.—Severe H storm. At *Martley* some H stones were 4 in. long; poultry and even one sheep killed. More than 24 hours afterwards H was measured $\frac{3}{4}$ in. in diameter. One farmer alone had 20 ducks and nearly as many chickens killed by the H. Cattle also killed by L and trees struck. As regards the H, it is said not to have been equalled since 1852, prior to which there were great H storms in 1830 and 1811.

Uppingham.—Sharp TS with H. Between 5.0 and 5.23 p.m., .51 in. fell, and of that probably .34 in. fell in the first nine minutes.—G. H. MULLINS.

Derbyshire.—TS and much damage done; one man killed.

Queensbury, Bradford.—Woman killed by L.

MAY 29TH.

Buildings struck at *Liverpool, Preston*, and other places in *Lancashire*. Hail up to $1\frac{1}{2}$ in. in diameter; local floods, and a whirlwind near *Frodsham, Cheshire*.

JUNE 2ND.

Meltham, Yorks.—Three TSS, one 7 to 7 $\frac{1}{2}$ a.m., another 8.50 to 9.20 a.m., and the third 2.35 to 5 p.m. During the last some exceptionally large H fell. One stone was measured $1\frac{1}{8}$ by $1\frac{1}{8}$ by $\frac{1}{2}$; 29 stones, when melted, gave 0.30 in. in an 8 in. rain gauge glass, so that each stone must have contained nearly half a cubic inch of water. Most of them had opaque centres and a coating of clear ice, but one was, and probably more were, composed of four layers, the kernel being opaque, then a layer of clear ice, then more opaque ice, and finally a clear ice coating. There was only one fall of these large ones, it lasted less than a minute, and they fell at an average distance of about three yards one from another.—C. L. BROOK.

Allendale, Northumberland.—Two houses struck by L.

Pawston, Cornhill-on-Tweed.—Very severe TS about noon; H $1\frac{1}{2}$ in. in diameter, and .62 in. of R in 20 minutes (time carefully noted).—B. P. SELBY.

Berwick-on-Tweed.—11 a.m. to 1 p.m. heavy TS with much H in many towns and villages. Much conservatory glass broken; at *Allanbank, Allanton*, over 1,000 panes were broken. The H was

frequently more than one inch long, perhaps $1\frac{1}{4} \times 1 \times \frac{1}{2}$, but it is often reported as 5 inches in circumference, which would give $1\frac{1}{2}$ in. in diameter.

JUNE 6TH.

Langton Herring, Dorset.—The most terrific TS for 28 years, began in evening of 6th and lasted till 6.30 a.m. of 7th. R = 1.89 in. A house damaged and a cow killed.—C. H. GOSSET.

Bishop's Cannings, Devizes.—Heavy TS, and six cottages burnt down.—C. W. HONY.

Camden Square.—Grand TS between 9 and 11 p.m.; L finer than I have seen since 1858. There were several separate centres of storm, mostly working from S. to N. No H of importance fell here, and the R was not exceptional, total 0.52 in.—G. J. SYMONS.

Northwood Road, Highgate.—The most glorious TS I ever saw. Heavy R, total 1.03 in., but the special feature was the beauty and frequency of the L. About 9.20 p.m. I began to count the displays, and, from a rough calculation, made the number up to that time 100; from then to 11.10 p.m. I counted 1,144 distinct displays, giving a total of 1,244 in two hours. Some of the flashes lasted perceptibly longer than others—in fact, one lasted while I counted up to ten.—H. SOWERBY WALLIS.

JUNE 7TH.

Rusper, Horsham.—Sharp TS between 1 and 2.30 p.m. In $1\frac{1}{4}$ hours 2.20 in. of R fell at Rusper Rectory, and in 30 minutes at Rusper House 0.86 in. was measured.—A. F. PARBURY.

Tunbridge Wells.—Sharp TS at 4 p.m., with H, which varied much in size in different parts of the town, but in Garden-road was as large as pigeon's eggs, and one stone was measured in Pembury-road the next day $1\frac{1}{4}$ inches in diameter.—T. COBB, JUN.

Ipswich.—Violent TS about 3 a.m., with much H. Many thousand squares of glass broken; indeed, the loss is put at 100,000 panes. No very large sizes are mentioned, but as the H broke 21 oz., and even 26 oz. glass, it must have been large and hard. At the Corn Exchange two lights, made with glass $\frac{1}{4}$ inch thick, were smashed. The storm continued in parts of Essex and Suffolk until after noon.

EARTHQUAKE SHOCK, MAY 30TH, 1889.

A RATHER sharp shock of earthquake was felt on both sides of the English Channel about 8.20 p.m. on May 30th.

STRUCTURAL DAMAGE.

This is, as far as we have heard, confined to the following:—

Cherbourg.—The windows of several houses broken, a bell turret on the Cathedral thrown down, and the cornice of the doorway of the Church of the Holy Trinity thrown to the ground.

Portsmouth.—Part of the plaster of the ceiling of St. Michael's Church fell among the congregation, and one young woman had her arm injured.

LIMITS WITHIN WHICH IT WAS FELT.

From France we have no reports south of latitude 48° , and it was felt most in Normandy and in Brittany. Paris seems to have been near the south-eastern limit. It was sharp in the Channel Isles, and caused suspended objects, lamps, lustres, cranes, &c., to oscillate along the English coast from the Land's End to Eastbourne, but it did not extend far inland. But for an isolated record from Henwick, near Worcester, we should have fixed the northern limit at which it was perceived as being slightly to the north of a line drawn through Bristol and London. We have eight or nine reports from London, but the letters with which we close this article sufficiently indicate its character towards its N.E. limits.

The reported times are not so discordant as usual, though they range from 8.14 to 8.30. The Channel Islands returns are mostly 8.14 or 8.15, and this is vexatious, because they are nearly equally wrong, whether this is supposed to be local or Greenwich time. If local time, then the shock is reported from there at about 8.24, which is probably four minutes later than the real time, and 8.15 is probably five minutes too early.*

Our impression is that the centre of the shock was nearly under Cherbourg, and at 8.20 p.m., and that the vibration travelled outwards at about 90 miles a minute, reaching the watering places on the south coast about 8.21, London 8.21½, and Worcester between 8.22 and 8.23.

This satisfies most of the coast reports, agrees precisely with Mr. Sowerby Wallis's time for Highgate, and agrees within a fraction of a minute with the most distant observation, viz., that at Worcester.

SIR,—I think it may interest you to know that two slight lateral shocks of earthquake were distinctly felt here last evening at about half-past eight. They were observed by two members of my family, one upstairs and one down. They were also observed next door. We read in the newspapers to-day that there were shocks of earthquake at Guernsey last evening at about 8.15.—Yours truly,

LEWIN HILL.

22, Parliament Hill Road, Hampstead, May 31st, 1889.

SIR,—On the evening of Thursday last (May 30th), sitting reading in a room here, facing S.E., I felt a movement which I at first attributed to a distant train, but as it had more of an undulatory character and was not followed by the passage of a train, it occurred to me that it might be an earthquake and I carefully noted the time, 8 hours 21 min. 30 sec. p.m.

* We are sorry to discredit these Channel Islands reports, but when we state that the records for Jersey and for Sark, which are within a few miles, differ by *eleven minutes* (= 1,000 miles travel of shock), it will be apparent why we have had to leave them out. When will people learn to keep their clocks right, and to be precise in noting the time of phenomena?

I intended to check my watch by a standard clock the next day, but, under the pressure of other matters, overlooked it. I have, however, fairly good evidence that the above is within a minute of true Greenwich time.

During the rest of the evening I remained in the same chair, and amused myself by noticing the very different character of the shaking caused by passing trains.

The sensation appeared to be that of an undulation travelling from S.E. to N.W.—Yours obediently,

H. SOWERBY WALLIS.

25, Northwood Road, Highgate, June 4th, 1889.

SIR,—You may be expecting information about the earthquake shock on the South Coast, perceived on the evening of May 30th. The following is the mem. I have made :—

May 30th.—About 8.15 to 8.20 p.m., a distinct earth-tremor from west to east was felt here, lasting for a few seconds. Not perceived by anyone in my own house, but distinctly opposite ; also by invalids in bed and by children, who woke up frightened and startled, saying their bed was being lifted up off the ground beneath them ; by others that the walls seemed to sway to and fro, west to east, and that crockery jingled. I have not been able to find that any clocks stopped. The weather was fine ; sky quite clear ; wind S.E. ; barometer 29.92, had been falling *very slightly* from 1 p.m. to 8 p.m., rising a fraction from 8 p.m. to 8.30 p.m., then steady till midnight ; the max. temp. in the shade for the day was 58° 6.— Yours very truly,

W. J. HARRIS.

Church House, Heene, Worthing, June 1st, 1889.

A COLD PERIOD.

M. LANCASTER has a paper on this subject in the last number (No. 6, 1889) of *Ciel et Terre*, entitled "The Temperature in Europe, 1885 to 1888," to which we desire to call attention.

It may be remembered that in our March number we gave a table in which we compared the values for Greenwich, Paris, Brussels, and Toronto in each month of the last four years, with averages extending over long periods, and finally summed up by showing that the greatest deficiency of temperature was at Toronto in 1885, viz., $-2^{\circ} 6$, followed by Paris in 1887, $-2^{\circ} 1$, and Paris, 1888, $-1^{\circ} 9$, and that, on the mean of the four years for the four stations, the deficiency was about $0^{\circ} 8$ per annum, and we therefore said :—

"We do not think that it is necessary to pursue the subject further, as all these values are within the limits of variation of mean annual temperature."

M. Lancaster evidently does not think so, as he has devoted seven more pages of *Ciel et Terre* to it. We do not say that he was unwise in so doing, but we should like to show on what we relied in writing

the previous three lines. We found that at Greenwich the difference from the mean was, for the respective years :—

1886.	1886.	1887.	1888.	Mean for the four years.
0°·0	+0°·1	-0°·8	-1°·0	-0°·4

Then we turned to the useful and interesting diagram in Drew's *Practical Meteorology*, on which is plotted the mean temperature of every year from 1771 to 1853 at Greenwich, and we found such cases as the following* :—

* We have taken the Greenwich mean temp. at 49°·0; this is probably rather too low, but we prefer to take a value which cannot be impugned.—See *Quar. Jour., Roy. Met. Soc.*, vol. xiv., p. 34.

1784.	1785.	1786.	1787.	Mean.
-4°·0	-2°·6	-3°·2	-0°·9	-2°·7
1796.	1797.	1798.	1799.	
-1°·2	-1°·8	-0°·4	-3°·3	-1°·7
1813.	1814.	1815.	1816.	
-1°·8	3°·2	-0°·1	-2°·6	-1°·9
1837.	1838.	1839.	1840.	
-1°·7	-2°·6	-1°·3	-1°·2	-1°·7

Every one of these groups is more than four times as remarkable as the 1885—88 period, and that is why we thought that we had devoted sufficient time and attention to the matter.

On the other hand, meteorology is in many branches so much of a puzzle that no one can presume to dictate the path which will lead to the discovery of the key to the whole, and therefore we welcome the efforts which M. Lancaster has made, and we hope will continue, to track the conditions which have produced this recent cold period.

We can, of course, reproduce here only fragments from M. Lancaster's article, but we will endeavour to select such as will bring out the salient points :—

Nearest Similar Periods at Brussels.

Nov. 1841 to Oct. 1845, 48 months, 30 months below the mean; aver. defect	1°·3
Nov. 1846 to Oct. 1850, 48 „ 28 „ „ „ „ „	0°·7
Feb. 1853 to Jan. 1857, 48 „ 27 „ „ „ „ „	1°·1
Nov. 1884 to Oct. 1888, 48 „ 32 „ „ „ „ „	1°·4

Defects in 1885—88 in various parts of Europe.

	Lat.	Lon.	Months below mean.	Average defect. deg.
St. Martin de Hinx, Bayonne, France	43° 45' ...	1° 16' W.	37 ...	2·2
Perpignan, France	42 43 ...	2 53 E.	36 ...	1·8
Tarm, West Denmark	55 53 ...	8 31 E.	38 ...	1·8
Löningen, Oldenbourg	52 44 ...	7 44 E.	33 ...	1·6
Göttingen	51 32 ...	9 56 E.	33 ...	1·4
Madrid, Spain	40 25 ...	3 43 W.	34 ...	1·4
Brussels, Belgium	50 52 ...	4 21 E.	32 ...	1·4
Utrecht, Holland	52 5 ...	5 7 E.	32 ...	1·4
Shields, Northumberland, England	55 0 ...	1 27 W.	33 ...	1·3
Paris, France	48 50 ...	2 20 E.	29 ...	1·0
Stornoway, Lewis, Scotland	58 11 ...	6 22 W.	34 ...	0·9
Lisbon, Portugal	38 41 ...	9 10 W.	33 ...	0·7
Greenwich, England	51 28 ...	0 0	28 ...	0·4

Relative Intensity in Eastern and in Western Europe.

M. Lancaster proceeds to divide 22 records into two groups,

11 easterly and 11 westerly stations, and he finds that, at the westerly stations, the deficit was $1^{\circ}3$, and at the easterly only half as much, or $0^{\circ}7$; he states further that, at Genoa and Milan, there has been an excess, but he does not state the amount.

It seems to us that the above table shows such irregularities as prove that M. Lancaster has a heavy task before him, and this is corroborated by the consideration that, besides the most fruitful source of error—changed instruments, changed positions, and in many cases changed modes of computing the mean temperature—there is the fact of no two observatories quoting averages extending over precisely the same group of years. Probably the best plan would be to collect a very large number of reports, so that errors may be diminished by neutralization. Certainly cases of excess should be reported as carefully as those of defect, because it is quite likely that in them may be found the explanation of the persistent cold.

ROYAL METEOROLOGICAL SOCIETY.

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

Mr. T. H. Hall was elected a Fellow of the Society.

The following papers were read:—

1. "Account of some experiments made to investigate the connection between the Pressure and Velocity of the Wind," by Mr. W. H. Dines, B.A., F.R.Met.Soc. These experiments were made for the purpose of determining the relation between the velocity of the wind and the pressure it exerts upon obstacles of various kinds exposed to it. The pressure plates were placed at the end of the long arm of a whirling machine, which was rotated by steam power. The author gives the results of experiments with about 25 pressure plates, all differing in shape or size. The pressure upon a plane area of fairly compact form is about $1\frac{1}{2}$ lbs. per square foot for a velocity of 21 miles per hour; or, in other words, a pressure of 1 lb. per square foot is caused by a wind of a little more than 17 miles per hour.* The pressure upon the same area is increased by increasing the perimeter. The pressure upon a $\frac{1}{4}$ ft. plate is proportionally less than that upon a plate either half or double its size. The pressure upon any surface is but slightly altered by a cone or rim, projecting at the back, a cone seeming to cause a slight increase, but a rim having apparently no effect.

2. "On an improved method of preparing Ozone papers, and other

* This is the most satisfactory statement that we have seen respecting anemometry for a long time. As far back as 1860 Col. Sir H. James, R.E., F.R.S., gave 14.1 miles as the equivalent of 1 lb., and in 1861 Mr. Harvey Simmonds gave it as 14.8 miles. Hence all authorities seem to agree that when the wind exerts a pressure of 1 lb. on a square foot it is moving with a velocity of between 14 and 17 miles an hour.—ED.

forms of the test, with starch and potassium iodide," by Dr. C. H. Blackley, F.R.Met.Soc. Some years ago the author made some experiments with the ordinary ozone test papers, but found that the papers did not always give the same result when two or more were exposed under precisely the same conditions. He subsequently tried what re-action would take place between unboiled starch and potassium iodide when exposed to the influence of ozone; but the difficulty of getting this spread evenly upon paper by hand, so as to ensure a perfectly even tint after being acted upon by ozone, led him to devise a new method of accomplishing this. Briefly described, it may be said to be a method by which the starch is deposited upon the surface of the paper by precipitation, and for delicacy, and precision in regulating the quantity on any given surface, it leaves very little to be desired.

3. "Notes on the Climate of Akassa, Niger Territory," by Mr. F. Russell, F.R.G.S. This paper gives the results of observations made from February, 1887, to October, 1888, at Akassa, which is the seaport and principal dépôt of the Royal Niger Company, and is situated at the mouth of the River Nun in the Niger Delta.

4. "Wind Storm at Sydney, New South Wales, on January 29th, 1889," by Mr. H. C. Russell, F.R.S.

WATERSPOUT IN DORSET, JUNE 7TH.

A correspondent of *The Times* at Yeovil, telegraphing on the 9th inst., says :—

"A great disaster befell a rural district of Dorsetshire on Friday evening last. During the afternoon thunder and lightning had been incessant, but very little rain had fallen. About six o'clock in the evening great waves of water from eight to ten feet high rolled down the Batcombe hills upon the little village of Chetnole. What is ordinarily a small brook supplying a millstream became a powerful torrent, and spread alarm among the inhabitants. At Hannaford Mill great damage was done, and stock of all kinds were drowned. At Chetnole Mills the devastation was very great. The torrent brought with it large trees which it had uprooted. Everything that stood in its path was swept away. Men who were working at the mill engines had only just time to rush out of the building before the water reached the top of the first floor. Several school children were rescued by Major Digby. The damage to property is estimated at several thousand pounds. The villages of Cerne and Mintern also suffered greatly, and miles of road were washed away. Several cottagers had all their furniture carried away. The cause of the remarkable occurrence was for some time unknown. It has now been ascertained that a waterspout burst on Batcombe-hill. An eye-witness described it as a solid stream of water of about the thickness of a man's body. It tore up the ground to a considerable depth, and forced a channel for its escape down the hillside."

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOVEMBER, 1888.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
°		°		°	°	°	0-100	°	°	inches	0-10		
England, London	59·9	16	34·6	28	51·0	43·3	43·3	87	78·9	28·2	4·38	20	7·9
Malta	77·6	2	49·1	23	69·0	57·2	53·0	75	126·3	43·8	·74	7	4·4
<i>Cape of Good Hope.</i> ...	81·8	13	48·0	4	67·8	53·5	...	...	...	...	1·42	8	...
<i>Mauritius</i>	84·6	23	67·0	16	82·1	70·1	65·1	71	138·1	59·1	1·25	15	6·1
Calcutta	86·7	1	58·3	19	80·9	65·5	64·4	68	148·5	49·4	3·13	2	4·2
Bombay	95·6	2	70·0	21	88·2	75·4	70·9	70	144·6	58·1	1·16	7	3·3
Ceylon, Colombo	88·7	...	71·8	...	86·8	73·8	72·5	81	151·0	68·2	14·19	21	6·2
<i>Melbourne</i>	102·0	23	38·1	1	74·1	51·8	49·4	64	145·9	28·4	·62	6	4·8
<i>Adelaide</i>	105·8	23	46·4	11	83·4	59·4	49·3	45	156·8	39·4	·66	8	3·5
<i>Wellington</i>	66·5	19	39·0	2, 25	60·8	46·4	44·9	72	138·0	33·0	7·10	20	4·4
<i>Auckland</i>	71·0	17a	45·0	10, 25	63·3	50·3	47·4	70	135·0	36·0	3·63	22	6·0
Jamaica, Kingston	94·3	13	63·7	27	91·3	70·2	70·7	74	...	...	·07	...	...
Barbados .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	62·0	1	14·1	23	43·9	31·3	33·6	80	...	9·0	3·10	19	7·6
New Brunswick, Fredericton	60·7	2	—0·5	23	39·7	23·6	30·7	80	...	...	6·47	15	6·0
Manitoba, Winnipeg ...	46·7	12	—4·0	19	32·5	16·6	21·2	85	...	...	·50	11	6·1
British Columbia, Victoria	55·0	1	25·0	16	47·5	37·9	...	...	...	...	2·69	16	...

a And 18.

REMARKS, NOVEMBER, 1888.

MALTA.—Mean temp. 61°·8; mean hourly velocity of wind 10·7 miles. Sea temp. fell from 69°·0 to 64°·8. TS on 19th; L on 22nd and 23rd; H on 23rd. R 3·39 in. below average. J. SCOLES.

Mauritius.—Mean temp. of air 1°·6 above, of dew point 1°·5 above, and R ·56 in. below their respective averages. Mean hourly velocity of wind 10·5 miles, or 0·8 below average; extremes 28·2 on 11th and 2·2 on 1st and 9th. Prevailing direction, E. by N. T on 7th, L on 18th, and T and L on 19th. Fine solar halos on 10th and 16th. Floods in the southern part of the island on 19th. C. MELDRUM, F.R.S.

COLOMBO.—TSS on 17 days and L on one other day. J. C. H. CLARK.

Melbourne.—Mean temp. of air 2°·5 and of dew point 0°·9 above the average; humidity 3, mean amount of cloud 1, and R 1·92 in. below the average. Prevailing winds S. and S.W.; stormy on 13 days. Distant T on 2nd and 27th; T and L on the 9th; L on the 2nd and 3rd. R. L. J. ELLERY, F.R.S.

Adelaide.—The hottest November on record. Mean temp. nearly 5° above the average of 32 years. R two-thirds of the average. Drought general over the whole colony. C. TODD, F.R.S.

Wellington.—Unpleasant and showery weather almost throughout. Strong S.E. wind on the 9th, 10th, and 11th; cold and stormy from 13th to 16th. Prevailing wind N.W. T on 20th; H on 1st and 23rd. Mean temp. 2°·9 below and R 2·93 in. above average. R. B. GORE.

Auckland.—Unusually cold, stormy, and showery. Mean temp. 4° below the average, and the lowest recorded for November. R ·75 in. above the average; pressure considerably below it. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
MAY, 1889.

[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 Hall.	4·03	XI.	Castle Malgwyn	2·60
„	Margate, Birchington...	2·02	„	Rhayader, Nantgwillt..	4·10
„	Littlehampton	2·28	„	Carno, Tybrith ...	3·91
„	Hailsham	1·43	„	Corwen, Rhug	3·89
„	Ryde, Thornbrough	2·03	„	Port Madoc	2·27
„	Alton, Ashdell	3·51	„	I. of Man, Douglas	2·67
III.	Oxford, Magdalen Col...	2·91	XII.	Stoneykirk, Ardwell Ho.	3·37
„	Banbury, Bloxham	3·81	„	New Galloway, Glenlee	4·37
„	Northampton	3·34	„	Melrose, Abbey Gate...	2·08
„	Cambridge, Beech Ho...	3·92	XIII.	N. Esk Res. [Penicuik]	2·45
„	Wisbech, Bank House..	3·65	XIV.	Ballantrae, Glendrisaig	3·42
IV.	Southend	2·40	„	Glasgow, Queen's Park.	3·19
„	Harlow, Sheering ...	3·89	XV.	Islay, Gruinart School..	2·12
„	Rendlesham Hall	2·47	XVI.	Dollar	2·60
„	Diss	2·87	„	St. Andrews, PilmourCot	1·59
„	Swaffham	2·72	„	Balquhider, Stronvar..	5·02
V.	Salisbury, Alderbury...	2·03	„	Dunkeld, Inver Braan..	3·20
„	Warminster .....	...	„	Dalnaspidal H.R.S. ...	3·49
„	Bishop's Cannings	1·98	XVII.	Keith H.R.S.	·32
„	Ashburton, Holne Vic...	3·10	„	Forres H.R.S.	·45
„	Hatherleigh, Winsford.	3·07	XVIII.	Strome Ferry H.R.S....	2·19
„	Lymouth, Glenthorne.	3·53	„	Fearn, Lower Pitkerrie.	·66
„	Probus, Lamellyn	3·88	„	Loch Shiel, Glenaladale	3·74
„	Launceston, S. Petherwin	3·31	„	N. Uist. Loch Maddy ...	2·40
„	Wincanton, Stowell Rec.	2·32	„	Invergarry	1·39
„	Taunton, Lydeard Ho...	...	„	Loch Ness, Drumnadrochit	1·20
„	Wells, Westbury	4·07	XIX.	Lairg H.R.S.	·40
VI.	Bristol, Clifton	2·69	„	Forsinard H.R.S. ....	...
„	Ross	3·81	„	Watten H.R.S.	·47
„	Wem, Clive Vicarage ...	3·15	XX.	Dunmanway, Coolkelure	4·79
„	Cheadle, The Heath Ho.	3·64	„	Fermoy, Gas Works ...	3·42
„	Worcester, Diglis Lock	2·93	„	Tipperary, Henry Street	3·75
„	Coventry, Coundon	3·42	„	Limerick, Kilcornan ...	1·63
VII.	Ketton Hall [Stamford]	6·14	„	Miltown Malbay	4·80
„	Grantham, Stainby	4·71	XXI.	Gorey, Courtown House	3·07
„	Horncastle, Bucknall ...	3·77	„	Navan, Balrath	2·07
„	Mansfield, St. John's St.	3·77	„	Mullingar, Belvedere ...	2·69
VIII.	Neston, Hinderton	2·31	„	Athlone, Twyford	3·43
„	Knutsford, Heathside ...	2·66	„	Longford, Currygrane...	3·84
„	Lancaster, South Road.	4·10	XXII.	Galway, Queen's Coll...	4·41
„	Broughton-in-Furness ..	4·34	„	Clifden, Kylemore	7·91
IX.	Wakefield Prison	3·98	„	Crossmolina, Enniscoe..	4·97
„	Ripon, Mickley	2·62	„	Collooney, Markree Obs.	4·76
„	Scarborough, WestBank	2·41	„	Ballinamore, Lawderdale	...
„	EastLayton[Darlington]	2·05	XXIII.	Warrenpoint	3·90
„	Middleton, Mickleton..	1·48	„	Seaforde	3·33
„	Haltwhistle, Unthank..	1·38	„	Belfast, New Barnsley..	1·89
X.	Shap, Copy Hill	2·85	„	Bushmills, Dundarave...	2·48
XI.	Llanfrechfa Grange	3·76	„	Stewartstown	3·50
„	Llandovery	3·91	„	Buncrana	4·13

MAY, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which .01 or more fell.	TEMPERATURE				No. of Nights below 32°		
		Total Fall.	Difference from average. 1870-9	Greatest Fall in 24 hours.		Max		Min.		In shade.	On grass.			
				Dpth.	Date.			Deg.	Date.				Deg.	Date.
		inches	inches.	in.			Deg.	Date.	Deg.	Date.				
I.	London (Camden Square)	3.22	+ 1.30	1.08	26	14	81.2	24	42.7	2	0	0		
II.	Maidstone (Hunton Court)....	1.32	— .70	.37	9	11	...	...	...	...	...	...
III.	Strathfield Turgiss	3.36	+ 1.68	1.70	26	20	79.2	23	40.3	2	0	0		
III.	Hitchin	4.33	+ 2.34	1.37	11	19	77.0	24	40.0	2	0	...		
IV.	Winslow (Addington)	3.34	+ 1.11	1.12	26	15	80.0	23a	39.0	2	0	0		
IV.	Bury St. Edmunds (Culford) ..	...	...	...	...	...	...	...	...	...	...	...
V.	Norwich (Cossey)	3.15	+ 1.34	.90	10	9	79.0	24	...	...	...	...
V.	Weymouth (Langton Herring) ..	1.24	...	.39	8	11	73.0	24	43.0	1, 11	0	...
"	Barnstaple	3.43	+ 1.33	.70	16	17	70.0	23	35.0	11	0	...		
"	Bodmin	4.35	+ 1.51	.85	8	19	68.0	22	40.0	2	0	0		
VI.	Stroud (Upfield)	3.11	+ .81	.74	24	14	79.0	22	40.0	11	0	...		
"	Church Stretton (Woolstaston) ..	3.24	+ .85	.54	11	16	75.0	22	36.5	2	0	1		
"	Tenbury (Orleton)	3.19	+ .76	.74	24	17	78.2	22	35.0	2	0	0		
VII.	Leicester (Barkby)	3.69	+ 1.81	.90	26	18	84.0	24	35.0	1	0	0		
"	Boston	3.16	+ 1.39	.82	10	14	85.0	22	37.0	3	0	...		
"	Hesley Hall [Tickhill]	3.71	...	.76	10	16	80.0	22	38.0	3	0	...
VIII.	Manchester (Ardwick)	2.31	+ .08	.65	11	13	75.0	22	42.0	1	0	...		
IX.	Wetherby (Ribston Hall) ..	2.95	+ 1.13	1.14	11	10	...	...	...	...	...	...
"	Skipton (Arncliffe) ..	2.95	— .17	.72	10	13	81.0	22	45.0	10	0	...		
"	Hull (People's Park)	2.95	+ 1.07	.64	10	13	...	...	...	...	...	...
X.	North Shields	1.48	— .37	.40	27	16	75.0	22	39.2	15	0	0		
"	Borrowdale (Seathwaite)	5.79	+ 1.19	1.32	30	18	...	...	...	...	...	...
XI.	Cardiff (Ely)	2.86	+ .26	.70	31	17	...	...	...	...	...	...
"	Haverfordwest	3.39	+ .70	.83	17	15	70.1	21	36.0	14	0	2		
"	Plinlimmon (Cwmsymlog) ..	3.48	...	.65	29	12	...	...	...	...	...	...
"	Llandudno	2.53	+ .91	.47	16	15	68.2	21	40.5	2	0	...		
XII.	Cargen [Dumfries]	3.33	+ .80	.68	10	15	76.4	21	39.0	27	0	...		
"	Jedburgh (Sunnyside)	1.55	— .24	.34	27	10	77.0	21	39.0	30	0	...		
XIV.	Old Cumnock	2.56	+ .16	.45	10	15	81.5	21	34.0	26	0	...		
XV.	Lochgilhead (Kilmory)	3.04	+ .28	.65	29	18	...	...	...	...	...	...
"	Oban (Craigvarren)	2.81	...	.75	7	18	71.5	6	41.9	25	0	...
"	Mull (Quinish)	2.52	...	.40	7	18	...	...	...	...	...	...
XVI.	Loch Leven Sluices	3.10	+ .81	.80	15	11	...	...	...	...	...	...
"	Dundee (Eastern Necropolis) ..	1.45	— .49	.40	28	12	75.3	22	40.6	3	0	...		
XVII.	Braemar	1.30	— 1.12	.48	14	9	71.0	6b	36.4	13	0	7		
"	Aberdeen (Cranford) ..	1.18	...	.26	31	10	71.0	22c	39.0	26	0	...
XVIII.	Lochbroom	1.10	...	.24	7	10	...	...	...	...	...	...
"	Culloden .....	.72	— 1.06	...	...	...	73.0	7d	41.0	26	0	0
XIX.	Dunrobin .....	.83	...	.32	29	6	68.8	21	40.0	1	0	...
"	S. Ronaldsay (Roeberry) .....	.66	— .84	.22	1	7	69.0	22	41.0	18	0	...	
XX.	Cork (Blackrock)	4.72	+ 2.56	.80	2	16	70.0	27	40.0	12f	0	...		
"	Dromore Castle	4.80	...	.62	2	21	69.0	27	34.0	6	0	...
"	Waterford (Brook Lodge) ..	3.32	...	.62	5	16	68.0	27	38.0	25g	0	...
"	O'Brien's bridge (Ross)	2.32	...	.29	29	18	72.0	22e	42.0	1	0	...
XXI.	Carlow (Browne's Hill)	2.58	+ .46	.64	5	16	...	...	...	...	...	...
"	Dublin (Fitz William Square) ..	2.13	+ .41	.51	5	17	72.5	21	40.8	11	0	1		
XXII.	Ballinasloe	3.59	+ 1.18	.41	29	22	68.0	20	32.0	7	1	...		
XXIII.	Waringstown	2.35	+ .24	.39	12	15	79.0	20	39.0	1h	0	0		
"	Londonderry (Creggan Res.) ..	...	...	...	...	...	...	...	...	...	...	...
"	Omagh (Edenfel)	3.62	+ 1.27	.94	5	18	70.0	21	35.0	24	0	...		

a And 24. b And 21. c And 23. d And 21, 22. e And 23. f And 14. g And 27. h And 26, 30.
 + Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON MAY, 1889.

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 weather was very unsettled at the beginning of the month, but was relieved by a few spring-like days of sunshine. R storms were frequent, and the temp. varied considerably; from 21st to 25th very hot, the close of the month cool and showery. TSS on 9th and 17th. Wild, strawberry in flower and oak in leaf on 11th.

HITCHIN.—The hottest May in 40 years' record, and the wettest but two.

WINSLOW, ADDINGTON.—A very favourable month, vegetation making rapid progress. No frost, not even on grass; the temp. rose to 80 twice, having reached that point only once before in May since 1871. There were two falls of R exceeding an inch, which caused very large floods, that on the 26th doing an immense deal of damage to the hay crop.

WEYMOUTH, LANGTON HERRING.—The R for the five months of this year is only 62 per cent. of the average, and less than in the corresponding period of any of the 13 previous years. Mean temp. at 9 a.m. for May $57^{\circ}3$, the highest in May during 18 years, and $3^{\circ}7$ above the average. The max. in shade on 24th has only once been exceeded in May in 17 years. Solar halos on 4th, 8th, and 12th. Slight TSS on 6th and 11th.

BODMIN.—On the whole a cold May, but a very bright enjoyable month.

UPFIELD, STROUD.—TSS on 5th and 24th; L on 6th, 17th, 23rd and 30th. On 24th, 26 in. of R fell within 15 minutes, and the TS was preceded by a great gust of wind, which blew down two or three trees.

WOOLSTASTON.—A warm genial month, very favourable for the hay crop, which promises to be heavy. Violent storms of T and L on 5th, 7th and 9th. Mean temp. $54^{\circ}8$.

ORLETON.—The temp. and the weather were variable, with frequent TSS, followed by many cloudy and gloomy days. From 19th to 25th the weather was unusually bright and hot. Mean temp. nearly 2° above the average of 28 years. Fluctuations of pressure slight. TSS on 4 days and T on 7 days. The storm of the 24th was accompanied by large and destructive H. Cherry trees in full bloom about the 3rd, and apple trees about the 20th.

HULL.—With the exception of the 10th and 11th, the weather up to the 23rd was generally fine; from that date to the end of the month it rained more or less every day, often with T, and a heavy fall of H on 30th.

NORTH SHEILDS.—TSS on 4 days and T on 4 other days.

WALES.

HAVERFORDWEST.—The most genial May for many years, with an entire absence of frost in air, though white frosts occurred on the 10th and 14th. The oak was in leaf on the 15th and the ash had almost bare branches at the end of the month; no such disparity can be remembered. The R, though scarcely the average, was so distributed over the month as to secure, with the genial warmth, abundance of grass. Barley sowing late. Every description of tree in leaf exceptionally early, and if nothing unforeseen occurs there is every promise of a beautiful summer.

SCOTLAND.

CARGEN.—A remarkably fine and warm month, the warmest recorded during 30 years. Mean temp. $54^{\circ}5$, or $3^{\circ}6$ above the average. Sunshine 243 hours, or 23 hours above the average; the last week of the month was considerably cooler than the first 23 days. Vegetation made unusual progress, and corn, hay, and pastures never looked better at this season. All flowering trees and shrubs in bloom three weeks earlier than usual. E. and S.E. winds prevailed for 17 days.

JEDBURGH.—The weather during the month was remarkably fine ; the temp. was high and the result was a rush of vegetation that has not been equalled in May for a long series of years. All crops alike in garden and field look well and are far advanced.

CRAIGVARREN, OBAN.—A decidedly warm month, very free from E. winds and of equable temperature. R moderate ; growth making great progress, grass and foliage in particular both forward and abundant in quantity. Slight T on the 7th ; sheet L on the 14th.

QUINISH, MULL.—A warm dripping month, most favourable to growth. This spring season is the earliest and best that has been known for the last 25 years, being distinctly better than the remarkable one of 1878.

BRAEMAR.—The finest May on record, foliage and vegetation looking remarkably well and three weeks in advance of former seasons. Mean temp. 51°·7.

ABERDEEN.—The finest May experienced here for a great number of years.

LOCHBROOM.—The month in every respect could not be excelled so far as outdoor work is concerned, but followers of Walton complain. TS on 7th.

CULLODEN, INVERNESS.—The month was finer in all respects than any May for more than 20 years. E. winds and damaging frosts were entirely absent. R very small, but there were heavy dews at night and the growth of grass was constant, and the same can be said of corn crops and vegetation generally.

S. RONALDSAY, ROEBERRY.—The driest May since 1876.

IRELAND.

CORK.—On the whole a very propitious month, although the wettest May during 24 years, except 1869 and 1878. Mean temp. about the average. Total R to the end of May 15·93 in., which is 4·44 in. less than the average of 24 years.

WATERFORD.—R 1·01 in. above the average.

ROSS, O'BRIENSBRIDGE.—Excellent vegetation during the month. Frequently very warm and bright, with heavy dews and sufficient R. Mean temp. above the average of 10 years.

DUBLIN.—A very favourable month, singularly free from parching E. winds, with a high mean temp. and genial R. Atmosphere generally quiet and no gales. Solar halos on 16th and 20th. Foggy on 9 days, high winds on 5 days : H on 31st. The mean min. on grass was 42°·4, compared with 37°·5 in May, 1888, and 37°·9 in May, 1887.

BALLINASLOE.—Wet, windy, and cold. TSS on 14th and 23rd.

FLOODS IN AUSTRALIA.

EXTRACT from a letter written by R. Humphrey Marten, M.B. Camb., of Adelaide, South Australia :—

“ April 22nd, 1889.

“ I wrote you on Jannary 1st, saying our fearful drought had broken up, and it continues to break, and people say they can now believe in the history of Noah and the ark.

“ It began to rain on Sunday last, and continued in one steady downpour till Wednesday evening. In some places as much as 8½ inches fell in 24 hours, and the average throughout the colonies was over an inch in 24 hours. The floods came down our usually dry rivers in tremendous torrents, sweeping everything before them—man, beast, produce, bridges, all swept away—and even in our city the floods reached a dangerous height. We have a dam to uphold a lake in the river which flows through the city, and although the dam stood, it was rendered useless by the floods boring out a new course for the river. The oldest settlers never remember such rains, and everyone is jubilant about the glorious seasons it will lead to. All the dams and tanks throughout the country are full, and lakes have appeared inland where no such things were ever dreamt of.”

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

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THE PARIS EXHIBITION AND ITS CONGRESSES.

IN 1878 we were able to begin our articles descriptive of the Paris Exhibition in our May number, but it would not have been wise to do so this year, owing to the backwardness of the exhibitors. Our notice of the exhibits, and of the utilization of the Eiffel Tower, must now stand over until the autumn. Meanwhile our French friends are very desirous that the Congresses, of which they have arranged a multitude, should be largely attended.

There are two which chiefly concern meteorologists—and, rather inconveniently, they are not consecutive—so that visitors must either make two journeys, give up one of the two Congresses, or remain in France from September 19th to October 10th, or 20th, if they stop for the excursion to the Thermal establishments in the Vosges.

The precise dates are :—

Meteorology, September 19th to 26th.

Hydrology and Climatology, October 3rd to 10th.

Excursion to health resorts, October 11th to 20th.

METEOROLOGY.

Members will consist of all persons interested in the science, and who send 12 francs to the President of the Congress, M. Renou, 7, Rue des Grands Augustins, Paris.

They will receive a card of admission to all the meetings during the week, and to the excursion, and a copy of the report of the papers read, and of the discussions upon them.

The programme of subjects to be discussed is quite alarming. Some persons might be tempted to say that it includes all branches of meteorology. It does not, but it certainly gives a remarkable proof of the development of this branch of science, and on that account we translate it *in extenso*.

Pressure.—On the reduction of barometer readings to sea level pressures. Verification of the relations between the barometric gradient and the velocity of the wind. Difference between the effects of equal gradients in summer and in winter.

Temperature.—Comparison between the temperature indicated on various thermometer stands and that shown by the *thermomètre fronde*. Decrease of temperature with altitude. Distribution of solar heat over the globe. Secular change of climate.

Wind.—Choice and graduation of anemometers. Results of recent measures of the vertical component of the wind.

Vapour.—Measure of the water in a liquid state suspended in the atmosphere. Accurate measure of evaporation from different surfaces.

Clouds.—Progress made in various countries in the observation of cirrus. Measurement of altitude of clouds. Cloud photography. Classification. Definition of nimbus.

Precipitation.—What progress has been made in the measurement of very slight rains, and of dew. Rainfall at sea. Study of floods, and of warnings against them, in various countries.

Influence of cosmic phenomena.—Lunar and solar atmospheric tides. Influence of sunspots on meteorological phenomena. Lunar influences.

Weather forecasting.—Researches destined to improve it.

Various.—Measure of the intensity of solar radiation. Actinometry. Polarisation of the atmosphere. Transparency of the atmosphere for various rays of the spectrum. Scintillation of the stars. Optical phenomena.

Magnetism.—Relation between magnetic phenomena and earthquakes. Magnetic disturbances and sunspots. Study of earth currents. Magnetic observations at sea.

Electricity.—Modes of observing atmospheric electricity. Relations between electricity and other meteorological phenomena. Aurora.

Storms.—Recent progress in the study of. Barometric oscillations during.

Applications of Meteorology.—Relation between meteorological phenomena and phenological phenomena. The migration of birds and appearance of insects. Application of meteorology to agriculture and to hygiene.

Our verdict upon this programme is, that if it be carried out, the members will have to be carried out also, and will certainly have to spend the interval between it and the Hydrological Congress on October 3rd, under medical care. In fact, it will be only the trip to the Vosges, October 11th to 20th, which will restore them to mental equilibrium. The programme cannot be fully carried out, but it is useful as indicating the field outside of which the discussions must not wander.

HYDROLOGY AND CLIMATOLOGY.

THIS is the second meeting of the Congress, of which the first was held at Biarritz in October, 1886. We yield to no one in our esteem for M. Renou, the director of the Parc St. Maur Observa-

tory, but we cannot help thinking that somebody has imposed too much on his good nature, in asking him this year to preside over this congress as well as over that upon meteorology. Of the Meteorological one, he, as President of the Meteorological Society, could hardly refuse the Presidency, but we cannot help thinking that it is, as we say, "working the willing horse too hard" to have thrown the Hydrological Congress also upon him.

The general arrangements are much the same as for the Meteorological Congress, except that members have to send 20 francs instead of 12, and that the 20 francs has to be sent to M. Doin, 8, Place de l'Odéon, Paris, and that it is proposed to circulate *in advance* printed copies of the papers to be discussed.

The programme of subjects for discussion is very much shorter than that for the Meteorological Congress; it is divided into three sections, of which we omit the one dealing with Medical Hydrology.

Scientific Hydrology.

1. Precautions necessary for determining accurately the temperature of thermal springs.
2. Relations between mineral waters and geological formations.
3. On micro-organisms in mineral waters, and their influence on the composition and properties of those waters.
4. On the influence of theories as to microbes on thermal therapeutics.
5. On the origin of the gas contained in mineral waters, and on the share which it has in their properties.
6. On the vapours escaping from mineral waters, and on their transformations.
7. Programme of instruction in Hydrology.

Climatology.

1. Conditions which should govern the establishment of a Meteorological Observatory established chiefly for medical purposes.
2. Organization for announcing coming weather at health resorts; rules for weather forecasting.
3. Climatology of various health resorts.
4. Comparison and classification of health resorts according to their climate.
5. On the action of mountain climates on affections of the lungs.
6. On the action of maritime climates in tubercular affections.
7. Programme of instruction in Climatology.

The general meetings will be at the Trocadéro, the sectional ones at the Faculté de Médecine; the latter will usually last from 9 a.m. till noon, and from 2 till 5 p.m.; during the week there will be an excursion to Pierrefonds and Compiègne, and two others, one to Enghein and the other to the Observatory at Parc St. Maur.

On October 11th will commence an excursion of nine days in the Vosges, starting from Nancy, and visiting, among other places,

Plombières, Luxeuil, Contrexéville and Bourbonne-les-bains. As was the case with the excursion to the Pyrenees, the railway companies will allow members to travel at half-price.

We ought not to omit to state that, as regards this congress and excursion, it is expressly stated that ladies can qualify as members by the same payment as gentlemen, and will enjoy similar rights and privileges.

THE DORSETSHIRE WATERSPOUT OF JUNE 7TH.

Thanks to the Rev. H. J. Poole, of Stowell Rectory, Somerset, who has visited the district, photographed some of the damage, and favoured us with copies, and with notes of what he saw, we are able to add considerably to the note on page 75 of our last number and to give a compact account of what occurred.

In Dorsetshire, 15 miles North of Weymouth, and 12 miles inland from the English Channel, near Bridport, is the small town of Cerne Abbas, which is to be found on almost every map. About two miles N. of Cerne Abbas there is a range of hills running generally W.-E., and from the Northern slope of these hills several small streams flow, which eventually form the river Yeo, which passes Yeo-vil, joins the Parrett, and finally discharges into the Bristol Channel. The highest point on these hills is known as High Stoy, and that it is a commanding position is proved by its having formerly been a station for one of the old semaphores—the word “telegraph” remaining on the Ordnance Map.

It was close to this that the waterspout fell. *The Times* reporter said, “It has now been ascertained that a waterspout burst on Batcombe Hill. * An eye-witness described it as a solid stream of water of about the thickness of a man’s body. It tore up the ground to a considerable depth, and forced a channel for its escape down the hillside.” Mr. Poole had evidently never before seen the effects of a waterspout, and, while recording with strict accuracy what he saw, was rather puzzled. He approached High Stoy from the west, and says, “The road all the way up was much washed, deep pits occurring at intervals. About 7 or 8 ft. below the summit, or plateau of High Stoy, I found the deepest excavations of all; they were then (June 18th) filled in, but the roadmen assured me that they were 8 or 9 feet deep. The road was slightly washed above these pits, and the course of the torrent could be so far easily traced, but above and around them there was not the slightest trace of any disarrangement of the soil. The mystery is—supposing that this was a very heavy fall of rain in a thunderstorm, the water concentrating

* Batcombe is a village at the foot of Batcombe Hill, the eastern extremity of which is sometimes called Batcombe Hill, sometimes (and more appropriately) High Stoy.

at the union of the two combes down which it poured—how came these deep pits very nearly at the summit ? ”

Evidently the facts are, as Mr. Poole points out, quite inconsistent with the effects of a heavy rain, which would cause most mischief where the water was brought together by the configuration of the country—but though there was very heavy rain—perhaps 4 or 5 inches—that would not tear holes 8 or 9 feet deep in a road on the flat top of a hill. Such damage is by no means rare—a closely parallel case in Yorkshire is described in the *Meteorological Magazine* for July last (p. 84)—and there is no doubt that *The Times* correspondent's statement as to the “solid stream of water about the thickness of a man's body” is strictly correct. It is only by such a column of water as he describes that these holes can be excavated, and there is no doubt that over the small area (probably less than a yard across, but moving) the fall of water would have to be measured, not by inches, but by feet or yards; most of the water ran away northwards, but some southwards through Minterne and Upcerne, where damage occurred.

Mr. Poole followed the Northern portion, which went through Batcombe and Heniford to Chetnole, and he has sent us interesting photographs of the damage. At Batcombe the rush of water undermined the front of a cottage, so that it had to be shored up, and the pig sty at the end was completely washed away. About a mile further down the stream was Heniford Mill, the damage to which was reported in our last. A mile further is the village of Chetnole, and there the very well-built garden wall perhaps 100 feet in length, of Major Digby's house, was thrown over in large masses, and a greenhouse overturned.

The nearest rain gauge stations to the High Stoy are Cattistock Lodge, which is five miles S.W.; Melbury, which is five miles W.N.W.; and Hazelbury Bryan, which is seven miles E.N.E. of High Stoy—we have the pleasure of adding at the end reports from the observers at these stations. It is much to be regretted that the Rev. H. Pix, who used to observe at Minterne, removed from there in 1887, and did not succeed in finding any one to continue the record, otherwise that would have been the nearest station, being within a mile of High Stoy.

There are just two remarks which we desire to add in concluding our notice of this subject.

(1) That Mr. Poole's visit, photographs and report, well illustrate the excellent service which the widely-distributed rainfall observers can and do render to the progress of knowledge.

(2) That it is much to be regretted that no record seems to have been preserved as to whether the water was fresh or salt. Our impression is that it was probably sea water lifted from the English Channel by a whirlwind, and dropped upon the top of High Stoy.

SIR,—I am sending a report of the very big rainfall of Friday last, the 7th of June. The thunder and lightning were incessant, accompanied by torrents of rain lasting for three hours, from 2.45 till 5.45 p.m., when I ventured out to measure the fall, it being no less than 3.78 inches; for the 24 hours ending Saturday morning the fall was 3.84 inches. This is an accurate report; no one could be more precise in measuring.

I may mention that it was about four miles from here, where a waterspout burst on Batcombe Hill the same day, as reported in the *Standard* of Monday last.

ARTHUR CHAPPLE.

Cattistock Lodge, Dorchester, June 14th, 1889.

P.S.—I forgot to say that the fall for the 24 hours ending at 8 o'clock Friday morning 7th, was .96 in.; as no rain fell on Thursday, 6th, till after 6 p.m., more than $4\frac{1}{2}$ inches of rain fell in the 24 hours ending 6 p.m. on 7th.

SIR,—In answer to your enquiry as to the fall of rain here at the beginning of June it was :—

		in.	
June	1st .....	.18	
	„ 6th .....	.20	Thunder and lightning.
	„ 7th .....	.32	„ „
	„ 9th .....	.20	
	„ 10th .....	.07	
	„ 11th .....	.03	
		<hr/> 1.00	

No more afterwards up to the present time. We had continuous thunder and lightning all through the 6th and 7th, and on the latter it was considered somewhat fearful, but we had not torrents of rain as at Batcombe, &c. High Stoy is at the north or north-east end of Batcombe-hill, a road runs along the top from Evershot station to Minterne. The hill, as seen on the western side, has a sharp-edged appearance, but on the top it is strikingly flat for a considerable distance; towards Batcombe village (which lies in a curve at the bottom) the top narrows. On the other and Cerne Abbas side is a steep, narrow valley leading to Sydling. Traces of the storm are all about; the road leading down to Batcombe village was quite impassable in the lower parts; great holes washed out, the size of some of the stones, too, quite surprising.

T. C. ELLIOTT.

Melbury House Gardens, July 6th, 1889.

SIR.—The rainfall here on June 7th was less than an inch, .95 in.

R. F. WHEELER.

Hazelbury Bryan.

THE DROUGHT.

THE general table on page 94 is peculiar, in that not one station in the British Isles had its average rainfall in June. Generally a dry month in one part of the British Isles is a wet one in another. But here we have Seathwaite with very little more than half as much as London, and a dry month everywhere. We append a few letters from correspondents in very widely scattered localities, and at the end of them a few cuttings illustrative of the effects of the drought.

CAMDEN SQUARE, LONDON.—There was from the 16th of June until July 7th, an absolute drought of 22 days—the only longer ones since 1857 have been 1863, June 27th to July 20th, 24 days; 1865, June 4th to June 28th, 25 days; 1880, March 8th to March 30th, 23 days; 1880, August 9th to September 5th, 28 days; 1887, June 9th to July 3rd, 25 days.—G. J. SYMONS.

INGLESIDE, KENLEY, SURREY.—I herewith send you particulars of a dry period here which has just terminated, and which may be interesting to you.

	in.	
June 11th.....	·02	
„ 15th.....	·03	
July 7th.....	·01	21 days absolute drought.
„ 8th.....	·10	
„ 9th.....	·33	28 days ·16.

The dry period has been very favourable for the hay gathering, the crop of which is said to be larger, and obtained in better condition, than for 20 years.—HAROLD SMITH.

TENTERDEN.—The three weeks from June 16th to July 6th were absolutely rainless, except for a little moisture on July 3rd, which did not give ·005 in. Last night we had ·30 in., and on 7th and 8th, ·13 in. and ·10 in. The drought was beginning to be felt at last. Only ·91 in. in June, and 1·30 in. in May, giving a total less than in 1887, and nearly as small as in 1870, though 50 per cent. more than in 1868 and 1884. Three days with temp. above 80° in June, more than I have had since 1881.—J. ELLIS MACE.

SEDGEBROOK, NORTHAMPTON.—From June 10th to July 8th there was here a partial drought, the amount of rain being only ·10 in., which fell on two days; and from May 29th to July 8th the total fall was only ·65 in. This is the longest drought here since 1887, when there was an absolute drought from June 4th to July 3rd, and from June 4th to July 13th a partial drought, for only ·15 in. fell. During the period mentioned, this year, there was no great heat, the highest shade temperature being 78°·9, and the weather uniformly pleasant.—C. A. MARKHAM.

BLOFIELD, NORWICH.—Rainless from June 11th to July 6th, both inclusive; only ·01 in. on 7th, and no rain on 8th; ·48 in. on 9th closed the drought.—A. W. PRESTON.

BECKFORD, TEWKESBURY.—The welcome rain has come at last, terminating the drought, which has lasted just a month.

From June 11th to July 8th, both inclusive, or for a period of 28 days, no rain fell at Beckford.

This is almost equal to the absolute drought in 1887, when we had 31 consecutive rainless days.—FREDK. SLADE.

ROTHERBY HALL, LEICESTER.—Total rainfall June, 1889, '59 in. Driest June in previous 20 years, 1874, '64 in.—J. HAINES.

FOX HILL, FRODSHAM.—I give particulars of the rainfall, as it is the smallest in any month that I have recorded in the 16 years I have kept a gauge—June 1st, '18 in. ; 2nd, '08 in. ; 8th, '10 in. ; 9th, '03 in. ; total, '39 in.—JAMES REYNOLDS.

ALEXANDRA PARK, MANCHESTER.—June was remarkably dry, and the authorities are beginning to be anxious about the water supply, and have already recommended the greatest economy.—J. CASARTELLI.

HURST BANK, HEATON, BOLTON.—The longest drought, or rather the longest period with the least rainfall, registered by me since I commenced taking the rainfall in 1863, has just come to an end.

On the 1st and 2nd June '58 in. fell—chiefly during a TS from 7.45 to 8.15 a.m. on the 2nd—after which day, until the 9th July, only '09 in. fell, namely, '03 in. on the 8th, and '03 in. on the 14th June, and '03 in. on the 6th July. An absolute drought reigned from 15th June to 5th July inclusive—21 days ; and a partial one from June 3rd to July 8th inclusive—36 days, during which only only '09 in. fell.

The rainfall on the 9th July was '32 in., with every prospect of a continuance.

The next longest drought was in 1887, when, from June 4th to July 8th inclusive—35 days—only '21 in. fell, and there was an absolute drought from June 9th to July 3rd inclusive—25 days.—JAMES WATKINS, F.R.MET.SOC.

PAWSTON, CORNHILL-ON-TWEED.—June proved an unusually dry month, beating even the record of the Jubilee year. After the thunderstorm of the 2nd, only '23 in. of rain fell up to July 3rd ; all pastures are much burnt, and corn prospects have been very much spoilt by the three weeks or so of drought.—B. P. SELBY.

TREVALYN HALL, WREXHAM.—The period of drought, which has now terminated, has been unusually protracted, and absolute for 25 days. I therefore send you the rainfall for last month and up to the present date, showing that, with a very slight exception (on June 13th), an absolute drought prevailed here from June 8th to July 9th, a period of 30 consecutive days. It has been a glorious time for securing the hay crop, which, owing to a wet April and a showery May, has been very abundant. We had a remarkable hail-storm on June 2nd, the hail consisting of very large and irregularly-

shaped cubes of ice, which caused much destruction to greenhouses in this locality.—B. T. GRIFFITH-BOSCAWEN.

Rainfall at Trevalyn Hall, Rossett, Denbighshire. Above sea level, 58 feet.

		in.	
June	1st.....	·16	
„	2nd	·30	Thunder and hail, 3 p.m.
„	8th	·12	
„	13th	·02	
July	9th	·09	Bar. falling and drought apparently terminated.
Total fall in 39 days		·69	

BLACKET PLACE, EDINBURGH.—No rain fell here from June 15th to July 2nd, and only ·08 in. in 27 days.—R. C. MOSSMAN.

BUSHY HILL, CAMBUSLANG.—I send note of drought and rainfall :—

Absolute drought from June 15th till July 5th, both inclusive—20 days—0·00 in.

Partial drought from June 3rd till July 8th, both inclusive—36 days—0·11 in.

0·83 in. of rain fell on 2nd June, 0·60 in. on 9th July from 5 p.m. till 9 a.m. of the 10th.—HENRY MUIRHEAD.

SCARCITY OF WATER AT GLOSSOP.—The extensive paper mills belonging to Messrs. Olive and Partington, at which a large number of hands is employed, will be stopped shortly if the present fine weather continues, owing to scarcity of water.—*Sheffield Independent, June 28th.*

SCARCITY OF WATER AT GLOSSOP.—A large number of employes at Captain Partington's extensive paper mills, Glossop, are working only three and four days a week, owing to the scarcity of water, and it is stated that, if the present drought continues much longer, it is probable the whole of the hands will have to work short time. Other large mills in the town are seriously affected by the dry season.—*Sheffield Telegraph, July 5th.*

LANCASHIRE AND DISTRICT.—The prolonged dry weather is causing much anxiety to those connected with the supply of water to the public in this district. At Manchester particularly is this the case, and the continuance of the drought is beginning to tell heavily upon the supply in store, the springs which feed the reservoirs being at a very low ebb indeed. The consumption, on the other hand, seems to be increasing daily, and reaches as much as seven million gallons per day in excess of the quantity consumed under ordinary conditions. Still, there is a very fair quantity in store, and up to now the Water Works Committee have not thought it needful to limit the supply in any way. In some of the outer districts of Rochdale the supply is giving out, and the inhabitants have to resort to wells and springs, which are generally available as a last resource.

In some parts of Cheshire also much inconvenience is being met with, while in North Wales several quarries are at a standstill owing to the lack of water to work the machinery used. Unless rain speedily falls, some thousands of men employed at the quarries will be thrown out of employment. Altogether matters are getting serious, and a smart downfall of rain would be hailed with satisfaction throughout the district, especially as the farmers have practically got their hay safely barned.—*Gas and Water Review*, July 6th.

WATER FAMINE IN CHESHIRE.—Owing to the protracted drought, no rain having fallen since the hail and rain storm a month back, there is a water famine in all the Cheshire villages which depend upon local or irregular supplies. At Saughall a meeting of residents is summoned to consider the question, as wells and water pits are all dried up.—*Notts Daily Guardian*, July 18th.

THE DROUGHT IN LINCOLNSHIRE.—The continued absence of rain is causing serious misgivings respecting the crops in Lincolnshire. No rain has fallen for over a month, and the growing crops are sadly in need of moisture. The roots are especially suffering, and it is feared, if the dry weather continues much longer, the mangolds and turnips will be a failure. In many parts of the district the dykes and ponds are rapidly drying up, and farmers are in some instances under the necessity of carting water to their cattle.—*Sheffield Telegraph*, July 10th.

ROYAL METEOROLOGICAL SOCIETY.

THE last meeting of this Society for the present session was held on June 19th, at the Institution of Civil Engineers, 25, Great George-street, Westminster, Dr. W. Marcet, F.R.S., President, in the chair.

Mr. T. J. Moss-Flower, Mr. A. H. Halder, Mr. R. A. Naylor, and Mr. C. B. Penlington were elected Fellows.

Mr. W. Marriott gave an interesting account of the thunderstorms which prevailed over the country during June.

On Sunday, June 2nd, a thunderstorm passed in a northerly direction from Wiltshire about 3 a.m., and reached Edinburgh by 10.44 a.m. It travelled at the rate of about 50 miles an hour. It is possible that this storm travelled still further north, and reached Kirkwall at 3.37 p.m. A severe thunderstorm prevailed over the neighbourhood of the Tweed between 11 a.m. and noon, and was accompanied by hail of very large size, some of the stones being five inches in circumference. A very destructive storm occurred over the whole of the North-west of England and South of Scotland during the afternoon of the same day; much damage was caused by lightning, and very large hail fell over an extensive area. Some of the hail-stones measured seven inches in circumference and weighed seven

ounces. During the night of the same day a severe thunderstorm prevailed over Norfolk, which was also accompanied by very large hailstones, some of which were five to six inches in circumference.

On Thursday, the 6th, thunderstorms prevailed during the afternoon over the whole of the South-east of England. That which passed over the Metropolis about nine o'clock was remarkable for the brilliant and continuous display of lightning. During the same night, and in the early morning of the following day, a very destructive storm prevailed over the Eastern Counties, much damage being done by the lightning in the North-west of Norfolk. Severe hailstorms occurred between 2 and 3 a.m., both at Margate and Ipswich.

During the afternoon of the 7th, destructive thunderstorms prevailed over the whole of the Southern Counties, much damage being done by lightning, while at Tunbridge Wells there was a most remarkable hailstorm. One of the hailstones, which was weighed, was actually half-a-pound in weight.

An interesting collection of more than 40 photographs of lightning taken during the storm on June 6th was exhibited to the meeting. In addition to the sinuous, ribbon and meandering flashes of lightning, several photographs showed knotted, multiple and dark flashes.

The following papers were also read :—

“The Climate of British North Borneo,” by Mr. R. H. Scott, M.A., F.R.S.

“On the Variation of the Temperature of the Air in England during the period 1849 to 1888,” by Mr. W. Ellis, F.R.A.S., F.R.Met.Soc.

“Atlantic Weather and Rapid Steamship Navigation,” by Mr. C. Harding, F.R.Met.Soc.

“Meteorological Phenomena observed during 1875-87 in the neighbourhood of Chelmsford,” by Mr. Henry Corder.

“Rainfall in China, and Meteorological Observations made at Ichang and South Cape in 1888,” by Dr. W. Doberck, F.R.Met.Soc.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DECEMBER, 1888.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
°		°		°	°	°	0.100	°	°	inches		0.10	
England, London	58·9	5	25·9	31	46·2	36·2	38·5	91	69·9	19·2	1·29	9	5·6
Malta.....	71·2	1	43·7	9	63·2	53·9	50·1	79	117·4	36·5	1·67	7	6·4
Cape of Good Hope. ...	92·5	25	50·2	28	75·2	58·9	...	...	...	...	1·23	6	5·2
Mauritius.....	85·0	18	66·0	18	82·3	72·4	69·4	79	137·3	59·3	12·64	23	7·1
Calcutta.....	79·2	1	51·3	26	75·0	54·6	53·4	60	130·6	41·5	·00	0	0·6
Bombay.....	90·4	18	67·0	30	86·0	71·3	65·0	64	136·6	52·4	·00	0	0·8
Ceylon, Colombo.....	91·0	18	69·8	31	85·4	72·6	70·0	78	150·5	65·6	6·93	11	6·7
Melbourne	96·4	26	47·2	2	78·6	56·2	54·6	66	149·4	34·7	2·72	9	5·2
Adelaide	107·5	25	48·9	22	86·8	62·9	51·7	45	155·4	42·7	·28	8	4·2
Wellington	71·0	24	44·3	14	64·0	50·3	50·5	78	140·0	34·0	2·43	14	4·0
Auckland	75·0	23	43·0	14	66·6	52·4	48·3	67	139·0	36·0	1·26	9	5·0
Jamaica, Kingston.....	93·5	3	66·1	15	89·3	70·1	69·7	76	...	...	1·11	...	...
Barbados .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	46·7	25	0·0	22	35·7	23·1	25·3	78	...	—10·0	·83	22	8·1
New Brunswick, Fredericton	50·3	27	— 7·6	14	29·9	12·4	20·2	78	...	...	3·59	16	6·7
Manitoba, Winnipeg ...	35·2	4, 9	—14·0	13	22·1	2·3	12·3	90	...	...	·48	10	4·8
British Columbia, Victoria	59·0	3, 4	26·0	24, 25	48·2	37·7	...	...	...	...	1·96	13	...

REMARKS, DECEMBER, 1888.

MALTA.—Mean temp. $57^{\circ}\cdot 7$; mean hourly velocity of wind 9·8 miles. Sea temp. fell from $65^{\circ}\cdot 4$ to $62^{\circ}\cdot 1$. TS on 19th; L on 4th and 27th. R only half the average. J. SCOLES.

Mauritius.—Mean temp. of air $0^{\circ}\cdot 4$ below, of dew point $1^{\circ}\cdot 7$ above, and R $6\cdot 83$ in. above their respective averages. Mean hourly velocity of wind 9·3 miles, or 2·0 miles below average; extremes 19·8 on 8th and 2·0 on 21st. Prevailing direction, E. by N. T on 3rd, 24th, and 31st. T and L on 30th. Inundation in some parts of the island on 28th. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air $3^{\circ}\cdot 2$, of dew point $4^{\circ}\cdot 0$, humidity 1, R $\cdot 23$ in., and pressure $\cdot 070$ in. above average; mean amount of cloud $0\cdot 4$ below average. Prevailing winds S.E. and S.; strong on 8 days. Very sultry and oppressive on 9 days. T and L on 13th, and heavy TS on 31st. R. L. J. ELLERY, F.R.S.

Adelaide.—The hottest December, with one exception, on record, the mean temp. being $3^{\circ}\cdot 8$ above the average; the hottest Christmas-day ever known in Adelaide. Mean min. considerably higher than any previously recorded. R one-third of the average. On the 31st the drought had commenced to break up in the far N. and extreme W., and on January 1st, 1889, some of the heaviest floods recorded were experienced over the colony generally. Total fall of R for the year $14\cdot 57$ in., one of the smallest amounts on record, the fall having been less in only three years since the foundation of the colony. C. TODD, F.R.S.

Wellington.—Fine weather generally, but strong winds from W. and N.W.; showery at the commencement, during the middle, and at the end of the month, but the total rainfall small. Distant T and L on 9th. Mean temp. $3^{\circ}\cdot 6$ and R $1\cdot 51$ in. below the average. R. B. GORE.

Auckland.—An unusually cold month, the mean temp. being 5° below the average. R not half the average; pressure rather above the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
 JUNE, 1889.

[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 Hall.	1·00	XI.	Castle Malgwyn	·71
„	Margate, Birchington...	1·61	„	Rhayader, Nantgwillt..	·99
„	Littlehampton	·88	„	Carno, Tybrith ...	·46
„	Hailsham	·24	„	Corwen, Rhug	·66
„	Ryde, Thornbrough	·66	„	Port Madoc	·57
„	Alton, Ashdell	·92	„	I. of Man, Douglas	·36
III.	Oxford, Magdalen Col...	1·90	XII.	Stoneykirk, Ardwell Ho.	·90
„	Banbury, Bloxham	1·31	„	New Galloway, Glenlee	·86
„	Northampton	·88	„	Melrose, Abbey Gate...	·98
„	Cambridge, Beech Ho...	2·41	XIII.	N. Esk Res. [Penicuik]	1·50
„	Wisbech, Bank House..	1·26	XIV.	Ballantrae, Glendrisaig	·49
IV.	Southend	2·10	„	Glasgow, Queen's Park.	·91
„	Harlow, Sheering	1·35	XV.	Islay, Gruinart School..	·91
„	Rendlesham Hall	4·22	XVI.	Dollar	·64
„	Diss	1·41	„	St. Andrews, Pilmour Cot	·82
„	Swaffham	1·86	„	Balquhiddier, Stronvar..	1·56
V.	Salisbury, Alderbury...	2·26	„	Dunkeld, Inver Braan..	·56
„	Warminster	2·61	„	Dalnaspidal H.R.S.	1·13
„	Bishop's Cannings	1·23	XVII.	Keith H.R.S.	·82
„	Ashburton, Holne Vic...	·41	„	Forres H.R.S.	·32
„	Hatherleigh, Winsford.	·71	XVIII.	Strome Ferry H.R.S....	·76
„	Lynmouth, Glenthorne.	·74	„	Fearn, Lower Pitkerrie.	·64
„	Probus, Lamellyn	·86	„	Loch Shiel, Glenaladale	...
„	Launceston, S. Petherwin	·65	„	N. Uist. Loch Maddy ...	1·35
„	Wincanton, Stowell Rec.	·99	„	Invergarry	·30
„	Taunton, Lydeard Ho...	·57	„	Loch Ness, Drumnadrochit	·33
„	Wells, Westbury	·68	XIX.	Lairg H.R.S.	·97
VI.	Bristol, Clifton	·51	„	Forsinard H.R.S. ....	...
„	Ross	·41	„	Watten H.R.S.	·70
„	Wem, Clive Vicarage ...	·51	XX.	Dunmanway, Coolkelure	1·67
„	Cheadle, The Heath Ho.	·57	„	Fermoy, Gas Works ...	1·96
„	Worcester, Diglis Lock	·97	„	Tipperary, Henry Street	1·64
„	Coventry, Coundon	1·05	„	Limerick, Kilcornan ...	·68
VII.	Ketton Hall [Stamford]	·73	„	Miltown Malbay	1·06
„	Grantham, Stainby	·36	XXI.	Gorey, Courtown House	·26
„	Horncastle, Bucknall ...	·52	„	Navan, Balrath	·00
„	Mansfield, St. John's St.	·59	„	Mullingar, Belvedere ...	·83
VIII.	Neston, Hinderton	1·18	„	Athlone, Twyford	1·49
„	Knutsford, Heathside	·66	„	Longford, Currygrane...	·98
„	Lancaster, South Road.	1·61	XXII.	Galway, Queen's Coll...	1·05
„	Broughton-in-Furness ..	1·75	„	Clifden, Kylemore	2·41
IX.	Wakefield Prison	·46	„	Crossmolina, Enniscoe...	1·67
„	Ripon, Mickley	·35	„	Collooney, Markree Obs.	·89
„	Scarborough, West Bank	·37	„	Ballinamore, Lawderdale	·77
„	East Layton [Darlington]	·22	XXIII.	Warrenpoint	·03
„	Middleton, Mickleton...	·14	„	Seaforde	·41
X.	Haltwhistle, Unthank..	·83	„	Belfast, New Barnsley .	·53
„	Shap, Copy Hill	2·31	„	Bushmills, Dundarave...	·78
XI.	Llanfrechfa Grange	·77	„	Stewartstown	·34
„	Llandovery	·73	„	Buncrana	·78

JUNE, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which ·01 or more fell.	TEMPERATURE				No. of Ni t below 32°		
		Total Fall.	Difference from average. 1870-9	Greatest Fall in 24 hours.		Dpth	Date.		Max.		Min.			In shade	On grass.
				inches.	in.				Deg.	Date	Deg.	Date.			
I.	London (Camden Square) ...	2·03	— ·64	·61	9	6	84·5	6	46·9	1	0	0	0		
II.	Maidstone (Hunton Court)...	1·20	— ·87	·77	9	4	...	...	...	...	...	...	...
III.	Strathfield Turgiss	1·12	— ·98	·42	2	11	81·1	27	43·0	1	0	0	0		
III.	Hitchin	1·72	— ·41	·70	10	6	80·0	2	48·0	10d	0	0	0		
IV.	Winslow (Addington)	1·45	— 1·06	·43	10	7	82·0	2	44·0	18	0	0	0		
V.	Bury St. Edmunds (Culford)	...	...	...	...	...	...	...	...	...	...	...	...
V.	Norwich (Cossey)	·93	— 1·29	·40	10	3	...	...	...	...	...	...	...
V.	Weymouth (Langton Herring)	3·55	...	1·89	6	7	77·0	7, 27	47·0	11	0	...	...
V.	Barnstaple	·33	— 2·39	·13	8	5	80·0	23	42·5	12	0	...	...
VI.	Bodmin	·75	— 2·46	·20	19	8	74·0	22a	43·0	12e	0	0	0		
VI.	Stroud (Upfield)	·45	— 1·93	·21	2	5	83·0	27	44·0	15	0	...	...
VI.	Churchstretton (Woolstaston)	·45	— 2·42	·18	1	5	76·0	22	45·0	11	0	0	0		
VII.	Tenbury (Orleton)	·66	— 2·08	·24	1	6	82·5	27	42·0	12f	0	0	0		
VII.	Leicester (Barkby)	·86	— 1·65	·48	8	7	86·0	2, 27	43·0	17	0	...	...
VII.	Boston	·28	— 1·97	·11	2	6	90·0	2	44·0	1	0	0	0		
VIII.	Hesley Hall [Tickhill]	·40	...	·16	9, 28	3	83·0	2	45·0	16	0	...	...
VIII.	Manchester (Ardwick) .....	...	...	...	...	...	...	...	...	...	...	...	...
IX.	Wetherby (Ribston Hall) ...	·64	— 2·23	·29	9	4	...	...	...	...	...	...	...
IX.	Skipton (Arncliffe)	·72	— 3·10	·63	2	4	83·0	27	44·0	22	0	...	...
X.	Hull (People's Park)	·43	— 1·84	·18	7	7	...	...	...	...	...	...	...
X.	North Shields	·23	— 1·80	·12	8	5	79·5	26	40·5	11	0	0	0		
XI.	Borrowdale (Seathwaite)	1·11	— 6·70	·52	2	6	...	...	...	...	...	...	...
XI.	Cardiff (Ely)	·33	— 2·73	·19	1	4	...	...	...	...	...	...	...
XI.	Haverfordwest	·51	— 2·52	·27	8	7	76·4	22	40·0	11	0	0	0		
XI.	Plinlimmon (Cwmsymlog) ...	·48	...	·20	8	3	...	...	...	...	...	...	...
XII.	Llandudno	·62	— 1·38	·30	8	5	74·2	22	46·3	16	0	...	...
XII.	Cargen [Dumfries]	2·14	— 1·03	1·39	6	4	80·8	22	35·2	11	0	...	...
XIV.	Jedburgh (Sunnyside)	·35	— 2·05	·19	2	5	77·0	26	32·0	11	1	...	...
XIV.	Old Cumnock	·59	— 2·33	·25	2	8	86·0	21	35·0	9, 10	0	...	...
XV.	Lochgilhead (Kilmory)	1·44	— 2·40	·53	9	6	...	...	...	...	...	...	...
XV.	Oban (Craigvarren)	1·37	...	·50	2	9	75·3	21	41·1	10	0	...	...
XV.	Mull (Quinish)	1·51	...	·58	2	10	...	...	...	...	...	...	...
XVI.	Loch Leven Sluices	·90	— 1·87	·30	3, 7	4	...	...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	·75	— 1·91	·25	6	5	80·5	26	40·2	10	0	...	...
XVII.	Braemar	·74	— 2·35	·38	2	8	78·2	21	38·0	11	0	2	...		
XVII.	Aberdeen (Cranford)	·69	...	·42	6	7	77·0	26	38·0	10	0	...	...
XVIII.	Lochbroom	1·21	...	·50	2	4	...	...	...	...	...	...	...
XVIII.	Culloden	·11	— 2·14	...	...	...	78·0	26	37·0	10	0	2	...
XIX.	Dunrobin	·95	...	·31	2	7	75·0	21	42·0	13	0	...	...
XIX.	S. Ronaldsay (Roeberry)	·66	— 1·11	·19	2	9	69·0	25b	45·0	10	0	...	...
XX.	Cork (Blackrock)	1·76	— 1·79	1·28	1	5	77·0	26	45·0	7g	0	...	...
XX.	Dromore Castle	1·71	...	1·00	1	8	78·0	22	41·0	7	0	...	...
XX.	Waterford (Brook Lodge) ...	1·15	...	·95	1	5	76·0	6c	...	...	...	...	...
XX.	O'Briensbridge (Ross)	·64	...	·26	2	7	75·0	...	42·0	9	0	...	...
XXI.	Carlow (Browne's Hill)	·86	— 1·80	·57	1	6	...	...	...	...	...	...	...
XXI.	Dublin (FitzWilliam Square)	·10	— 2·10	·03	8	6	74·8	22	41·2	11	0	0	0		
XXII.	Ballinasloe	1·15	— 2·04	·29	1	12	69·0	24	37·0	10	0	0	0		
XXIII.	Waringstown	·37	— 2·29	·13	2	5	82·0	21	38·0	4	0	0	0		
XXIII.	Londonderry (Creggan Res.) ..	·52	...	·20	13	9	...	...	...	...	...	...	...
XXIII.	Omagh (Edenfel)	·41	— 2·64	·17	1	6	78·0	21	41·0	7	0	...	...

a And 26. b And 26. c And 22, 26. d And 17. e And 13. f And 28. g And 12, 14.

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

METEOROLOGICAL NOTES ON JUNE, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—The R at the commencement of the month started the weeds with much vigour, but the succeeding hot sunshine did great service to the hay and wheat crops; magnificent weather for haymaking, and heavy crops everywhere. TS on 6th. Elder in flower on 6th, dogrose on 9th, fox-glove on 13th, mallow on 19th, and pink convolvulus on 27th.

HITCHIN.—A terrific TS on 6th, the most severe ever experienced. The highest mean temp. for the month in 40 years, with two exceptions.

WINSLOW, ADDINGTON.—A fine month, the latter part all that could be wished for haymaking, and a large quantity was secured in good condition. TS on 6th. T on 5 days.

LANGTON HERRING.—R 1·46 in. above the average of 14 years, 2·66 in. falling between 2 a.m. and 7 p.m. on 6th during terrific TSS. No R whatever fell after the 15th, and the mean temp. has only twice been exceeded in 17 years, 72° being reached or exceeded 12 times. Altogether, a very beautiful month, with splendid weather for securing the heaviest hay crop ever known.

WOOLSTASTON.—A very dry month, R falling on only five days; mean temp. 59°·3.

ORLETON.—On the morning of the 2nd, at 6 a.m., a violent storm of L, T, H, and R passed from S. to N. about four or five miles to the E., here there was only heavy R. The weather after was warm, with occasional falls of R till the 10th, after which there was no measurable R during the remainder of the month, and the weather was generally warm and fine with a few cold, cloudy days. Mean temp. 0°·8 above the average of 28 years. R the smallest in June during 58 years, with the exception of 1844, 1868, and 1870. The bar. was high and remarkably steady. No T was heard after the 2nd. A large quantity of hay was secured without R, but the fruit crops are a general failure.

SKIPTON, ARNCLIFFE.—An unusually dry and sultry month. TS on 2nd, with ·50 in. of R in 30 minutes.

HULL.—The weather during the month was generally fine and calm, but often with a considerable amount of cloud.

NORTH SHIELDS.—An extremely fine, dry, and sunny month. Hay harvest general. TS on the 2nd.

WALES.

HAVERFORDWEST.—One of the finest Junes during 40 years, and the driest with two exceptions. A very small amount of R fell during the first 14 days: the rest of the month was made up of bright, fresh, warm days, with wind mostly from N.W. to N.N.E. and cool, cloudless nights. Dense fogs occurred about sunrise during the last week, and the sky several times assumed a threatening appearance. The country was beginning to look faded at the close from the continued drought. Temp. above 70° on 12 days. Some ash trees had scarcely a fully developed leaf as late as the 12th. No T or L.

SCOTLAND.

CARGEN.—Mean temp. 58°·4, the highest for June since 1865. The nights being generally very clear and cloudless produced low minima and reduced the mean. A sharp TS occurred on 2nd and a very severe one on 6th lasting nearly 11 hours off and on, accompanied by heavy R and H, 1·39 in. falling in two or three hours. E. winds prevailed for 15 days and the wind was generally light and variable. Sunshine 65 hours above the average. The drought which prevailed from the 7th was seriously affecting crops on light soils at the close.

JEDBURGH.—The temp. of the month was generally high, 70° being reached or exceeded on 10 days. Vegetation progressed rapidly. Up to the close of the month the need of R was not much felt, except for particular soils.

BRAEMAR.—A very dry, scorching month. Mean temp. 56°·5.

LOCHBROOM.—Such a June has rarely been experienced in this country. R on only four days and not a drop after the 11th. Such sunshine and heat that everything that is not dried up is three weeks earlier than usual. T and L on 2nd and 3rd.

CULLODEN.—The month was remarkable for the very small R, and crops of all kinds were suffering greatly at the close. TSS very severe on 2nd and 3rd.

DUNROBIN.—A very dry month.

S. RONALDSAY, ROEBERRY.—The driest June since 1871, the R being little more than one third of the average of 20 years; heavy TS on 2nd.

IRELAND.

CORK.—Mostly fine and bright and no R after the 13th. Fall for the first six months of 1889 3·77 in. less than the average of 24 years.

DROMORE.—A very fine month.

ROSS, O'BRIENSBIDGE.—Perfect summer weather all through the month, with an exceptionally small R. Mean temp. 59°·6.

DUBLIN.—This month resembled June, 1887, as one of the driest and warmest months on record. The mean temp. was 2°·8 below that of 1887, but still 1°·7 above the average. E. and N.E. winds prevailed. The R and number of rainy days were remarkably small. High winds on 5 days. The temp. reached 70° in the screen on 10 days, as compared with 17 days in 1887 and only one day in 1888.

WARINGSTOWN.—The driest month recorded. The last fortnight unusually hot, and R much required at the close, but crops still generally good.

EDENFELL OMAGH.—The smallest R in June since 1865, when ·40 in. fell, and the drought lasted 17 days. This year the drought has already lasted 18 days with no immediate prospect of a change, but the heat has been moderated by frequently overcast skies and fresh breezes, and as a result vegetation remains fresh and luxuriant. One of the earliest and heaviest hay harvests for many years has been almost completed under the most favourable conditions.

HEAVY RAIN AT ST. ALBANS, JULY 12TH.

To the Editor of the Meteorological Magazine.

SIR,—During a TS here, between 9.30 and 11.30 p.m., on Friday, July 12th, rain fell in "floods" at intervals, and the total was 2·54 in.

E. A. ORMEROD.

Torrington Ho., St. Albans.

SYMONS'S

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THE OAK AND THE ASH.

WEATHER proverbs, like most other things, are of various quality. Far be it from us to assign rank to any of them, but their antiquity alone entitles them to careful consideration before they are swept away (in this utilitarian age) as mere rubbish.

At a recent meeting of the Woolhope Naturalists' Field Club, the various proverbs depending upon the priority of leafage of the Oak and the Ash were treated with such a fulness as we have not before seen. We therefore reprint the account from the *Hereford Times*, and add at the end some versions not referred to therein.—[ED.]

Mr. Moore, in the absence of their author, read the following few notes, prepared by Dr. T. A. Chapman, on "If the Oak," &c. :—

If the Oak is in leaf before the Ash,
'Twill be dry and warm, and good wheat to thrash ;
If the Ash is in leaf before the Oak,
'Twill be cold, and, of rain, too great a soak ;
If the Oak and the Ash open their leaves together,
Expect a summer of changeable weather.

If the Oak is out before the Ash,
'Twill be a summer of wet and splash ;
But if the Ash is before the Oak,
'Twill be a summer of fire and smoke.

There are several versions of this piece of weather-lore, an old Kentish one being "Oak, smoke ; Ash, quash," and according to a version given in *Notes and Queries* (1st series, vi. 71) :—

If the Oak's before the Ash,
Then you'll only get a splash ;
If the Ash precedes the Oak,
Then you may expect a soak.

The Folk-lore of Plants, Thistleton Dyer, p. 117.

Two versions of these rhymes are to be met with, whose prophecies are diametrically opposed ; it is enough for me at present to take them as a proof that common observation asserts that the leafing of these two trees varies in different seasons, sometimes one and sometimes the other acquiring its foliage earlier in spring than its fellow.

This year it has been a matter of frequent remark that the oak is notably in advance of the ash.

I have very little to say except to record this circumstance, and to inquire what is known about the matter.

I may first give a few dates which, for two reasons, are only approximate ; firstly, that it is difficult to say precisely what advance in growth may be decided to be "in leaf ;" and secondly, trees of the same species may differ from each other by a week or more in their forwardness.

April 20.—Ash in flower.

April 29.—Ash in leaf in hedges (not hedgerow trees, but ashes cropped with the hedge).

May 6.—Oak leaves may be found on trees.

May 6.—Ash buds (on trees) barely swelling.

May 17.—Oaks well in leaf.

May 17.—Most ash trees quite bare ; shoots perhaps 2 inches long.

May 17.—Oaks in hedges leafless, though buds well grown.

May 22.—Oaks in hedges still to be found without decided leaves ; and

May 22.—Ash trees without leaves.

About the 6th of May, when an oak leaf about an inch long could be readily found, the season for oaks was about 18 days behind an ordinary season. So rapid has been the progress since that date, that at present, May 23rd, trees that submit to forcing are at about a stage normal to the season.

On May 17th oaks were generally well in leaf ; that is, there were shoots of several inches long and leaves fairly developed. At that date many ash trees showed nothing like a leaf, and the most forward were only at about the stage reached by oaks on May 6th, and even yesterday, May 22nd, I saw an ash tree with buds only just breaking, whilst most oak trees now have full-sized leaves.

But there is another circumstance that is very curious, though few, I think, have noticed it, and that is that when ash and oak have been cropped in hedges, the reverse state of matters holds. Well-developed ash leaves could be found in hedges on April 29th, and on May 5th all such specimens were fairly in leaf. Yet on May 17th many oaks clipped in hedges had buds swelled to an inch or two in length, yet without anything like a leaf.

I think that these dates are well to be noted ; the only comment I would make on them would be in the form of a few questions.

Firstly, and most radically, does the ash ever leaf before the oak ? The ash always blossoms a week or two, more often four or five weeks, before it breaks into leaf. For the last few years the ash has blossomed very freely, and many trees thereby put on a clothed, not exactly leafy appearance, very early. This year the ash has hardly bloomed at all, and the first movement seen has been the bursting of the leaf bud. My inquiry is, therefore, whether the supposed variation in the date (relative to the oak) at which the ash bursts into leaf,

is not in reality merely a variation in the amount of blossom it bears?

The hedge plants behave this year in a way to suggest that the ash may, under certain conditions, leaf first. My next query would be, why this remarkable difference between trees and plants cropped to bush size and protected in hedges? If it is the warmth afforded by the protection of the hedge that forces on the ash, why does it not force on the oak?

I have noticed that many oaks leaf first at the top, whilst ash trees are apt to be latest there, and ash suckers leaf earlier than trees.

If the relative dates of leafing are reversed in the two trees in different seasons, we can only suppose that one tree breaks into leaf after a long-continued moderate temperature, but is not rapidly affected by a higher temperature, whilst the other does not move at the temperature suitable to the former, but advances rapidly at a slightly higher temperature. Should this be so, which is the tree that moves at the lower temperature? Has anything accurate been recorded on the subject?

After the paper had been read, the President (Mr. H. Southall), said that he had received two answers to inquiries he had made respecting the subject. Mr. Gulson, a very good observer, in writing to the *Coventry Herald*, June 7th, says:—"The newspapers contain the usual observations that the oak is in leaf before the ash, and predict the wet or dry season which they suppose is to follow. As I have never observed any season in which the oak was not in leaf before the ash, I am unable to say what force there is in such predictions."

Now follows a letter from Mr. Westley Richards, dated June 7th, 1889:—

"Dear Sir,—Mr. Symons informs me that you have been keeping records about the oak and the ash. This year, in my county (Rutland), the oak was decidedly out much before the ash, and we had 5·75 inches of rain, and it is one of the best grass years I remember. This does not agree with the proverb I enclose:—

When buds the Oak before the Ash,
You'll only have a summer splash.

I do not remember to have had 5·75 in. of rain in May before.—
Yours faithfully,

WESTLEY RICHARDS."

From a newspaper cutting of a letter, signed John Thomson, Tweedside, June 2nd, 1889:—

Oak and ash. The rhyme varies in words, but its meaning is always the same, thus—

When buds the Oak before the Ash,
You'll only have a summer splash;
When buds the Ash before the Oak,
You'll surely have a summer soak.

That is, oak and soak rhyme together, and ash and splash. G. A. H.

The appearance of the ash in this part of Herefordshire must be very different from that it presents in North Radnorshire as described by Mr. G. A. Haig. Here it is almost impossible this season to state with rigorous exactness whether the oak or the ash has priority. A great many trees of each species as yet show scarcely any signs of energetic vitality, while an equal number are well adorned in frondescence, both oaks and ashes vying with each other. On the borders the rhyme runs :—

The Ash before the Oak,
Choke, choke, choke ;
The Oak before the Ash,
Splash, splash, splash.

Considerable weight attaches to arboreal and other signs in this part of the country, and had the ash been as advanced as it is in North Radnorshire, instead of a wet summer, as anticipated by Mr. Haig, a very dry season would have been confidently looked for.

The President then made a few remarks on the peculiarity of the present season in Herefordshire, saying that the three spring months of March, April, and May, of 1889, were wetter than any corresponding period since observations were first taken in this county in 1818, the amount being as under :—

			Total inches.		Rainy days.
March	...	...	3·28	...	18
April	...	...	5·64	...	22
May	...	...	3·81	...	18
			12·73		58

or more than double the average fall, the fall in April being three times the usual quantity. Another striking fact had been the absence of frost. Since March 26th there had been no frost at Ross at 4 ft. from the ground. During May, the lowest temperature in the screen was 42°·4, on May 1st and 2nd ; this appears to be unparalleled, and perhaps explains the unusual prevalence of insect life which, in some places, has been so destructive.

[The following are other versions which we have found.—ED.] :—

Oak before Ash,
Have a splash ;
Ash before Oak,
Have a soak.

If the Oak before the Ash comes out,
There has been, or there will be, drought.

“ *Proverbial Folk-lore.* ”—ANON, N. D.

When the Oak comes out before the Ash, there will be fine weather in harvest ; but when the Ash comes out before the Oak, the harvest will be wet. (*Midland Counties*).

“ *Weather-lore.* ”—R. INWARDS, 1869.

If the Ash is out before the Oak,
Colin's always in a soak ;
If the Oak before the Ash,
Dolly Scarr can get a wash.

When the Oak is out before the Ash,
You'll scarce have water for to wash ;
If the Ash is out before the Oak,
You may put your clothes to soak.

Ash before Oak,
There'll be a smoke ;
Oak before Ash,
There'll be a splash.

TWO OPPOSITE VERSIONS.

When the Oak before the Ash,
The summer will be splash, splash ;
When the Ash before the Oak,
The summer will choke, choke.

When the Oak before the Ash,
Then you'll only get a splash ;
When the Ash before the Oak,
Then you may expect a soak.

“ *Weather Sayings.* ”—W. ROPER, 1883.

TWO GREAT RAINFALLS, MAY 25TH—30TH, 1889.

THE following may or may not be a mere coincidence, but we call attention to the dates and leave others to theorize :—

SYDNEY, NEW SOUTH WALES, MAY 25TH TO 28TH.

We have been favoured by Mr. Cushing with copies of the *Sydney Morning Herald*, of May 29th and 31st, 1889, and from the ample reports therein contained, have drawn up the following *précis* :—

The Rainfall was	At Sydney Observatory	At Windsor Observatory	At Castle Hill Parramatta
Up to 9 a.m. on May 24th, '05 in.	?	?	?
“ “ “ 25th, 2'23 “	?	2'75	2'01
“ “ “ 26th, 4'05 “	2'75	5'65	3'40
“ “ “ 27th, 4'69 “	5'65	12'69	6'82
“ “ “ 28th, 8'36 “	12'69		12'20
“ 10 a.m. “ 28th, '55 “			
Total.....	19'93	21'09	24'43

The greatest hourly fall at Sydney was from midnight on 27th to 1 a.m. on 28th, 2'42 in.

The stations whence large falls are reported seem to be all within 40 miles of Sydney. The totals up to 9 a.m. on 28th were :

Springwood... 16'50 in.	Sydney ... 19'38
Ryde 16'50 “	Windsor ... 21'09
St. Mary's ... 17'73 “	Burwood ... 21'80
Richmond..... 19'12 (12 in. in 24 hours up to 9 a.m., 28th).	Castle Hill. 24'43
Penrith 13'60 (from 1 p.m., 24th, to 1 p.m., 28th).	

RAINSTORMS IN HONG-KONG, MAY 29TH—30TH.

The following details of the disasters occasioned by the recent severe rainstorm in Hong-Kong, which are supplied from information from

Major Wilkinson, of the Royal Engineers, stationed there, will be interesting to many. Writing from Hong-Kong, on 30th May last, this gentleman said they had had unknown disasters there during the last 36 hours, from an unprecedented rainfall. The following he took from special editions :—From 7 a.m. on 29th to 7 a.m. on 30th, 24 inches of rain in 24 hours. From 7 a.m. on 29th to 0.30 p.m. on the 30th, 11.56 inches of rain in $5\frac{1}{2}$ hours. From 0.30 p.m. on 29th to 10.15 a.m. on the 30th, 13.2 inches of rain. Those who know what the usual rainfall is in certain places will appreciate the tale told in these figures. In Norfolk the average rainfall *per annum* is about 29 inches. Nearly two-thirds of this they had had in Hong-Kong in one day. The letter next describes scenes of which the writer was an eye-witness. When he arrived in the town at 9.30 a.m. the rain was coming down in torrents, and they were obliged to have their lamps alight in the office. About 11.30 a.m. the whole road in front of the office was flooded some 12 inches deep, and the flood was rushing through the ground floor towards the sea. The rain stopped, and the waters subsided rapidly. A large landslip had occurred on the Peak Tramway, carrying away a lot of the line, and it was impossible to say what damage had been done, but two months was about the time given to reconstruct the damaged line. The torrents coming down the hills had swept over all channels, and were rushing into a service reservoir about 400 feet above the sea. The reservoir consequently commenced to overflow at once, and the earthen dam outside the masonry retaining wall was washed bodily away. Great fears were entertained that the masonry would not stand, and inhabitants, especially the troops in a certain barrack, were warned to clear out of the valley. Had it burst, their subsequent experience had taught them that their precautions were absurdly inadequate, but luckily it did not burst. In the town large stone water drains were burst up, and down one street there was a wide rapid stream to the sea. In some places the ground had fallen, and huge yawning abysses were to be seen in places, and gas and water-pipes were laid bare. Having been much about all day, the writer retired early to rest, but was soon aroused, about five minutes to two, by a terrific clap of thunder, with a flash of lightning simultaneously, and he had heard that a house within twenty yards of his had been struck. The rest of the night was very much on the same lines. There seemed to be two or three storms raging on the peak for some time, and the flashes were not accompanied by thunder. Mount Kellet, a sharp peak under which he lived, seemed to be the centre of attraction. The roof of his house was leaky like a sieve, the hall was flooded, and at times the servants were shovelling the water out of the door; part of the coolies' quarters at the back had given way, and on examination he found their room minus an end wall, and the side wall bodily cracked. The end wall had gone down a landslip. This landslip also came pretty close to his dressing-

room. Going to look at the reservoir he saw the water flowing over the wall in a wide sheet, like a miniature Niagara.

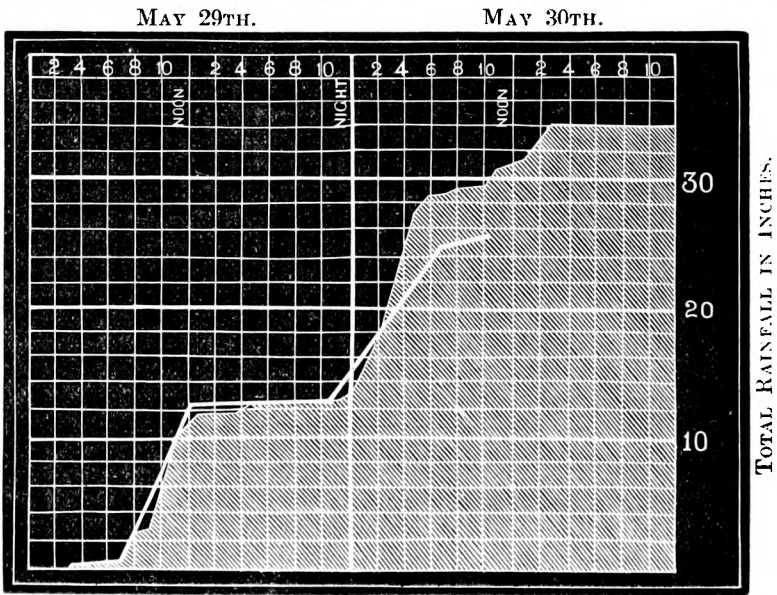
Writing from the same place on June 2nd, the writer gives a fuller description of the havoc caused. At Victoria there were scenes of havoc on all sides, the road nearly impassable in places, but the greatest damage was caused by a stream that came down past the Racket-court and between Murray-barracks and the general's house. This stream would have overflowed if the reservoir had burst. Towards the end of its course it runs in a wide granite block nullah, some 25 feet wide by 10 feet deep. The nullah is crossed by a bridge to carry the Queen's-road, and about 100 yards beyond the Queen's-road the stream discharges into the sea. Enormous quantities of sand were washed down, and a regular delta had been formed at its mouth. Huge rocks were carried down by the stream, and these, jamming against the bridge, dammed it, and the water rose and swept in torrents over the lower part of Murray-barracks, across and along Queen's-road into the North-barracks, and so found its way ultimately to the sea. It required six or eight men to roll over some of the big rocks that were carried down, and there were most likely bigger ones at the bottom of the nullah which they could not yet get clear. In the evening the stream was running over instead of under the bridge, and a large branch of the stream had been diverted by the embankments so as to run through the barracks, the idea being to divert the whole stream through the barracks till they could clear the bed of the nullah. To add to the confusion, a landslide occurred from the hill on which the general's house stands, rendering it unsafe. The damage done in the colony was immense. To see the finest city in the far East wrecked, was indeed sad. The greatest havoc had occurred down a ravine, called Glinealy, the prettiest place in Hong-Kong. Torrents swept down the ravine, breaking away bridges and carrying away roads. Large granite blocks were lying about the roads. The new water supply for Hong-Kong is stored in a large reservoir on the south side of the island, and an aqueduct leads the water through a tunnel and round the hills into the service reservoir mentioned above. Landslips occurred along the aqueduct and carried it away; and for a time the aqueduct, as well as the streams above, were flooding the Happy Valley. Water rushed through the cemetery, carrying away tombstones, bursting down the boundary wall, and spreading itself out on the low-lying ground, where once was a racecourse. The forts had stood the rain fairly well, although a good many of the earth slopes had slipped.

[The above is reprinted from the *Norfolk Chronicle*, because it is the clearest brief account that we have yet seen of the exceptional phenomenon. The article concludes by giving the hourly rainfall at the observatory, which we have also reprinted, adding the total up to the close of each hour :—

Hourly Rainfall at Hong-Kong Observatory.

May 29th.					May 30th.				
	In hour.	Total.			In hour.	Total.			
	in.	in.			in.	in.			
1 a.m.	—	—	.....	1'80	15'41				
2	—	—	.....	2'30	17'71				
3	·08	·08	.....	3'20	20'91				
4	·20	·28	.....	3'40	24'31				
5	·08	·36	.....	3'00	27'31				
6	·14	·50	.....	1'63	28'94				
7	·40	·90	.....	·04	28'98				
8	1'44	2'34	.....	·58	29'56				
9	·46	2'80	.....	·02	29'58				
10	3'07	5'87	.....	·07	29'65				
11	3'35	9'22	.....	1'03	30'68				
Noon	1'27	10'49	.....	·55	31'23				
1 p.m.	1'08	11'57	.....	·55	31'78				
2	—	11'57	.....	1'20	32'98				
3	—	11'57	.....	1'12	34'10				
4	·37	11'94	.....	·01	34'11				
5	·40	12'34	.....	—	34'11				
6	·03	12'37	.....	—	34'11				
7	·02	12'39	.....	—	34'11				
8	·07	12'46	.....	—	34'11				
9	·20	12'66	.....	—	34'11				
10	—	12'66	.....	—	34'11				
11	·11	12'77	.....	—	34'11				
Mid.	·84	13'61	.....	—	34'11				
Total	13'61	13'61		20'50	34'11				

Considering the exceptional nature of this fall, we have prepared a diagram of it, on which will be noticed the records from an ordinary gauge, as quoted in the early part of Major Wilkinson's letter, as well as the above hourly values. It is satisfactory to note their general agreement.—ED.]



ABSOLUTE DROUGHTS AT ORLETON, 1885-1889.

To the Editor of the Meteorological Magazine.

SIR,—Observing in your magazine for this month many references to the long drought of 28 days which broke up here on the 9th of this month, I have looked through my meteorological diary from 1855, and find that, as the following have been the longest droughts that have occurred here in that period ; the recent one is without precedent for 34 years.

Periods of more than 14 days without rain.

Year.	Months.	Days.	Year.	Months.	Days.
1857...	August and September.....	16	1870...	February and March.....	16
1858...	June and July	15	„ ...	September and October.....	21
„ ...	November	18	1871...	May .. .	20
1861...	April	18	„ ...	November and December... 15	
1864...	April and May	16	1874...	April and May	18
„ ...	July	17	„ ...	July	16
„ ...	September	22	1876...	May	17
1865...	June... ..	16	1877...	September and October..... 15	
„ ...	September and October ... 16		1880...	June	17
„ ...	December	17	„ ...	August.....	16
1866...	May	17	1886...	September	15
„ ...	July	18	1887 ..	April	15
1868...	June.....	17	„ ...	June and July	25
„ ...	July and August	17	„ ...	July and August	15
„ ...	September	17	1888...	October	17
1869...	June and July	16	1889...	June and July	28
„ ...	August and September..... 22				

Believe me to be, yours truly, THOS. HENRY DAVIS.

Orleton, Tenbury, July 17th, 1889.

SALT HAILSTONES.

To the Editor of the Meteorological Magazine.

SIR,—In the last number of the *Meteorological Magazine*, the remarkable hailstorm which occurred at Tunbridge Wells and its neighbourhood on Friday, the 7th of June, is mentioned. Some of the hailstones were of the form and size of walnuts, others were like arrow-heads of ice, and the texture of many was similar to what is known as cat's ice. The hailstones were of immense size—the largest measuring four and a half inches in circumference, and being nearly two and a half inches in length.

In the description of the storm in the daily papers, the nature of the hailstones is not mentioned, but this was discovered by a singular incident. Mr. William Rogers, a friend of mine, of Ensfield Farm, Tunbridge, was walking over his farm at the time, accompanied by his dog. The dog seeing the large hailstones hopping about as they fell, ran after them, and began to eat some. This led my friend to taste them, and he found that they all tasted of salt. I thought that the nature of these hailstones was worthy of being recorded. Doubtless the water had been drawn up into the clouds by a water-spout.

J. WEBB.

Bristol, July 19th, 1889.

WATERSPOUTS.

To the Editor of the Meteorological Magazine.

SIR,—A few years ago I had, from Pembroke Dockyard, a notice of a shower of shells having fallen there in a thunder-storm, supposed to have been sucked up from the sea by a whirlwind. I wrote to Capt. Lecky, of Neyland House, to send me some of them, which he kindly did, and I found them to be very young common snail shells, so the mystery was easily explained. There had been a long continuance of dry weather; the snails crept forth in thousands from the extensive grass plots in the works (where ducks are not allowed) to enjoy the rain, which came down heavier than the poor things expected, and so they were drowned. A proof that stories of such-like phenomena require to be taken with a good pinch of salt until they receive reliable explanation. There cannot be a doubt that hay and such light matters have been carried some distance by whirlwinds, tornadoes, or cyclones, and that electrical discharges from the earth were mainly the cause, not only of tornadoes, but of such light matters being raised, or lifted to considerable elevations; but I have always understood that the elevation of water from the sea by a waterspout was a fallacy, and that the appearance of its being so raised was caused by the descending stream of heavy rain, almost, if not entirely, solid water, taking a spiral direction, which it would be compelled to do by atmospheric resistance, the illusion being explained in a popular way, by twirling a common corkscrew in the direction of inserting it into a cork, when the body of the screw assumes an ascending appearance. I take it that a waterspout is occasioned by an abnormal amount of electrical attraction between the cloud and the earth, the cloud being of extreme density, and the electric state of both the cloud and the earth being in extreme tension, the attraction between them being of sufficient strength to elevate the sea-surface into a small "hillock" of water at the place where it meets the descending stream of water from the cloud.

I make these remarks in consequence of the suggestion in your last issue at the end of the account of the "Dorsetshire Waterspout, June 7th," that the body of water "was probably seawater, lifted from the English Channel by a whirlwind and dropped upon the top of High Stoy." I cannot see any occasion for such an idea, even if it were physically possible, and I think this enormous quantity of water can be accounted for otherwise than by reference to the "English Channel."

The extremely dense cloud, or clouds, which doubtless contained many cubic miles of saturated air and dense fog, when concentrated by electrical attraction, and condensed in the usual course of the formation of rain, in such storms, would be doubtless quite sufficient in quantity; or to make it plainer, let us look at it in another form, and suppose these cubic miles of clouds to be filled with snow, and so concentrated; can anyone doubt there being enough to produce such effects, were that quantity of snow converted into water and discharged after the manner of waterspouts.

According to Mr. Glaisher's tables, a cubic foot of saturated air at 75° temperature contains ten grains of water, this gives 93,876 tons of water to the cubic mile. What quantity may be contained in the cube foot of thunder cloud, filled as it would be with solid globules of water in the form of heavy fog, may be left to the imagination of your readers, but I fancy it would be many times the above amount.

ROBT. J. LECKY.

20th July, 1889.

[It is a very fortunate thing for the general advancement of knowledge that the least scrap of theory inserted in these pages is almost invariably pounced down upon by some one.

Greatly to our regret, we have never yet seen a waterspout, so we leave that phenomenon to those who have seen one, and who have studied the subject.

But when Mr. Lecky suggests that whirlwinds lift only light materials, hay, &c., we must meet the suggestion with a protest. Why, we have dozens of photographs of heavy materials lifted and carried far away. Has he forgotten the four-wheeled waggon at Calne, and the roofs at Baldock and at Walmer?

As to the lifting of water, quite recently we were speaking to a gentleman who had actually seen the water lifted out of a pond; and there is the Banbury case, concerning which we reprint* the details.

"Landspouts, like waterspouts, seldom come alone. Whilst the three men threshing beyond Newbottle were looking with astonishment at the phenomenon just described, they saw the water of a pool near Mr. F. Dagley's farmhouse, three-quarters of a mile east of Newbottle (near "Bunting House" of the Ordnance Map), rising in spray above the tops of the trees, and this, the pool itself being hidden by higher ground, they could not have done unless it had risen at least 60 feet. The water fell again a little further north. Three little boys (William Boyles, John Markham, and George Payne) had just taken dinner to the men, who, seeing that a storm was coming on, had sent them back to Charlton as quickly as possible. Just as they passed the pool, the water rose up into the air. Of course they ran away as fast as they could; but in a little while curiosity got the better of fear;—they looked back and saw the water falling again like rain. They thought the pool was half emptied, but the brook runs through it, so that it soon filled again. Mrs. Mitchell, living in a cottage near the school at Charlton, noticed both whirlwinds:—one going towards Newbottle, Spinney; the other, after violently agitating the trees near her house, taking the direction of Mr. Dagley's farm, where after drinking at the pool, it seems to have vanished."

If water be not raised in bulk by whirlwinds, it is not easy to see how the fishes got on to the roofs and into the gutters, and rain water tanks, at Mountain Ash.—ED.]

* From *Met. Mag.* Vol. viii. (1873), p. 168.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JANUARY, 1889.

STATIONS.	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
<i>(Those in italics are South of the Equator.)</i>	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	53·1	31	22·0	7	41·8	32·4	34·4	89	76·8	16·4	·81	10	7·3
Malta	66·0	21	41·1	30	60·0	49·2	47·0	82	113·5	34·9	7·82	24	6·0
<i>Cape of Good Hope</i>	98·3	24	52·0	16	79·8	59·6	...	...	...	...	·08	1	2·0
<i>Mauritius</i>	84·4	2, 14	67·5	10	81·9	73·9	71·0	82	142·3	60·0	12·74	18	7·6
Calcutta	85·6	19	48·6	2	79·6	57·4	58·4	64	140·3	37·4	·16	4	1·1
Bombay	91·2	7	63·8	15	83·6	68·9	64·9	69	137·5	50·3	·00	0	0·5
Ceylon, Colombo	92·0	22	67·3	10	88·0	72·3	71·0	78	148·0	63·0	5·78	7	3·6
<i>Melbourne</i>	99·2	23	49·7	5	77·6	58·9	56·0	68	146·1	43·5	4·22	11	5·7
<i>Adelaide</i>	109·0	12	54·1	7	86·0	64·5	52·8	46	170·7	44·9	2·98	8	4·7
<i>Wellington</i>	80·0	24	52·0	21	70·6	57·0	55·6	77	139·0	42·0	2·24	9	4·0
<i>Auckland</i>	82·0	16	51·0	3	76·0	59·6	57·1	68	142·0	41·0	·64	5	3·5
Jamaica, Kingston	92·1	24	64·8	27	88·5	68·6	68·1	74	...	...	1·70	...	...
Trinidad	92·0	29	60·0	19	88·6	65·2	71·3	82	155·0	56·0	·94	...	...
Toronto	46·5	17	— 0·7	29	33·9	21·4	24·2	82	...	— 9·6	3·47	18	7·3
New Brunswick, Fredericton	46·9	10a	— 19·0	31	28·5	10·9	19·0	76	...	...	3·24	12	5·6
Manitoba, Winnipeg ...	38·2	2	— 36·8	18	15·6	— 5·1	9·0	94	...	...	1·51	14	6·4
British Columbia, Victoria	52·0	3, 4	24·0	14	44·6	33·1	...	...	...	...	2·84	14	...

a And 17.

REMARKS, JANUARY, 1889.

MALTA.—Mean temp. 53°·8; mean hourly velocity of wind 10·7 miles. Sea temp. fell from 62°·5 to 60°·0. TSS on 5 days; days with rain double the average; R more than double the average. J. SCOLES.

Mauritius.—Mean temp. of air 0°·9 below, of dew point 1°·3 above, and R 5·92 in. above, their respective averages. Mean hourly velocity of wind 10·1 miles, or 1·2 below average; extremes 24·7 on 4th and 2·2 on 9th. Prevailing direction, S.E. by E. T and L on 5 days. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·4, of dew point 3°·1, humidity 4, amount of cloud 0·6, and R 2·46 in. above their respective averages. Prevailing winds S. and S.W.; strong on 9 days. T, L on the 1st; L on 4th and 27th; T on 13th and 24th; heavy R on 1st, 2nd, and 3rd. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure ·049 in. above the average; mean temp. 0°·6 above average. On the 1st the long continued drought broke and heavy R (two to six inches) fell over the colony generally, commencing in the far north and extreme west on the 31st December. C. TODD, F.R.S.

Wellington.—Fine up to the 8th (excepting the night of 5th), with very strong N.W. wind. Showery during the middle of the month, with moderate wind. The latter part very fine until 30th, when heavy R fell. Prevailing wind N.W. L on 6th, 7th, and 17th. Mean temp. 1°·2 above average; R 1·26 in. below average. R. B. GORE.

Auckland.—Fine, hot, and dry throughout the month, the total R being less than one quarter of the average. Mean temp. slightly above the average; pressure considerably above. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
 JULY, 1889.

[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 Hall.	1·31	XI.	Castle Malgwyn	2·19
„	Margate, Birchington...	2·88	„	Rhayader, Nantgwillt..	5·35
„	Littlehampton	2·56	„	Carno, Tybrith	3·82
„	Hailsham	3·90	„	Corwen, Rhug	1·90
„	Ryde, Thornbrough	2·36	„	Port Madoc	3·27
„	Alton, Ashdell.....	1·80	„	I. of Man, Douglas	2·53
III.	Oxford, Magdalen Col...	2·69	XII.	Stoneykirk, Ardwell Ho.	2·91
„	Banbury, Bloxham	2·03	„	New Galloway, Glenlee	5·06
„	Northampton	2·91	„	Melrose, Abbey Gate...	4·86
„	Cambridge, Beech Ho...	4·52	XIII.	N. Esk Res. [Penicuik]	4·30
„	Wisbech, Bank House..	2·82	XIV.	Ballantrae, Glendrishaig	3·07
IV.	Southend	2·21	„	Glasgow, Queen's Park.	1·95
„	Harlow, Sheering ..	1·88	XV.	Islay, Gruinart School..	1·67
„	Rendlesham Hall	2·59	XVI.	Dollar.....	1·77
„	Diss	2·61	„	St. Andrews, Pilmour Cot	2·82
„	Swaffham	2·19	„	Balquhider, Stronvar..	1·78
V.	Salisbury, Alderbury...	2·41	„	Dunkeld, Inver Braan..	3·67
„	Warminster	2·49	„	Dalnaspidal H.R.S. ...	2·73
„	Bishop's Cannings	4·25	XVII.	Keith H.R.S.	3·41
„	Ashburton, Holne Vic....	...	„	Forres H.R.S.	1·46
„	Hatherleigh, Winsford.	...	XVIII.	Strome Ferry H.R.S....	1·07
„	Lymouth, Glenthorne.	1·85	„	Fearn, Lower Pitkerrie.	1·27
„	Probus, Lamellyn	3·59	„	Loch Shiel, Glenaladale	1·80
„	Launceston, S. Petherwin	4·80	„	N. Uist. Loch Maddy ...	·72
„	Wincanton, Stowell Rec.	3·46	„	Invergarry	1·24
„	Taunton, Lydeard Ho...	2·65	„	Loch Ness, Drumnadrochit	1·79
„	Wells, Westbury	2·73	XIX.	Lairg H.R.S.	2·10
VI.	Bristol, Clifton	4·43	„	Forsinard H.R.S. ....	..
„	Ross	2·27	„	Watten H.R.S.	2·05
„	Wem, Clive Vicarage ...	2·85	XX.	Dunmanway, Coolkelure	1·67
„	Cheadle, The Heath Ho.	2·75	„	Fermoy, Gas Works ...	1·36
„	Worcester, Diglis Lock	1·73	„	Tipperary, Henry Street	2·06
„	Coventry, Coundon	1·51	„	Limerick, Kilcornan ...	2·44
VII.	Ketton Hall [Stamford]	1·60	„	Miltown Malbay	3·77
„	Grantham, Stainby	1·83	XXI.	Gorey, Courtown House	2·57
„	Horncastle, Bucknall ...	1·41	„	Navan, Balrath	·99
„	Mansfield, St. John's St.	3·14	„	Mullingar, Belvedere...	2·62
VIII.	Neston, Hinderton	3·56	„	Athlone, Twyford	2·19
„	Knutsford, Heathside ...	4·39	„	Longford, Currygrane...	2·40
„	Lancaster, South Road.	2·87	XXII.	Galway, Queen's Coll...	2·65
„	Broughton-in-Furness ..	3·16	„	Clifden, Kylemore	4·93
IX.	Wakefield Prison	1·18	„	Crossmolina, Enniscoe..	1·78
„	Ripon, Mickley	2·46	„	Collooney, Markree Obs.	2·51
„	Scarborough, West Bank	2·98	„	Ballinamore, Lawderdale	...
„	East Layton [Darlington]	2·08	XXIII.	Warrenpoint	2·46
„	Middleton, Mickleton...	2·52	„	Seaforde	3·58
X.	Haltwhistle, Unthank..	4·28	„	Belfast, New Barnsley..	...
„	Shap, Copy Hill	3·46	„	Bushmills, Dundarave...	3·77
XI.	Llanfrechfa Grange	3·77	„	Stewartstown	3·94
„	Llandovery	3·50	„	Buncrana	3·26

JULY, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE								(No. of Nights below 32°)
		Total Fall.	Difference from average. 1870-9	Greatest Fall in 24 hours.		Days on which -01 or more fell.	Max		Min.		In shade.	On grass.			
				Dpth.	Date.		Deg.	Date.	Deg.	Date.					
inches	inches.	in.				Deg.	Date	Deg.	Date.						
I.	London (Camden Square) ...	2·64	+	17	86	21	17	80·9	5	46·1	19	0	0		
II.	Maidstone (Hunton Court)...	2·36	+	32	50	16	16	...	...	...	...	...	...
	Strathfield Turgiss	2·19	—	11	55	21	20	79·0	6, 30	44·9	24	0	0		
III.	Hitchin	4·30	+	1·60	2·10	12	15	74·0	6, 30	46·0	18	0	0		
	Winslow (Addington)	2·74	+	14	51	13	14	80·0	6, 30	41·0	19	0	0		
IV.	Bury St. Edmunds (Culford) ...	...	...	...	...	...	...	...	...	...	...	...	...
	Norwich (Cossey)	3·10	+	35	77	21	15	78·0	1	44·0	24	0	0		
V.	Weymouth (Langton Herring) ...	2·18	...	...	51	10	15	74·0	12	48·0	17b	0	0
	Barnstaple	3·44	—	11	1·08	8	15	77·5	6	48·0	2	0	0		
	Bodmin	3·87	+	43	91	8	17	...	...	...	...	...	...
VI.	Stroud (Upfield)	4·04	+	1·20	2·38	13	16	81·0	6a	53·0	24	0	0		
	Church Stretton (Woolstaston) ...	3·68	+	65	1·13	13	16	76·5	6	45·0	19	0	0		
	Tenbury (Orleton)	2·22	—	69	68	13	12	80·8	6	37·0	19	0	0		
VII.	Leicester (Barkby)	1·89	—	85	49	13	19	85·0	6	37·0	16	0	0		
	Boston	1·69	—	84	70	13	11	90·0	5	43·0	8	0	0		
	Hesley Hall [Tickhill]	1·71	...	...	43	10	14	81·0	31	40·0	24	0	0
VIII.	Manchester (Plymouth Grove) ...	3·14	—	56	64	21	17	81·0	30	42·0	7	0	0		
IX.	Wetherby (Ribston Hall) ...	1·59	—	1·02	32	25	9	...	...	...	...	...	...
	Skipton (Arncliffe)	3·97	—	98	73	24	16	83·0	6	36·0	8	0	0		
	Hull (People's Park)	1·38	—	1·44	32	9, 10	14	...	...	...	...	...	...
X.	North Shields	2·88	+	33	61	25	15	78·5	6	41·5	8	0	0		
	Borrowdale (Seathwaite)	5·78	—	2·99	1·13	24	15	...	...	...	...	...	...
XI.	Cardiff (Ely)	4·23	+	41	1·03	9	14	...	...	...	...	...	...
	Haverfordwest	2·62	—	1·31	56	9	13	77·0	31	45·3	11	0	0		
	Plinlimmon (Cwmsymlog) ...	4·24	...	...	80	13	12	...	...	...	...	...	...
	Llandudno	1·91	—	80	50	23	12	78·6	31	45·7	24	0	0		
XII.	Cargen [Dumfries]	3·76	+	63	98	10	14	76·8	31	39·0	8	0	0		
	Jedburgh (Sunnyside)	3·86	+	93	93	10	15	77·0	31	40·0	9, 24	0	0		
XIV.	Old Cumnock	3·12	+	02	87	10	16	81·0	31	33·0	7	0	0		
XV.	Lochgilhead (Kilmory)	·92	—	3·62	28	24	11	...	...	...	...	...	...
	Oban (Craigvarren)	1·27	...	...	39	10	12	75·2	4	46·6	18	0	0
	Mull (Quinish)	1·62	...	...	47	24	16	...	...	...	...	...	...
XVI.	Loch Leven Sluices	2·00	—	1·05	50	11	7	...	...	...	...	...	...
	Dundee (Eastern Necropolis) ...	2·55	—	24	1·05	24	10	77·1	6	38·9	18	0	0		
XVII.	Braemar	1·77	—	1·09	65	24	16	76·0	4	36·0	24	0	0		
	Aberdeen (Cranford)	3·41	...	...	73	15	19	70·0	30	40·0	23	0	0
XVIII.	Lochbroom	1·27	...	...	32	16	12	...	...	...	...	...	...
	Culloden	1·57	—	1·21	...	...	...	78·0	31	41·0	3	0	0
XIX.	Dunrobin	1·34	...	...	38	19	10	68·5	31	40·0	12	0	0
	S. Ronaldsay (Roeberry)	1·05	—	1·56	34	7	11	65·0	30	43·0	12	0	0		
XX.	Cork (Blackrock)	1·54	—	1·30	47	22	8	80·0	1	42·0	12	0	0		
	Dromore Castle	2·20	...	...	47	24	13	76·0	17	44·0	16	0	0
	Waterford (Brook Lodge) ...	2·42	...	...	58	19	15	78·0	6	43·0	11	0	0
	O'Briensbridge (Ross)	2·26	...	...	74	24	13	77·0	4	48·0	27	0	0
XXI.	Carlow (Browne's Hill)	2·09	—	47	47	16	14	...	...	...	...	...	...
	Dublin (Fitz William Square) ...	2·57	+	15	62	22	15	77·8	6	44·0	8	0	0		
XXII.	Ballinasloe	1·91	—	97	45	24	11	71·0	2, 3	38·0	7	0	0		
XXIII.	Waringstown	3·82	+	24	1·55	10	15	81·0	6	39·0	7	0	0		
	Londonderry (Creggan Res.) ..	3·33	...	...	86	10	19	...	...	...	...	...	...
	Omagh (Edenfel)	2·69	—	56	62	10	17	74·0	6	41·0	7	0	0		

a And 29, 30. b And 22.

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

METEOROLOGICAL NOTES ON JULY, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—TSS on 21st and 23rd. T on 26th.

ADDINGTON.—The early part of the month was very fine, but R began on the 9th, and the showery weather which continued until nearly the end made the securing of the hay crop very tedious. R was, however, much needed, and of great benefit to both grain and root crops as well as meadow land. Frequent T and heavy R at times.

LANGTON HERRING.—R 10 in. below the average. Mean temp. nearly equal to the average of 17 years. From June 14th to July 6th no R fell, giving an absolute drought of 22 days.

UPFIELD, STROUD.—Severe TS with heavy R from 3.30 to 5.30 p.m. on 13th; two trees struck by L within a mile.

WOOLSTASTON.—The long period of dry weather broke up on the 8th, and the remainder of the month was showery, R falling very heavily on 13th. TS on 23rd. Mean temp. 58° 4.

ORLETON.—The first 6 days were warm and dry, with a temp. above the average; from the 7th to the 29th there was generally much cloud during the days and the nights were clear and cold. It became warm again on the 30th, but the mean temp. was about 2° 3 below the average of 28 years, and was lower only in 1862, 1879, 1883 and 1888. The long drought (28 days without measurable rain) broke up on the 9th, and there were frequent falls of steady R after, with distant T occasionally, but no heavy storms. Distant T was heard on the 11th, 13th, 17th, 21st and 23rd. The bar. was very steady during the month, but below the average.

BARKBY.—Corn harvest just beginning at the end of the month. Hay harvest not completed in parts. Agricultural matters very fairly promising. T on 7 days.

WALES.

HAVERFORDWEST.—The first seven days, fine, dry and warm; from the 8th to 12th wet and showery; very close from the 12th to the 18th; cooler, but fine and dry with bright sunshine from the 19th till towards the end of the month, and the last three days warm, especially the 31st, which so far was the warmest day of the present summer. All crops look well, particularly oats and barley, but owing to the small R, potatoes and turnips are rather a failure as regards quantity. Temp. about the average; wind mostly N. and N.W., with some days S.W. to S.S.E. On the whole a fine summer month; temp. at or above 70° on 10 days. No T or L.

SCOTLAND.

CARGEN.—With the exception of a few warm days at the commencement and end of the month the temp. was unusually low, the mean from the 7th to the 25th inclusive being only 53° 1 or about 1° above the mean temp. of Sept., and the mean for the month 2° 1 below the average. The heaviest falls of R were generally accompanied by T, and were very partial. In the district 4·00 in. of R was reported to have fallen in less than two hours on the 11th near Thornhill, 14 miles N. of Dumfries. TSS on 10th, 13th and 16th.

JEDBURGH.—The weather was all that could be desired by almost everyone. The R in the early days of the month was of singular importance to cereal and root crops, which were in excellent condition at the close. The grain cutting promises to be fully a fortnight earlier than last year.

CRAIGVARREN, OBAN.—The drought continued throughout the month, accompanied by bright sunshine; the little grass was burnt up, and most of

the wells believed to be constant, failed. Such a drought has not been known here before, as the finest weather usually breaks in July. Hot easterly winds prevailed at the close of the month.

QUINISH, MULL.—A hot, dry month with much sunshine. Great scarcity of water in the Hebrides generally, owing to the long-continued drought.

LOCHBROOM.—The last three months were probably the driest consecutive three that have occurred during the last half century. It is now beginning to tell most disastrously on the crops, and especially on the grazing. Some turnip fields actually have not yet sprouted, while those sown very early are looking well.

CULLODEN, INVERNESS.—A fine month, but R much needed. Turnip crop very poor.

DUNROBIN.—A very dry month; pastures in most cases very much dried up. Hay crop light and secured earlier than in any season for the last 20 years.

ROEBERRY.—A very fine month throughout, with a small R.

IRELAND.

CORK.—A very fine month, with the exception of a few overcast days and distant T on the 13th. R 1.16 in. less than the average of 24 years.

WATERFORD.—R .57 in. below the average; mean temp. 58°·6.

ROSS.—The fine weather of June continued to the 11th of July, then some much-needed R fell in frequent light showers till the 24th, when there was a good fall of nearly three-quarters of an inch. The month closed with splendid harvest weather.

DUBLIN.—Warm and fine at the beginning and close, this month, on the whole, proved changeable, showery, and cool, with a great preponderance of N. W. winds. On the whole, the weather was favourable, from both a sanitary and an agricultural point of view. High winds on eight days, moderate gale on the 21st and 27th. Temp. reached 70° in screen on three days. The drought of June continued up to 6th of this month.

EDENFEL, OMAGH.—The drought which commenced on June 15th continued absolute until the 7th inst., lasting 22 days, thus covering a longer period than has been before recorded in the 25 years during which observations have been taken here. The remainder of the month was generally fresh and cool, with occasional heavy R, proving of the utmost benefit to grass and green crops, and not sufficiently persistent to impede the hay harvest. A slight frost occurred on the 7th, blackening the potato tops in low and damp situations.

EXCEPTIONAL RAINFALL, JULY 13TH, 1889.

To the Editor of the Meteorological Magazine.

SIR,—Before a carefully-observed torrential rainfall here passes into oblivion—as did a similar one 17 years ago, which I did not know then was so extraordinary—please note that on Saturday last, July 13th, between 4.35 and 5.40 p.m., 3.65 inches of rain fell here during a thunderstorm. I carefully measured and weighed it as a check at the time. The rainfall day gave 3.83 inches. I see that 3.65 in. in 65 minutes just makes your curve of extremes in *British Rainfall*, 1887, p. 134, complete.—Yours truly,

T. H. G. NEWTON.

Barrells, Henley-in-Arden, 17th July, 1889.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

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ANOTHER EXTRAORDINARY RAIN IN ESSEX.

Up to the present year, among all the thousands of rain records which have passed through our hands, one fact has remained. No very exceptional fall, such as, in ordinary localities, 4 inches in one day, has ever occurred twice at any one station. But the following letters prove that the rule is broken, though evidently the writers do not fully realise the exceptional nature of what they have recorded. The facts are so unprecedented that we must put them before our readers in the very clearest way—especially noteworthy are they, as occurring at two stations where the average annual rainfall is under 24 inches—almost the driest part of the British Isles.

1888, AUGUST 1ST.		1889, SEPTEMBER 2ND.
Romford, North Ockendon	4·56 besides what ran over.	4·55
„ Upminster Hall	4·50 „ „ „	4·32

We commend these figures to the consideration of those who (because they have themselves never measured two inches for one day) insist that a gauge which will hold two or three inches is large enough; it is not.

The damage by lightning was nearly as exceptional as the rain, but our readers will remember that all thunderstorm data go to the Royal Meteorological Society.

To the Editor of the Meteorological Magazine.

SIR,—The storm of August 1, 1888, with rainfall exceeding 4·56 inches, was almost repeated last night. The lightning was most vivid, varying from large sheets to zigzag serpents falling perpendicularly to the earth, at intervals almost continuously.

The thunder was terrific. The rainfall was scarcely more than a few drops till 9 p.m., when a downpour of varying volume began, so that by 11.15 p.m. 1·55 inches had fallen, which was increased to 4·55 inches by 5.15 this morning, at which time rain and thunder ceased. The storm came from S.E. and appeared to circle round this neighbourhood. The only damage at present reported here is a hay-

stack and a barn struck and burnt at 11 o'clock last night.—Yours faithfully,

ROBERT T. CRAWLEY.

North Ockendon Rectory, Romford, 3rd September, 1889.

SIR,—It may interest you to know that the rainfall in the series of storms lasting from 9 p.m. 2nd until 5 a.m. 3rd was 4.32 in. The lightning was as bad as the storm last year, but the rain not so continuous. Brentwood seems to have caught it, but there was no water out in the Romford district. The damage to cattle is great. The minimum temperature was 59° Far. I think that a great deal of rain splashed out, as the drops were very large.—Yours faithfully,
G. P. HOPE.

Upminster Hall, Essex, 3rd September, 1889.

TWO SHROPSHIRE WHIRLWINDS, AUGUST 21ST.

We have been favoured with several cuttings relative to whirlwinds in North Shropshire on August 21st, and as one of them passed over property belonging to one of our correspondents, we have, in addition to the newspaper statements, the agent's report as to the damage.

We have headed this article "Two whirlwinds," but, as will presently appear, it is possible that it was two manifestations of one. Both occurred in the Northern half of Shropshire. The earliest observation of the first was at Pentre in Lat. 52° 44' N., and Lon. 2° 56' W., and it was last seen in 52° 47' N., and 2° 53' W., having travelled about 3½ miles from S.W. to N.E.—its precise mean direction was N. 32 E.

The following reports are from the *Oswestry and Border Counties Advertiser*.

"Our Nescliff correspondent writes.—On Wednesday about 1.45 p.m., the inhabitants of this neighbourhood were alarmed by the extraordinary roaring noise accompanying a very dark and heavy cloud which was approaching from the direction of Melverley. It passed over the Pentre, doing comparatively little damage beyond scattering the fields with boughs of trees. It next passed over Mr. John Green's at Wilcot, making the sheds and barns rattle, then down one of that gentlemen's wheat fields, laying low all the mows in the line of direction, which was about 70 yards wide, through a small coppice, lopping the top off most of the trees, and then made for Hopton, leaving the "Old Three Pigeons" on its right, and the Prill on its left. The first place to show signs that something very unusual was happening was Mr. Wilding's buildings, where the ridge tiles were all blown off, also the slates for nearly a yard on each side of the building. In a field to the left stood an ash tree, whose slender top, measuring about four yards in length, was snapped

off and carried over the top of Hopton Hill. At the Quarry House 10 plum trees were uprooted, and an apple tree was blown on to the roof of the next house, Mr. Bowker's, making a great hole therein. Every garden in Hopton, between Nescliff Hill and Mrs. Suckley's, was strewn all over with fallen apple trees, plum trees, walnut trees, and the branches of elm, oak and ash trees, carried from trees in the hedges and fields. The cyclone now swept up the bare face of Hopton Hill, and leaving untouched a distance of about 50 yards, descended with renewed force upon a coppice at the back of the hill, belonging to Mr. Lloyd, the Knolls, where between 100 and 150 trees, mostly larch, well-grown, and measuring from one to three feet in circumference, were torn up by the roots. The last heard of it was at Queen's Court, between Little Ness and Ruyton-xi-Towns, where more trees were blown down. Close by, Dr. Burrell and a lady in a trap were sheltering under an oak tree, when a bough came crashing down and smashed the shafts, besides doing other damage. In a most remarkable manner the occupants of the trap escaped with a fright and a shaking. A gentleman from Yorkshire, staying at Hopton, says the whole thing lasted only two or three minutes, and during that time the air was full of leaves, birds and branches, all being whirled around, and finally disappearing over Hopton Hill. The direction was from south-west to north-east."

"Another correspondent writes:—On Wednesday afternoon a cyclone passed through the neighbourhood of Hopton, near Nescliff and Valeswood, near Ruyton. It came on suddenly with a great roar, and appeared like a white vapour. At Mr. Bowker's, of Hopton, it tore the boughs of several trees and scattered some of them a distance of about 30 yards. The cyclone passed from there to Hopton Hill, where it uprooted nearly 200 trees and tore the tops off many others. In several gardens near the hill it uprooted fruit trees. The cyclone passed on over the cliff in Valeswood, and again tore the tops off trees. Dr. Burrell and Mrs. Pollard of Ruyton-xi-Towns were passing by Valeswood in a trap at the time, when a bough of a tree fell upon them, breaking the trap and slightly injuring Mrs. Pollard, the doctor escaping unhurt. The cyclone passed on to the New Mills, Ruyton, where it expended itself. It there carried a sheep trough about seven yards, and carried a door mat into the air a distance of about 30 feet."

The second whirlwind is first reported from a farm known as Waterloo, in Lat. $52^{\circ}53'$ N. and Lon. $2^{\circ}45'$ W., or about 9 miles N 37° E. of where the previous one disappeared, and is said to have expended itself at Tilstock Park in Lat. $52^{\circ}56'$ N. and Lon. $2^{\circ}42'$ W., after a path of $3\frac{1}{2}$ miles with a mean direction of N. 37° E. It will be noticed that *débris* is said to have been carried over Whitchurch, which is 6 miles N. 31° E. of Waterloo.

"On Wednesday afternoon the neighbourhood of Whixall was visited by a great whirlwind, and very considerable damage has been

done to property and crops. The inhabitants agree in the description they give of the phenomenon. Without any warning, the cyclone came on with a great roar, which for the time drowned all ordinary sounds, as if it were the rush of a large body of water ; and an intense feeling of terror was created. This sound lasted about five minutes, and in that short space of time trees were uprooted and stripped of their branches, haystacks were bodily displaced, houses were partially unroofed, and barns and outbuildings were demolished. The cyclone appears to have originated at Mr. Sherwood's, of Waterloo, where many plum and other trees were uprooted. It then went over the canal, past Bostock Hall, and on to Whixall Hall, which suffered most. There Mr. William Sutton, of Rose Cottage, Whixall, brother-in-law to Mr. Darlington, the occupier of the hall, had a very narrow escape. He states that he was blown across a large yard just outside the hall, and a heavy stone crest, which was torn off the upper part of the hall, with some tiles, struck him on the side of the head. He was just able to avoid it falling directly upon his head by a sudden movement, and he escaped with a deep cut over his ear. He is now confined to his room and under medical treatment. Part of his property also suffered. Mr. Darlington and his family saw from within, great branches of trees torn off and carried away. Some part of a large beech tree was carried 150 yards, crashing up against the strong walls of the hall. A big dog kennel and dog went away in the wind a distance of some twenty yards. Orchards, gardens, cornfields, and the land around the hall were strewn all over with branches, hay, straw, slates, and various missiles ; and Mr. Darlington is at present unable to estimate his loss, which must be very considerable. A large farmstead, half a mile from Whixall Hall, and occupied by Mr. Fowles, was also greatly damaged, and it was there evident that the cyclone had a peculiar deviation in its course, for a range of outbuildings which might have been thought to be in the greatest danger remain as before, while structures on the opposite side were swept away. Uprooted trees and branches and *débris* indicate clearly that the cyclone passed directly over several country residences, whose occupants were in indescribable dread of being carried away. The cyclone took a westerly course—[No ; from S.W.—*Ed. M.M.*]—about three and a half miles in length and 150 yards in width, expending itself at Tilstock Park, four miles from Whitchurch. It first appeared like a great white mass of vapour. An idea may be conceived of its tremendous force from the fact, which is stated by eyewitnesses, that portions of trees and quantities of hay and straw were carried over the outskirts of Whitchurch. Large numbers of people from various parts visited the district on Friday. A Canadian gentleman who happened to be on a visit to the district and who has witnessed cyclones in America, declares that this is of a precisely similar description, though inferior in extent and velocity."

The letter from Mr. Tayleur's agent is chiefly confirmatory, but we quote two sentences.

"The tenant's [of Whixall Hall] wife and daughter, heard a rushing sound and saw a white silvery mist approaching the house."

"It blew all the haystacks over, carried a dog and its kennel many yards, removed a big horse trough no one knows where, carried corn away by its roots, and tore many trees down. It seems to have devastated about 50 yards wide."

SUMMARY.

If we join Pentre and Whitchurch by a straight line it will be 18 miles long, and have a direction of N.37°E.; the first track occupies the first $3\frac{1}{2}$ miles of this line, and no damage is reported a quarter of a mile laterally from the straight line. There are then nine miles without a record, followed by the second track, which makes a slight eastward bend, but is never $\frac{3}{4}$ of a mile from the straight line, and which returns actually on to it. The path in the earlier part is said to have been about 70 yards wide, and in the latter part, by the reporter, 150 yards wide, by Mr. Mainwaring 50 yards.

All these points of agreement lead us to infer that it was two manifestations of one phenomenon.

BATCOMBE WATERSPOUT.

To the Editor of the Meteorological Magazine.

SIR—The other day I met a lady who knows Batcombe well, and she said that she distinctly remembered having seen, a few years ago, a large waterspout carried up from the sea, with one of its spouts dangling over Batcombe Hill. On that occasion it did not burst, but was eventually drawn up into the clouds.—Yours truly,

H. J. POOLE.

Stowell Rectory, Sherborne, 22nd Aug., 1888.

SIR,—I think you mistake the object of my letter, which was not to deny the power of the wind, whatever form its force may assume, whether direct or in whirls, but to show, according to my ideas, that the waterspout could be as easily accounted for by ordinary natural causes, as that it "was sea water lifted from the English Channel by a whirlwind." It was reading the most interesting report of this waterspout (pp. 84-5), that led me to calculate the actual quantity of water contained in such heavy clouds; and I must acknowledge that the amount was a surprise to me. If there be 10 grains in a foot of saturated air, we may very well suppose that a foot of heavy thunder-cloud would contain a very much larger quantity, and this again increased many, many fold by electrical attraction and consequent concentration prior to discharge.

I have lived long enough to know the danger of denouncing, prior to proof, any hypothesis, however absurd it may at first sight appear, *e.g.*, I would not deny M. Faye's ideas, little as I believe in them, of his colliding aerial cones being the cause of tornadoes, but I prefer the simpler one of electrical discharges, or currents. So in this case. When we take into consideration the enormous mass of water required to dig holes 8 feet deep in High Stoy, and to do all the damage reported from Batcombe and there away, it is all the better to account for its advent from the clouds, rather than from the English Channel.

From what I have seen, read, or heard of thunderstorms, tornadoes, whirlwinds, *et hoc genus omne*, they all appear to me to arise from one great cause, viz., the existence of two vast accumulations of electricity of opposite kinds: one in the earth, the other in the atmosphere. One of these being induced by the other; and that the current arising from the interchange, or mixing of these accumulations, under various atmospheric and mundane conditions, is the cause of the variety of forms assumed by these different phenomena. The first cause of these accumulations is and has ever been a puzzle to the best electricians, but much is being done to clear up the difficulty, *e.g.*, the interesting observations and experiments made on Teneriffe by the Hon. Ralph Abercromby, together with those at Greenwich, Kew, and elsewhere. You are wrong in using the word "only" with respect to what I said in my last letter, for I think all your examples of whirlwinds, and their atrocities, are explicable by the theory of electric currents, which as surely exist, in the ordinary course of nature, as do those of water or wind.

ROBT. J. LECKY.

August 23rd.

SALT HAILSTONES.

To the Editor of the Meteorological Magazine.

SIR,—Mr. Webb gives in your last issue a circumstantial and interesting account of salt hailstones having falling on the 7th of last June at Mr. Rogers' farm near Tunbridge, and his suggestion of their being caused by salt water, "drawn up into the clouds by a waterspout," was so much in accord with the idea of the whirl of salt water on High Stoy, that I asked a gentleman at Tunbridge Wells if he could ascertain the facts of such an extraordinary occurrence. He luckily is acquainted with Mr. Rogers and writes me that "Mr. Rogers seemed greatly surprised and amused at his remark as to the saltish taste of the hailstones having been taken seriously. He says that on coming home he told his people that he fancied it had a saltish taste, but he is by no means sure that it really was salt; he only just fancied it." He thinks that there must have been some exaggeration arising out of his ladies' correspondence with Bristol.

My friend also states that the hailstones which fell at his place, near to Tunbridge Wells, were the largest he had ever seen, some being a little over one inch in diameter and a little under half an inch in thickness ; he did not see any resembling walnuts. He goes on to say that he brought a number of the largest into the house, and the thermometer being 80° and the air very sultry, he found a few of them very refreshing, and that he certainly did not perceive any saline taste. Some of his friends also give him exactly the same experiences.

I fear, therefore, that this interesting story must go in the same category as the Pembroke Dock snail shells, and that it certainly wants, both mentally and physically, "a good pinch of salt."

ROBT. J. LECKY.

August 31st, 1889.

[Being desirous of economizing time and space, we sent a proof of the above to Mr. Webb and have received the following reply, with which we think that the discussion should close.—ED. *M. M.*]

To the Editor of the Meteorological Magazine.

SIR,—In reply to Mr. Lecky, I beg to state that Miss Rogers in her letter describing the damage done by the hailstones during the storm, says, "Father was at Haysden, he had Ben (the dog) with him ; when it saw the hail jumping about it began eating it, so Father thought he would taste it, and he said it was *very salt*."

The italics are mine. Mr. Rogers is too conscientious a gentleman to exaggerate in the least degree ; I believe his statement "very salt" is correct. It appears to me that the visitor sent by Mr. Lecky endeavoured to make some impression upon the mind of Mr. Rogers, with the object of leading him to think that his sense of taste had deceived him.

The visit of Mr. Lecky's friend reminds me of an historical fact. Galileo discovered the satellites of the planet Jupiter. But Galileo had visitors who endeavoured to persuade him to believe that his sense of eyesight deceived him. Nevertheless, they could not blot out Galileo's moons from the skies.

With regard to the form and size of the hailstones mentioned in my letter I obtained the information from the *Standard*, which gave an account of them, as seen by observers who resided in the districts over which the storm passed.

J. WEBB.

September 9th, 1889.

ERRATA IN METEOROLOGICAL MAGAZINE, 1888.

REGULAR TABLE.

Leicester, February	<i>should be</i> 1'39	Jedburgh, March	<i>should be</i> 1'98
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SUPPLEMENTARY TABLE.

Birchington, June ...	<i>should be</i> 1'75	Ardwell Ho., Nov.	<i>should be</i> 3'76
Lancaster, February	„ 1'38	Galway, July	„ 4'14
Llanfrehfa, April ...	„ 1'63		

THE OAK AND THE ASH.

To the Editor of the Meteorological Magazine.

SIR,—I was much interested in the article on the "Oak and Ash" in this month's *Met. Mag.* I have studied the subject myself for some years, and have long ago abandoned the idea of any truth in the theory; at the same time there are coincidences which certainly go some way for giving it a foundation.

My idea is that the Oak is much more influenced by the seasons than the Ash. The former in an early spring opens its leaves early; the latter has little variation in its time of leafing. Now, some of our wettest summers (*e.g.*, 1860, 1879, and 1888) have been preceded by cold, late springs. Hence the Oak has been late and has leafed sufficiently near the Ash that in isolated cases no doubt the Ash leaves have appeared first.

On the other hand, some of our hottest summers (*e.g.*, 1846, 1859, 1868, and 1884) have been preceded by warm, early springs, bringing the Oak into leaf exceptionally early, leaving the Ash to leaf at its usual time.

I have only noted dates of the leafing of trees for the past 9 years, but that is sufficient to bear out my statement. I have noted the date of "first leaf" of each tree, and afterwards the date of "full leaf," *i.e.*, when trees of each class are in their full foilage without exception. If we take a mean between these two dates we find the trees at a stage which would commonly be called "leafing," and the dates at foot are such intermediate dates.

Phenomena.	1881	1882	1883	1884	1885	1886	1887	1888	1889	Mean of 9 years.
Leafing of oak {	May 13	April 20	May 12	May 2	May 14	May 14	May 29	May 27	May 17	May 13
Leafing of ash {	May 19	May 11	May 17	May 17	May 16	May 21	May 31	May 26	May 25	May 20
Days oak leafed before ash ...	6	21	5	15	2	7	2	...	8	7
Days ash leafed before oak ...	...	...	...	...	...	...	...	1	...	...

The two earliest springs of the period were 1882 and 1884. Had the former been followed by a dry summer, it would have gone far in support of the theory that the oak leafing before the ash foretells a dry summer. This single instance upsets it, but confirms my view that the whole depends upon the character of the spring, early springs being more usually followed by warm summers, and late ones by wet summers.—Yours faithfully,

ARTHUR W. PRESTON.

The Rookery, Blofield, Norwich, August 20th, 1889.

To the Editor of the Meteorological Magazine.

SIR,—In all my experience of 30 or more years, I have never once seen the Ash come into leaf before the Oak. Sometimes the Oak precedes the Ash by only two or three days, but it always *does* precede, and occasionally it is 10 or 14 days in advance. This holds good in a comparison of individual specimens, or the trees in the aggregate as seen in the landscape. This year, the golden young leaves of the Oak were very conspicuous in contrast with the dark and bare aspect of the Ash, and in looking over an extensive view, this was very marked. As a prognostic, it seems to me to show the weather we have had, rather than that which is to come.

Yours truly,

FRANKLEN G. EVANS.

Llwynarthan, Castleton, near Cardiff, August 22nd, 1889.

[The following extracts are all from *Notes and Queries*; they are the only further fresh versions that we have been able to find.—ED.]

2nd Series, x., p. 184. September 8, 1860 :—

Oak before Ash,
There'll be a splash;
Ash before Oak,
There'll be a choke.

2nd Series, Vol. x., p. 256. September 29, 1860.

When the Ash comes out before the Oak
A wet summer, and no joke;
When the Oak comes out before the Ash
A dry summer, and no splash.

4th Series, Vol. xi., p. 421. May 24, 1873.

Oak, smoke.
Ash, squash.

4th Series, Vol. xii., p. 184. September 6, 1873.

OAK AND ASH.—This old saw should be for ever disposed of by competent authority, for it is one of those “vulgar errors” by which tradition attempts to stultify observation; and I agree with Mr. Wickham that “this miracle,” as he calls it, is a delusion. I have, for many years past, been careful to observe the order of the leafage of trees, and I extract the following paragraph from my *Pictures of Nature round the Malvern Hills*, published nearly twenty years ago.

“Every year, as a general fact, the oak is in leaf before the ash; yet in some localities a few flourishing ash trees may exhibit foliage before oaks not so favourably circumstanced. Thus last year (1854) I observed that in Cowleigh Park, on April 27th, the oak was generally out in leaf, and the ash not so; yet on the side of the Cradley-road, with a northern exposure, neither oak nor ash was in leaf. Yet on the eastern side of the Ridgway, in Cradley, there was an ash coming into leaf, while two young oaks beside it were quite bare.”

Situation and exposure determine the foliation of forest trees, and

an observer may, any year, notice similar anomalies to those above stated. But though a few oaks in unfavourable situations may be leafless while an ash in a sunny aspect shows expanding foliage, I never saw even a single ash thus circumstanced without there being numerous oaks in leafage at the same time, and numerous ash trees altogether bare. The last three years have shown, as usual, the general precedence of the oak in showing foliation to the ash, and therefore, any idea of a wet season being predicated from any single ash tree showing premature foliage is altogether delusive. When, indeed, both trees antedate their usual leafage time, a temperature above the average of the vernal period may be inferred, but the expanded leaves of the oak would always be in the van.

EDWIN LEES, F.L.S.

Worcester.

Elias Loomis.

Died August 15th, 1889, aged 78.

America has lost in Loomis one who for nearly half a century has been among its leading meteorologists. Loomis's first paper, "On Shooting Stars," appeared in Silliman's Journal for 1835, and he has continued working and writing, down to the present year. His attention has been equally divided between astronomy, magnetism, and meteorology, and he has done good work in all three subjects. His studies of the storms of December 30th, 1836, and October 20th, 1837, were among the earliest published specimens of the modern mode of tracking storms.

Prof. Loomis held various honorary titles; he was one of the 18 Ehrenmitglieder of the Deutschen Meteorologischen Gesellschaft and one of the 18 honorary members of the Royal Meteorological Society.

TRINIDAD RAINFALL.

We hope shortly to be able to give an account of the good work which is being done in Trinidad by Mr. J. H. Hart, F.L.S., but as an instalment have much pleasure in quoting the following table, of which the importance is self-evident.

This station is near the capital, Port of Spain, in Lon. $61^{\circ} 26' W.$ and Lat. $10^{\circ} 40' N.$, and therefore in the N.W. of the Island.

It will be seen that the annual fall varies between limits similar to, but rather less than, those usual in the British Isles.

	Depth. in.		Ratio.
Maximum	86·82	.....	133
Mean	65·45	.....	100
Minimum	43·22	.....	66

ANNUAL RAINFALL, 1862 TO 1888, AT THE ROYAL BOTANIC GARDEN, TRINIDAD.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1862	·00	·66	·77	·25	1·41	8·47	10·36	9·57	11·97	6·60	10·06	3·03	63·15
1863	1·54	2·71	1·45	·85	1·26	9·12	10·12	10·33	12·11	6·24	4·30	6·57	66·80
1864	2·51	·53	·36	·04	8·15	4·96	7·17	12·06	8·04	6·53	5·94	6·61	62·90
1865	2·62	3·20	1·07	7·98	3·22	5·64	10·35	14·83	7·32	14·62	4·81	9·62	85·28
1866	2·24	3·91	1·44	1·09	1·45	6·59	7·83	12·34	5·87	10·11	8·17	6·82	67·86
1867	1·31	6·36	·83	1·32	2·33	5·30	12·20	15·21	10·45	7·87	·67	2·71	66·56
1868	2·06	·82	3·20	·64	4·17	7·78	11·35	6·73	5·46	4·66	8·31	1·03	56·21
1869	·08	·93	·74	·41	·69	5·52	10·17	8·74	8·86	5·15	6·30	5·87	53·46
1870	2·61	·56	1·46	1·51	4·65	8·81	11·91	9·00	10·63	3·98	5·94	8·29	69·35
1871	6·62	1·40	2·89	·92	3·97	8·84	11·73	12·97	7·87	4·37	10·73	3·27	75·58
1872	1·45	·07	·74	·39	3·14	7·09	5·45	10·82	3·07	4·80	9·89	3·04	49·95
1873	1·78	1·08	1·98	·53	·00	4·31	5·04	8·37	5·80	10·34	3·48	1·31	44·02
1874	3·47	1·96	3·67	5·16	2·51	12·28	12·28	11·20	9·38	6·42	3·66	4·29	76·28
1875	3·39	·91	·56	·42	2·61	4·15	12·62	7·22	11·95	10·85	3·74	2·48	60·90
1876	3·26	1·03	1·78	1·67	6·65	11·17	12·23	15·18	12·03	7·04	5·95	3·96	81·95
1877	2·14	·00	7·46	3·38	3·19	8·43	8·35	12·94	6·39	6·68	7·66	5·48	72·10
1878	3·44	·70	·00	3·22	4·99	5·78	5·42	8·88	11·15	5·89	8·72	3·05	61·24
1879	1·52	2·76	4·56	3·03	3·08	14·92	6·86	10·35	6·15	3·54	4·28	4·38	65·43
1880	11·72	6·53	·67	2·32	3·90	7·83	6·30	17·39	7·47	5·74	10·51	1·96	82·34
1881	·57	·65	·23	1·60	4·66	11·05	7·82	10·90	10·59	3·36	12·06	2·23	65·72
1882	1·33	2·38	·73	1·57	3·74	6·33	5·93	8·40	4·93	5·86	10·29	1·50	52·99
1883	1·56	·71	·26	3·37	5·89	10·91	13·66	10·26	5·53	3·99	6·06	8·30	70·50
1884	3·43	2·50	4·40	1·51	2·91	6·84	5·71	8·70	5·03	5·05	5·14	5·66	56·88
1885	1·30	·89	1·49	·43	5·27	3·44	5·87	4·56	6·08	4·08	5·37	4·44	43·22
1886	3·32	1·97	3·27	3·83	4·49	9·70	17·48	8·15	6·73	12·59	8·54	6·75	86·82
1887	2·69	1·46	1·67	1·08	3·98	7·40	5·51	9·93	5·07	5·84	7·60	11·86	64·09
1888	8·37	1·79	2·41	2·28	3·46	11·92	6·89	7·02	5·53	5·06	7·76	2·95	65·44
Means	2·83	1·80	1·85	1·88	3·55	7·95	9·13	10·45	7·83	6·57	6·89	4·72	65·45

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEBRUARY, 1889.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	58·1	17	20·4	13	43·3	31·7	33·2	86	86·3	13·5	2·28	18	6·8
Malta	72·5	27	41·0	14	60·2	50·0	45·5	75	117·7	39·0	1·60	12	5·7
Cape of Good Hope. ...	90·2	25	53·8	14	79·6	60·6	...	...	...	...	1·22	3	4·3
Mauritius	84·0	4, 9	69·0	11, 13	82·9	73·1	69·6	78	136·4	61·1	5·51	15	6·2
Calcutta	87·3	28	49·6	6	80·0	59·1	57·2	60	141·8	40·4	2·46	4	1·6
Bombay	89·7	12	64·8	1	83·7	69·3	65·2	69	141·6	56·0	·00	0	0·8
Ceylon, Colombo .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Melbourne	96·0	13	45·5	20	76·2	56·6	54·1	67	149·8	33·0	1·50	7	5·6
Adelaide	100·4	2	53·5	28	85·0	61·8	51·4	46	160·7	42·1	·23	2	4·0
Wellington	79·0	8, 27	48·0	19	70·4	56·0	53·8	72	139·0	·28	1·48	7	3·4
Auckland	80·0	18	55·0	3, 4	74·8	59·5	57·3	71	145·0	43·0	4·04	9	5·0
Jamaica, Kingston	92·2	9	62·6	8	89·1	67·1	68·1	73	...	...	0·45	...	...
Trinidad	93·0	3	61·0	13	89·1	68·2	68·2	85	157·0	57·0	·93	...	...
Toronto	39·8	17	—11·3	6	26·1	8·0	16·0	82	...	—18·6	2·37	19	6·6
New Brunswick, Fredericton	42·9	6	—33·0	24	25·3	— 0·8	10·7	76	...	...	3·55	14	4·6
Manitoba, Winnipeg ...	40·0	28	—42·6	23	7·6	—15·2	2·3	95	...	...	1·03	8	5·0
British Columbia, Victoria	57·0	27	25·0	18	46·3	35·8	...	...	...	...	1·12	7	...

REMARKS, FEBRUARY, 1889.

MALTA.—Mean temp. $54^{\circ}4$; mean hourly velocity of wind 15·5 miles. Sea temp. fell from $60^{\circ}0$ to $57^{\circ}0$. H on 14th, 16th and 23rd. A hot wind from S.W. with haze on the 26th raised the temp. to $70^{\circ}0$ at 8 p.m.

J. SCOLES.

Mauritius.—Mean temp. of air $1^{\circ}0$, and of dew point $0^{\circ}2$ below, and R ·36 in. above, their respective averages. Mean hourly velocity of wind 10·7 miles, or 0·3 below average; extremes 27·1 on 22nd and 0·0 on 13th. Prevailing direction, E.S.E. T on 5 days, and L on 6 days.

C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air $0^{\circ}3$, of dew point $0^{\circ}9$, humidity 1, and mean amount of cloud 0·3 above average; R ·44 in. below average. Prevailing winds S. and S.W.; strong on 8 days. Greatest hourly velocity 31 miles from 3 to 4 p.m. on 27th from W. Heavy dew on 3 days. L on 4 days.

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

Adelaide.—Mean temp. slightly below, and R less than half the average.

C. TODD, F.R.S.

Wellington.—Fine in the early part of the month, with light southerly winds, showing from 10th to 12th, then fine again until the 19th when ·50 in. of R fell, and the remainder of the month fine. Prevailing wind N.W., strong on 7 days.

R. B. GORE.

Auckland.—Rainfall slightly in excess of the average of 22 years; mean temp. close to the average, barometric pressure slightly below.

T. F. CHEESEMAM.

SUPPLEMENTARY TABLE OF RAINFALL, AUGUST, 1889.

[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 Hall.	2·60	XI.	Castle Malgwyn	3·24
„	Margate, Birchington...	1·73	„	Rhayader, Nantgwillt..	6·32
„	Littlehampton	2·33	„	Carno, Tybrith	5·32
„	Hailsham	2·65	„	Corwen, Rhug	3·36
„	Ryde, Thornbrough	2·90	„	Port Madoc	6·72
„	Alton, Ashdell.....	2·30	„	I. of Man, Douglas	5·32
III.	Oxford, Magdalen Col...	2·29	XII.	Stoneykirk, Ardwell Ho.	5·10
„	Banbury, Bloxham	2·48	„	New Galloway, Glenlee	5·37
„	Northampton	1·76	„	Melrose, Abbey Gate...	4·80
„	Cambridge, Beech Ho...	2·01	XIII.	N. Esk Res. [Penicuick]	7·10
„	Wisbech, Bank House..	2·04	XIV.	Ballantrae, Glendrisaig	5·01
IV.	Southend	2·33	„	Glasgow, Queen's Park.	4·35
„	Harlow, Sheering	2·42	XV.	Islay, Gruinart School..	5·47
„	Rendlesham Hall	4·22	XVI.	Dollar.....	5·19
„	Diss	3·26	„	St. Andrews, Pilmour Cot	5·64
„	Swaffham	4·30	„	Balquhiddier, Stronvar..	6·16
V.	Salisbury, Alderbury ...	1·96	„	Dunkeld, Inver Braan..	5·77
„	Warminster	2·76	„	Dalnaspidal H.R.S. ...	7·81
„	Bishop's Cannings	3·51	XVII.	Keith H.R.S.	5·89
„	Ashburton, S. Petherwin...	4·83	„	Forres H.R.S.	4·73
„	Hatherleigh, Winsford.	3·11	XVIII.	Strome Ferry H.R.S....	6·83
„	Lynmouth, Glenthorne.	3·45	„	Fearn, Lower Pitkerrie.	4·55
„	Probus, Lamellyn	3·60	„	Loch Shiel, Glenaladale	...
„	Launceston, S. Petherwin	3·94	„	N. Uist, Loch Maddy ...	5·33
„	Wincanton, Stowell Rec.	3·38	„	Invergarry	5·35
„	Taunton, Lydeard Ho...	2·87	„	Loch Ness, Drumnadrochit	4·76
„	Wells, Westbury	4·47	XIX.	Lairg H.R.S.	5·44
VI.	Bristol, Clifton	3·33	„	Forsinard H.R.S. ....	...
„	Ross	2·23	„	Watten H.R.S.	3·91
„	Wem, Clive Vicarage ...	4·06	XX.	Dunmanway, Coolkelure	8·78
„	Cheadle, The Heath Ho.	3·97	„	Fermoy, Gas Works ...	5·20
„	Worcester, Diglis Lock	2·28	„	Tipperary, Henry Street	5·11
„	Coventry, Coundon	2·54	„	Limerick, Kilcornan ...	4·84
VII.	Ketton Hall [Stamford]	2·92	„	Miltown Malbay..	6·08
„	Grantham, Stainby	3·52	XXI.	Gorey, Courtown House	3·85
„	Horncastle, Bucknall ...	3·55	„	Navan, Balrath	5·49
„	Mansfield, St. John's St.	2·08	„	Mullingar, Belvedere ...	5·78
VIII.	Neston, Hinderton	4·46	„	Athlone, Twyford	5·26
„	Knutsford, Heathside ...	5·64	„	Longford, Currygrane...	5·11
„	Lancaster, South Road.	5·42	XXII.	Galway, Queen's Coll...	4·80
„	Broughton-in-Furness ..	7·18	„	Clifden, Kylemore	9·83
IX.	Wakefield Prison	3·58	„	Crossmolina, Enniscoe..	7·02
„	Ripon, Mickley	4·11	„	Collooney, Markree Obs.	5·96
„	Scarborough, West Bank	4·53	„	Ballinamore, Lawderdale	...
„	East Layton [Darlington]	4·17	XXIII.	Warrenpoint	6·93
„	Middleton, Mickleton..	3·59	„	Seaforde	5·55
X.	Haltwhistle, Unthank..	5·19	„	Belfast, New Barnsley..	7·98
„	Shap, Copy Hill	4·73	„	Bushmills, Dundarave...	6·15
XI.	Llanfrechfa Grange	3·88	„	Stewartstown	7·27
„	Llandovery	4·19	„	Buncrana	6·44

AUGUST, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 1/2 or more fell.	TEMPERATURE				No. of Nights below 32°	
		Total Fall.	Differ- ence from average. 1870-9	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth.	Date.			Deg.	Date.	Deg.	Date.		
		inches.	inches.	in.				Deg.	Date.	Deg.	Date.	In shade.	On grass.
I.	London (Camden Square) ...	1·80	—	·94	·31	19	16	84·4	1	44·2	25	0	0
II.	Maidstone (Hunton Court)...	1·77	—	·47	·46	19	13	...	...	...	...	...	...
"	Strathfield Turgiss	2·47	+	·05	·77	21	17	80·9	30	39·7	25	0	0
III.	Hitchin	1·21	—	1·07	·37	21	14	77·0	1	45·0	24	0	0
"	Winslow (Addington)	2·31	—	·64	·47	9	14	83·0	1	40·0	25	0	0
IV.	Bury St. Edmunds (Westley)	3·33	+	1·21	·87	11	14	...	...	...	...	...	...
"	Norwich (Cossey)	3·15	+	·53	·86	11	21	...	...	...	...	...	...
V.	Weymouth (Langton Herring)	2·20	...	...	·48	10	16	73·0	31	47·0	25 ^b	0	0
"	Barnstaple	2·89	—	1·21	·45	23	20	77·0	1 ^a	43·0	21	0	0
"	Bodmin .....	...	...	...	...	...	...	...	...	...	...	...	...
VI.	Stroud (Upfield)	2·04	—	1·13	·48	21	17	80·0	1, 2	42·0	24	0	0
"	Church Stretton (Woolstaston)	3·19	—	·89	·59	21	22	76·5	30	45·0	23 ^c	0	0
"	Tenbury (Orleton)	2·61	—	1·11	·46	10	15	80·2	30	35·0	25	0	1
VII.	Leicester (Barkby)	2·79	+	·24	·54	9	18	85·0	1	39·0	24	0	0
"	Boston	3·42	+	·81	·95	11	18	87·0	30	44·0	26	0	0
"	Hesley Hall [Tickhill]	2·76	...	...	·48	9	18	78·0	1, 30	42·0	25	0	0
VIII.	Manchester (Plymouth Grove)	6·00	+	2·14	·76	5	22	76·0	30	43·0	24	0	0
IX.	Wetherby (Ribston Hall) ...	4·96	+	2·33	·51	15	21	...	...	...	...	...	...
"	Skipton (Arncliffe)	7·21	+	1·41	·74	5	26	78·0	1	38·0	24 ^c	0	...
"	Hull (People's Park)	4·03	+	1·01	·98	11	21	...	...	...	...	...	...
X.	North Shields	4·54	+	1·45	1·00	19	21	75·0	1	43·0	25	0	0
"	Borrowdale (Seathwaite)	11·92	+	·88	1·42	5	26	...	...	...	...	...	...
XI.	Cardiff (Ely)	4·68	—	·65	·97	2	20	...	...	...	...	...	...
"	Haverfordwest	4·61	—	·36	·67	19	20	71·0	2, 30	41·4	10	0	0
"	Plinlimmon (Cwmsymlog) ...	...	...	...	...	...	...	...	...	...	...	...	...
"	Llandudno	3·85	+	·66	·97	19	17	70·0	1	47·0	11	0	0
XII.	Cargen [Dumfries]	4·46	+	·19	·76	19	24	70·2	1	40·0	31	0	0
"	Jedburgh (Sunnyside)	4·54	+	1·17	1·05	19	21	71·0	1	40·0	31	0	...
XIV.	Old Cumnock	5·64	+	1·50	1·14	5	24	76·5	1	33·0	25	0	...
XV.	Lochgilhead (Kilmory)	5·82	+	·60	1·53	19	21	...	...	...	...	...	...
"	Oban (Craigvarren)	6·16	...	...	1·20	27	24	67·0	1	44·8	24	0	0
"	Mull (Quinish)	6·30	...	...	1·55	27	24	...	...	...	...	...	...
XVI.	Loch Leven Sluices	5·60	+	1·52	1·00	17	16	...	...	...	...	...	...
"	Dundee (Eastern Necropolis)	6·50	+	3·23	1·00	9	20	76·3	1	42·1	24 ^d	0	0
XVII.	Braemar	7·57	+	3·14	2·13	9	27	69·7	1	35·2	31	0	2
"	Aberdeen (Cranford)	5·64	...	...	1·45	10	22	73·0	1, 2	42·0	23 ^e	0	0
XVIII.	Lochbroom	3·96	...	...	·55	21	21	...	...	...	...	...	...
"	Culloden	4·83	+	1·83	...	...	...	75·0	1	43·0	14	0	0
XIX.	Dunrobin .....	...	...	...	...	...	...	...	...	...	...	...	...
"	S. Ronaldsay (Roeberry)	5·99	+	3·29	1·94	20	23	66·0	2	43·0	26	0	0
XX.	Cork (Blackrock)	4·85	+	1·02	1·36	19	17	77·0	25	43·0	24 ^f	0	0
"	Dromore Castle	8·63	...	...	1·55	19	22	72·0	3	45·0	31	0	0
"	Waterford (Brook Lodge) ...	4·78	...	...	1·23	19	18	70·0	30	43·0	26	0	...
"	O'Briensbridge (Ross)	5·75	...	...	2·48	19	23	74·0	1	40·0	25 ^g	0	0
XXI.	Carlow (Browne's Hill)	5·13	+	1·40	1·45	19	21	...	...	...	...	...	...
"	Dublin (Fitz William Square)	5·75	+	2·57	1·94	19	22	71·8	1	46·4	25	0	0
XXII.	Ballinasloe	4·21	+	·18	1·30	19	23	66·0	1 ^h	41·0	25	0	...
XXIII.	Waringstown	7·29	+	3·85	1·61	19	24	72·0	1	41·0	31	0	0
"	Londonderry (Creggan Res.) ..	7·95	...	...	1·27	9	30	...	...	...	...	...	...
"	Omagh (Edenfel)	5·69	+	2·04	·99	19	25	68·0	1	42·0	20	0	0

α And 2, 31. b And 27. c And 25. d And 26. e And 30. f And 31. g And 26, 27. h And 2, 16
 + Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON AUGUST, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—On the whole, August was rainy and chilly, and at times stormy. The close of the month was beautifully warm and clear, a second summer, very acceptable to the farmers. TS on 24th. T on three other days.

HITCHIN.—Extraordinary high average temp. May, $56^{\circ}0$; June, $60^{\circ}9$; July, $61^{\circ}0$; August, $61^{\circ}5$. Only exceeded once in 40 years, viz., in 1868, when the values were $55^{\circ}5$, $60^{\circ}5$, $64^{\circ}8$, $61^{\circ}9$.

ADDINGTON.—The 1st was very fine, with high temp., and the 2nd was also fine, but from thence until the 25th was very unfavourable, R falling so frequently as to hinder harvest work very much. From the 25th until the end, the weather was all that could be desired. TS on 24th with heavy R.

BURY ST. EDMUND'S, WESTLEY.*—A very similar month to August, 1881, when the harvest was one of the worst in the century. This year we had more wind, so the corn was not so much sprouted, but the barley was much discoloured. TSS on 11th and 24th.

1889	Rainfall.	Diff. from Average.	1889	Rainfall.	Diff. from Average.
Jan.....	·69	- 1·07	May.....	3·99	+2·02
Feb.....	1·46	- ·25	June.....	3·06	+ ·92
Mar.....	1·05	- ·41	July.....	3·18	+1·21
April	2·11	+ ·37			

LANGTON HERRING.—The weather from the 1st to the 24th was very variable and unsettled; the last week was bright and fine for carrying the harvest. R ·18 in. below the average. Mean 9 a.m. temp. $1^{\circ}1$ below the average. A fine parhelion was observed on 13th. On the 29th the moon before setting appeared of a crimson colour.

WOOLSTASTON.—A cold and stormy month till the last five days, when the weather became very hot. Sharp storms of T and L on 9th and 11th. Mean temp. $57^{\circ}4$.

ORLETON.—The temp. was above the average on the first 8 days, which were warm and pleasant, the weather then became cold and changeable, with frequent falls of R, much cloud, and very variable winds; it continued generally cold till the 28th, when the temp. rose and the last 3 days were very bright and warm. Mean temp. about $1^{\circ}3$ below the average of 28 years. Distant T on the 5th, 8th, 9th, and 10th. Strong wind on 20th. Slight frost on the morning of the 25th, and thick fog on the 30th. Harvest retarded.

BARKBY.—There were frequent TSS, and T was heard on 7 days. Mean temp. $58^{\circ}3$. Three-fourths of the corn harvest was secured by the end of the month.

MANCHESTER, PLYMOUTH GROVE.—The wettest August in 23 years. The mean temp. $58^{\circ}5$.

HULL.—With the exception of the last few days, the weather during the month was generally overcast or very cloudy, with frequent falls of R, and T on several occasions.

* The observations at Culford having ceased, the station is replaced by Westley, and we give the rainfall for the earlier months of the year.

WALES.

HAVERFORDWEST.—A month of constant R up the 24th, with temp. below the average. No heavy falls of R took place, consequently the river Cleddau was never once in flood, nor were the corn crops beaten down or injured by the damp. The temp. reached 70° on four days, three times in the first week and once in the last. Fine bright sunshine prevailed during the last 7 days, with, during the last three days, increase of temp. ; all the cereals are good, early turnips a good crop. Winds principally from westerly points.

SCOTLAND.

CARGEN.—A very unfavourable month for harvest operations. Duration of sunshine 61 hours below the average. Mean temp. 1°·7 below the average. The winds were generally very light throughout, and the atmosphere was laden with moisture. T on 6th, 7th, and 11th. It is feared the grain has suffered materially in quality, as a large breadth was cut before the middle of the month and little or none secured.

JEDBURGH.—R was frequent, but the cutting of the cereals went on steadily. The root crops are singularly good and promising.

LOCHBROOM.—The copious R of the month was very much required after the heat and drought of the last three months, and on the whole it was a beautiful month.

INVERNESS, CULLODEN.—Heavy rains occurred on the 8th, 9th, 21st, 22nd, and 23rd, and where the crops are heavy, considerable damage must result.

ROEBERRY.—The wettest August since 1879.

IRELAND.

CORK.—Showery and chilly up to the 25th, which much retarded harvest operations, thence to the close very fine, and the farmers were freed from serious apprehensions. T and L on 9th, distant T on 21st. Gale on 19th.

WATERFORD.—Rainfall 1·04 in. above the average. Mean temp. 57°·7. T on 6th, 9th, and 11th. H on 6th and 11th.

ROSS.—A bad month for hay harvesting. T on 14th, 15th, and 16th. The R on the 19th (2·48 in.) was continuous for 20 hours, and the heaviest within 24 hours from 1846 to the present time.

DUBLIN.—A wet, cold, and stormy month. Mean temp. 1°·2 below the average. Strong or squally winds on 14 days. Gales on 6th and 20th. Foggy on 31st. T heard on 7th and 11th. L seen on 30th. Temp. reached 70° in screen on only two days. A marked improvement took place in the weather from 25th to 31st inclusive. Prevailing winds westerly. Mean humidity 84; mean amount of cloud 6·0.

WARINGSTOWN.—The largest monthly R recorded since observations commenced in 1860, the next greatest fall being 6·81 in. in October, 1870. Total fall from July 15th, in St. Swithin's 40 days, 8·19 in. No serious injury to crops up to the close of the month.

EDENFEL, OMAGH.—A persistently wet and unsettled month without one summer's day, owing, however, to the previous favourable weather and to the fact that the harvest is seldom general before September; the fine weather that has now set in is enabling abundant crops to be gathered in excellent condition.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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THE AUTUMN CONGRESSES.

Is it permissible to the Editor of a scientific journal to suggest that there is too much activity in the branch of science which he is trying to advance? The answer is not easy; progress is what one ought to aim at, activity usually implies progress, and certainly there can be little progress without activity. On the other hand, the strain may be too great. The meetings of the great scientific societies run on from October to June, and the autumns used to be quiet and restful, but first the British Association, then the Social Science, and then the Sanitary Institute, started autumn meetings, and this year our French friends have brought matters to a crisis with 68 successive and partly simultaneous congresses. Of course with very few of these had meteorologists anything to do, but the following are all meetings which come within the province of this magazine:—

The British Association, Newcastle-on-Tyne, Sept. 11 to 18.

International Congress on Meteorology, Paris, Sept. 19 to 26.

The Sanitary Institute, Meteorological Section, Worcester,
Sept. 24 to 28.

International Congress on Climatology, Paris, Oct. 2 to 10.

Obviously we cannot report fully upon all these meetings. With the exception of the British Association, full accounts of each will be published, and therefore we need give only brief notices of the others.

THE BRITISH ASSOCIATION AT NEWCASTLE-ON-TYNE.

This meeting was in point of numbers far below that held in the same city in 1863, but we see no signs of analogous depreciation in the quality of the papers read, though there was perhaps nothing exceptionally striking in them. As Prof. Cleveland Abbe favoured us with a copy of his paper, and we are not aware that it will appear elsewhere in full, we print it *in extenso*, and add abstracts of such of the other papers as we have been able to obtain.

THE DETERMINATION OF THE AMOUNT OF RAINFALL.

BY PROF. CLEVELAND ABBE.

THE accurate measure of rain is a matter of equal importance to meteorology and engineering, but like all other problems in physics the accurate determination of any datum must be accompanied by a determination of the reliability of, or the confidence to be placed in, the numerical results. There must be some estimate or determination of the "possible error" or the "probable error" of the result of our measures, before we can safely make use of that result for any further deductions.

Many investigations have been made into the reliability of rainfall measures by means of comparative observations with gauges of various patterns placed in diverse localities with regard to surrounding obstacles and at different heights in respect to the surface of the ground or at different altitudes with respect to the surface of the sea.

The general result of these investigations so far as rain proper is concerned is about as follows:—

1. *As concerns the size and shape of the collecting funnel*, circular and square apertures of from ten to one hundred square inches area give results that vary only one or two per cent. among themselves.

2. *As regards the external shape of the gauge as a whole*.—Simple cylinders or cylinders with small rims or bulging rings, or conical flanges, vary but two or three per cent. among themselves on account of shape, but all catch decidedly less than cylinders with broad flanges or shields near their apertures as in the Henry and the Nipher gauge. The excess of the catch in these shielded gauges increases slightly in proportion to the force of the wind.

3. *As regards the location*.—Gauges on the ground close to the windward side of an obstacle catch more than those in the open field; gauges close to the leeward side catch less, while gauges a little farther to the leeward catch decidedly more; gauges on the top of the obstacle, such as the flat roof of a house, catch less when they are near the windward side, but the same or little more than the normal when they are nearer the leeward side of the roof. This shows that the presence of an obstacle in conjunction with the wind alters the distribution of what would otherwise be a uniform rainfall; the alteration increases more rapidly than the increase of the wind, and is approximately as the square of the velocity.

4. *With regard to elevation above sea level*.—Whether on an isolated mountain or on a broad rising plateau, on the windward side the rainfall increases up to a certain elevation and then diminishes rapidly, but on the leeward side there is only a rapid diminution from the summit downwards. In some cases this latter diminution causes an entire absence of rain over the greater part of the leeward side of the plateau or mountain; in many cases the available mountains are scarcely high enough to enable us to observe the diminution of rain above the belt of maximum precipitation.

5. *With regard to the altitude above ground.*—The higher gauges invariably catch less rain and the discrepancies caused by altitude are so large as to have hitherto been considered as the principal source of uncertainty in rainfall measurements, so that for gauges of uniform patterns exposed in unobjectionable locations in open fields the only method hitherto prescribed for securing comparable results has consisted in the adoption of a uniform small elevation above ground ; but this rule, of course, gives us no assurance that our rainfall measurements are correct in any absolute sense. The general explanation of the fact that the higher gauges catch less rain, as given by Bache and Jevons, was that the wind causes eddies about the mouth of the gauge and carries past some of the raindrops. This explanation is undoubtedly true and suffices to explain many observed phenomena ; but if true, it should be followed out to its logical consequences and be made to give us some method of correcting the record of a gauge for the influence of the wind so as to obtain a nearer approximation to the rain that has actually fallen upon the ground ; this I will now attempt to do.

6. In the case of ordinary rainfalls the air is full of large and small drops intermixed, or of heavy and light flakes of snow ; near the ground are additional fragments of drops broken up by spattering and again during snow storms with high winds the air is full of flakes that have been whirled up into the air after having once fallen to their resting place on the ground or trees. I shall for the present omit the consideration of spattering and drifting, hoping to treat of them at some future time, and will consider only the effect of the wind on the drops falling directly into a gauge whose mouth is high enough above the ground to avoid these two influences ; in fact, spattering and drifting can only influence the local distribution of rain or snow, a gauge placed within their influence must have its readings thereby increased, and the true amount of precipitation is more easily obtained by the method I shall present, if the gauges are raised a few feet above the ground.

We therefore consider that there is falling into the gauge a quantity of drops or flakes of various sizes and various vertical velocities while the wind is blowing horizontally against the gauge.

7. Now, when the wind strikes the gauge the deflected current just above the mouth of the gauge acquires a vertical component that it did not have before it struck the gauge, and also has a horizontal motion more rapid than it had before, and more rapid than that of the wind a few inches higher up. The larger drops of the falling rain may descend with a rapidity sufficient to penetrate this swiftly moving layer and enter the gauge, but the smaller drops falling more slowly will be carried over to the leeward of the gauge, and failing to enter it will miss of being measured as rainfall, although they really go on and fall to the ground near by. Evidently of two masses of rain having the same proportion of large and small drops, or rapid and slow falling snow flakes, the proportion of small drops

that are carried by will be large in proportion as the wind is stronger, the deficiency in the catch of the gauge being very nearly proportional to the velocity of the wind. Again for the same gauges and the same velocity of wind the deficiency will be proportional to the relative percentage of small and slow falling drops that occur in any given shower. Thus we easily see that the deficiency will be greater in winter snows than in summer rains, greater in fine drizzling rains than in heavy downfalls, greater in windy localities, greater for elevated gauges than for low ones. The application of these ideas gives us a satisfactory general explanation of the numerous irregularities that have been observed in rainfalls. In fact, they explain every one of the most extreme cases, such, *e.g.*, as that recorded by the Signal Service observer at Kitty Hawk on the sandy beach of North Carolina, where nine experimental gauges were by request established in a cluster, fully exposed to the wind, with their mouths two or three feet above the surface of the sand. The windward gauges of the cluster caught less rain than the leeward, but they also caught very much more sand, showing that the strong winds which carried the light raindrops on beyond to the leeward gauges also stirred up the light surface sand and were just able to drop this into the windward gauges.

8. The numerical results of all rainfall observations at different elevations of the gauge have been collected by me in a memoir read before the Philosophical Society of Washington, in December, 1888; most of these are also given in the excellent memoir of Wild, in volume IX. of his *Repertorium*, 1885. These observations represent many years of rainfall in a great variety of climates in the United States and Western Europe, and continued as they were through summer and winter, they represent the average effects (due to the average proportions between the precipitations that descend rapidly and slowly with the accompanying winds) characteristic of the respective climates. The following table shows the numerical results. In the fourth column are given the catch of the respective gauges expressed in percentage of the catch of the normal pit-gauge; the fifth column gives the deficit of this percentage; the sixth column gives the square root of the altitude.

Now, the studies of Archibald and Stevenson have shown that for small altitudes the velocity of the wind increases very nearly as the square root of the altitude. If, therefore, our deficits are proportional to the wind, they should be proportional to the numbers in the sixth column. This turns out to be the case so exactly that the formula

$$\text{Deficit} = 6 \text{ per cent.} \times \sqrt{\text{altitude in meters } P}$$

almost perfectly represents the deficits given in the fifth column.

Although the co-efficient 6 thus closely represents the average of many years' work, yet it cannot be safely adopted for any one locality, or even for any one year, since it involves the proportions of rain, snow and wind that actually occurred during the observa-

tions above summarized ; much less can it be adopted for any given month in the year, or any given storm. On the other hand, I conclude that for each wind, and for each style of precipitation, and for each style of gauge, there must be a special co-efficient to replace the figure 6. In other words, the co-efficient must be known for each individual rainfall or snowfall.

Location.	No. of Years.	Altitude. in Meters.	Relative Catch.	Relative Deficit.	Square Root of Altitude	\sqrt{Alt}
.....		0	100	0	0	0
Calne (5 and 8 inch gauges)	4	1	90	10	1.00	6
Castleton (5 and 8 inch gauges)...	3	2	88	12	1.41	8
Rotherham (5 inch gauges)	8	3	86	14	1.75	10
St. Petersburg (10 inch gauges)...	10	4	85	15	2.00	12
.....		5	85	15	2.24	13
.....		6	84	16	2.45	15
London (Westminster Abbey) ...	1	9	77	79	21	3.61
Enden	2	11	72			
St. Petersburg (Cent. Obs.)	1	13	68			
York (Museum)	3	13	80			
Calcutta (Alipore Obs.)	7	15	87			
Walton-on-Thames (Woodside)...	1	15	73			
Philadelphia (Frankfort Arsenal)	5	16	95	64	36	5.29
Sheerness (Water Works)	3	21	52			
Whitehaven (St. James's Church)	10	24	66			
St. Petersburg (Cent. Obs.)	10	25	59			
Paris (Astronomical Obs.)	40	27	31			
Dublin (Monkstown)	6	27	64			
Oxford (Radcliffe Obs.)	8	34	59	58	42	7.68
Copenhagen (Observatory)	4	36	67			
London (Westminster Abbey) ...	1	46	52			
Chester (Lead Works)	2	49	61			
Wolverhampton (Water Works)	3	55	69			
York Minster (Tower)	3	65	60			
Boston (St. Botolph Church)	2	79	47			

9. It is not difficult to devise a method of ascertaining this co-efficient at any moment. We have simply to establish two gauges at different heights, but near each other, and then, if they do not interfere with each other, and if the relative number of fine and large drops is the same at their respective elevations, and if the relative force of the wind at their mouths is known, we easily have the solution of the problem. If the gauges be placed above the roof of a flat building, we shall get the rainfall on that roof instead of on the ground.

It would be best to directly measure the relative wind velocity for each gauge-mouth by appropriate anemometers, or if this be not practicable, and if we have to assume some law, such as Archibald's, connecting wind and altitude, then it would be an improvement to use

three or more gauges at different altitudes, so as to check this assumption, and determine the extent to which for any shower the deficit depends on the square or other function of the velocity, rather than on the simple velocity itself. But assuming, for simplicity, that only two gauges are used, our method of procedure would consist in measuring the catch of the gauges placed at different heights for each storm or each hour, and substituting these results as the known data in the simple equation that connects these with the respective wind velocities. This equation is—

$$\text{Catch of gauge} = \text{Catch of normal pit-gauge} \times (1 - k \sqrt{\text{altitude}})$$

or

$$c = P (1 - k \sqrt{h})$$

Two values, c_1 and c_2 for two altitudes h_1 and h_2 , give us two equations, from which, by elimination, we determine P and k for each individual case. Of course, the values of k are of minor importance to the climatologist and the ordinary observer, who will be content to compute the value of P for each measured rainfall, and will enter it in the proper column of his daily register as the corrected precipitation, comparable in its scientific value with his corrected pressure or temperature.

The formula for this computation is easily deduced by elimination, and may be put in the following form, where c_2 and h_2 belong to the upper gauge:—

$$P = c_1 + \frac{1}{\frac{\sqrt{h_2}}{h_1} - 1} (c_1 - c_2)$$

The gauges being permanent as to their altitudes, and so high that any winter snow will not materially change the h_1 and h_2 , we may assume their ratio to be constant. Some one of the following combinations will naturally occur to the observer:—

$$\text{For altitude } \left\{ \begin{array}{l} 1 \text{ and } 4 \\ 2 \text{ and } 8 \\ 3 \text{ and } 12 \\ \text{\&c.} \end{array} \right\} \quad P = c_1 + (c_1 - c_2)$$

$$\text{For altitude } \left\{ \begin{array}{l} 1 \text{ and } 9 \\ 2 \text{ and } 18 \\ \text{\&c.} \end{array} \right\} \quad P = c_1 + \frac{1}{2} (c_1 - c_2)$$

$$\text{For altitude } \left\{ \begin{array}{l} 1 \text{ and } 16 \\ 2 \text{ and } 32 \\ \text{\&c.} \end{array} \right\} \quad P = c_1 + \frac{1}{3} (c_1 - c_2)$$

Thus from measured rainfalls of 2.11 and 1.96 units caught in gauges at elevations of 1 and 4 units, we find the rainfall to be 2.26 units; whereas if for gauges at elevations of 1 and 16 units we had measured 2.11 and 1.60, we should have computed the true rainfall to be 2.28 units.

10. We have thus provided for the approximate correction of the rain-gauge readings for the very large source of error introduced by the wind and the slowness of fall of the drops, and we find that this correction is, even for low gauges, quite as large as the quantities about which climatologists have had so much discussion, viz., the effect of forests and buildings, of the hour of the day, of the cultivation of land, of the sun-spots, and other suggested influences. None of these subjects can be properly studied until we correct the original catch of the gauge for the large error due to the influence of the wind. But the wind influence does not depend on altitude only, that is to say, the correction deducted for any pair of gauges at one spot cannot be transferred to a similar pair at a short distance, because the winds at that new position, during the falling of the rain, may have been different from those prevailing at the former location. A pair of gauges must be established and observed at every spot whose rainfall we would determine.

This leads me to remark that in such a case as is afforded by the valuable observations in the experimental rain field at Berlin, it is probable that the moderate differences in the horizontal distribution of rain are comparable with the differences due to the distribution of wind, so that the study of the uncorrected gauge readings is really a study into the effect of local winds on the catch of the gauge, and, in general, gauge readings do not show the geographical distribution of rain until they are corrected for the effect of the wind at the mouth of the gauge as for an instrumental error.

In the case of gauges placed above forests, the measured quantities will increase as the forests grow taller, because the gauges come to be nearer the level and shelter of the tree tops; a gauge within the foliage of a tree should have a correction nearly the same as one near the ground, because of the diminished force of the wind in its neighbourhood.

Professors Joseph Henry and F. E. Nipher have advocated the use of "shielded gauges," and Börnstein has advocated "protected gauges," all so constructed that eddies about the mouths are largely diminished. Such gauges, therefore, have smaller corrections than the simple cylinders, and a pair of such gauges mounted at different altitudes would give an excellent arrangement for studying the peculiarities of rainfall.

In the preceding, I have assumed that the rain at the level of each gauge contains an equal proportion of the small drops due to spattering and drifting, but this is not true for very low gauges, or for drifting snow, and a special discussion of that subject is reserved for future study.

TEMPERATURE OF RIVERS, &c.

The committee on variations of temperature in lakes, rivers and estuaries, reported that no formal meeting had been held, but some of the members had occasionally met informally, and the whole com-

mittee had been consulted by letter on all the arrangements which had been made. It is inadvisable to attempt at present to summarise the results of observations made, as, although more than a year's observations are available on some rivers, it is only a few months since the work was begun on others. At the end of another year it is expected that sufficient data will be found to justify a comprehensive report on the subject. Several members of the committee have taken much trouble in collecting observations. Dr. Sorby has collected and discussed a great mass of temperature observations which he had made from his yacht *Glimpse* in the estuaries of the south-east of England during the summer months of five successive years. That will be published separately. Prof. Fitzgerald took charge of the observations in Ireland, where he induced a number of observers to take up the work. Mr. Willis Bund had already inaugurated similar researches on the Severn. Rev. C. J. Steward and Mr. Isaac Roberts rendered important services in their districts. The committee have to thank Mr. John Gunn for his services in forwarding thermometers and observation books and corresponding with observers. The committee ask to be re-appointed with the addition of the name of the Rev. Mr. Andson, and with a grant of £50.

SOLAR RADIATION.

The Committee on Solar Radiation reported that the actinometer devised by the late Prof. Stewart for the continuous measurement of solar radiation, which was described in the report of the Association for 1887, is now ready for the preliminary trials, the internal thermometer with a flat bulb of green glass having been made since the date of that report. The construction of this thermometer occasioned more trouble than had been anticipated. No attempt has at present been made to render the instrument self-recording, as it would obviously be unwise to incur the outlay which any construction for this purpose would involve, unless the results of preliminary trials were such as to encourage a hope that the instrument might be really useful if rendered self-recording.

(*To be continued.*)

WATERSPOUTS.

To the Editor of the Meteorological Magazine.

SIR,—It is, I believe, well authenticated that electrical phenomena are sometimes observed in connection with waterspouts; but are we therefore at liberty to conclude that they are formed by electricity? I think it is an effect rather than a cause, and it may be doubted whether electricity causes, at least directly, any phenomena besides those which we at once recognise as strictly its own.

A waterspout is a whirlwind at sea, and a whirlwind on land may become a waterspout at sea—at least I suppose so, as I have myself seen one lift water out of the river in the act of crossing it, which afterwards sped across a meadow, lifted a couple of sheep over a fence of hurdles, and deluged everything in its course. This was a very

local affair and was quickly over. The whirl was formed in a gully between two hills by cross currents of air ; it lifted the water 80 or 100 feet, and then, as its force was soon spent, the lateral translation of the water ceased and it fell almost all together. The whole force was purely mechanical, and as I know well every foot of ground where the whirlwinds occurred which are described in the August number (p. 107), I should, without hesitation, explain them in the same way. I could therefore allow very easily that rain might be saline, but not hail, and the evidence for this does not seem to be well authenticated.

Arriving once at Freshwater Bay in the Isle of Wight, on my first view of the sea, I saw a waterspout in the act of drawing up to the cloud ; the cloud to which it was attached was carried by a westerly wind across the island, and, as informed by a local paper, it formed again, letting itself down to the sea on the eastern side of the island. How is this to be explained ? I should say the formation of the high land forbade the continuance of the whirl in the lower half, making it for the time mechanically impossible ; and when the obstruction ceased, being continued above all the time, the motion was again prolonged downwards to the sea.—Yours truly,

JOHN SLATTER.

Whitchurch Rectory, Oxon, 18th September, 1889.

EARTHQUAKE IN CORNWALL, OCT. 7TH.

A shock of earthquake, extending from Doublebois to Boscastle, occurred yesterday, Oct. 7th, at about a quarter to two o'clock, and whilst some observers describe it as a slight shock, others speak of it as smart. At Doublebois station (between Liskeard and Bodmin Road) and in the neighbourhood, the phenomenon was noted by several persons. In the farmhouse of North Folly, about a mile from the railway station, the shock seems to have been more severely felt than elsewhere in that neighbourhood. The house itself seemed to vibrate, and the small articles rattled, some pieces of china being thrown down and broken. Further down the valley at Lewarne, the shock was spoken of as smart. It was very momentary, but attracted the attention of everyone in the house, and it appeared to come from the west. In Camelford a distinct vibration of the ground was felt by a large number of persons. Earthenware and other goods in the shop shook, and in some cases fell. The vibration was accompanied by a rumbling noise like thunder, which was heard for some seconds, and seemed to proceed from beneath the surface of the earth. Observers at Boscastle speak of two distinct shocks.—*Western Morning News*.

[The places named are somewhat far apart, Boscastle being about 17 miles N. of Doublebois ; the centre of disturbance seems to have been near Bodmin Moor, one of the highest and wildest parts of Cornwall.—ED. M. M.]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1888.

STATIONS.	ABSOLUTE.				AVERAGE.						ABSOLUTE.		TOTAL RAIN.		AVER- AGE
	Maximum.		Minimum.		Max.	Min.	Mean.	Dew Point.	Humidity	Max. in Sun.	Min. on grass.	Depth.	Days.		
	Temp.	Date.	Temp.	Date.											
<i>Those in Italics are South of the Equator.</i>	°		°		°	°	°	°	°	°	°	in.		0—10	
England, London ...	84.7	June 25	19.1	February 2	55.5	41.9	48.7	42.3	82	127.6	17.7	27.74	173	6.7	
Malta	102.8	July 10	40.4	February 29	73.5	59.4	66.5	55.7	74	154.7	34.0	13.75	59	3.5	
<i>Cape of Good Hope</i>	99.2	January 28	35.5	July 19	70.5	54.1	62.3	...	...	...	...	36.06	101	5.2
<i>Mauritius</i>	85.4	February 3	56.7	July 18	78.9	68.6	73.8	64.9	76	139.6	47.3	52.81	208	5.8	
Calcutta	106.6	June 14	48.3	January 31	86.4	70.5	78.5	68.4	67	165.4	15.7	69.71	103	4.4	
Ceylon, Colombo ...	93.4	February 1	66.0	February 8	86.9	74.8	80.9	71.4	77	154.0	57.4	101.06	174	5.4	
Melbourne	104.0	January 15	28.3	July 27	66.8	48.8	57.8	47.6	71	155.8	20.9	19.42	123	5.5	
<i>Adelaide</i>	107.5	December 25	33.7	August 7	73.7	54.0	63.8	47.6	57	160.6	23.5	14.57	131	4.6	
<i>Wellington</i>	73.3	January 4	35.0	July 5, 21	60.7	48.1	54.4	47.5	77	151.0	27.0	41.00	186	4.2	
Jamaica, Kingston..	94.6	July 28	59.6	January 5	89.0	70.1	79.5	70.7	74	...	...	40.81	...	...
Toronto	92.0	June 22	-16.1	February 9	51.0	34.4	42.7	36.0	75	...	-23.0	26.26	191	6.2	
New Brunswick, { Fredericton ... }	87.7	June 23	-22.0	January 28	48.6	29.4	39.0	33.1	72	...	...	47.56	187	6.1
Manitoba, { Winnipeg	97.0	August 23	-46.4	February	43.6	21.1	32.3	28.1	80	...	...	16.89	139	5.1
British Columbia, { Victoria	85.0	July 17	8.0	January 13	57.1	41.1	49.1	...	...	...	...	24.77	125	...

*Those in Italics are
South of the
Equator.*

SUMMARY.

<i>Highest Temperature in Shade</i>	107°·5 at Adelaide on December 25th.
<i>Lowest Temperature in Shade</i>	— 46°·4 at Winnipeg in February.
<i>Greatest Range in Year</i>	143°·4 at Winnipeg.
<i>Least Range in Year</i>	27°·4 at Colombo, Ceylon.
<i>Greatest Mean Daily Range</i>	22°·5 at Winnipeg.
<i>Least Mean Daily Range</i>	10°·3 at Mauritius.
<i>Highest Mean Temperature</i>	80°·9 at Colombo, Ceylon.
<i>Lowest Mean Temperature</i>	32°·3 at Winnipeg.
<i>Driest Station</i>	Adelaide, mean humidity 57.
<i>Dampest Station</i>	England, London, mean humidity 82.
<i>Highest Temperature in Sun</i>	165°·4 at Calcutta.
<i>Lowest Temperature on Grass</i>	— 23°·0 at Toronto.*
<i>Greatest Rainfall</i>	101·06 inches at Colombo, Ceylon.
<i>Least Rainfall</i>	13·75 inches at Malta.
<i>Most Cloudy Station</i>	England, London, average amount 6·7.
<i>Least Cloudy Station</i>	Malta, average amount 3·5.

* There being no grass min. thermometer at any other Canadian station.

TORRENTIAL RAINS IN BAVARIA.

To the Editor of the Meteorological Magazine.

SIR,—I see that in *British Rainfall*, 1888, you have dealt specially with intense falls of rain; I have gone through my records of the last four years, and find that there have been eight falls which you would have classed as exceptional, and of these, three are equal to those of such an intense character as to be set out on page 33 of the above-mentioned volume.

Grouping them in the order of their noteworthiness, they are as follows:—

Date,	Amount. in.		Duration. h. m.		Rate per hour. in.
1889, July 9th	·85	.....	0 8	.....	6·37
1886	·48	.....	0 8½	.....	3·38
1886, July 14th	·80	.....	0 17½	.....	2·74
1886	·82	.....	0 37½	.....	1·31
1886	·71	.....	0 27½	.....	1·56
1885	1·10	.....	1 49	.....	·60
1884	·52	.....	0 26½	.....	1·17
1884	·14	.....	0 3½	.....	2·40

I see that you regard the table on page 33 as the epitome of about 20,000 yearly records, and yet you have only 43 entries, or about 1 in 500. As I have three cases in 5 years, one of two facts is obvious—(a) torrential rains are much more frequent here than in the British Isles; or (b) your observers do not look out sharp enough.

Yours very truly,

MICHAEL FOSTER WARD.

Partenkirchen, Bavaria.

[We think that both causes are in operation. Col. Ward was always a very careful observer, and would rarely miss any phenomenon, and we believe that the storms in Bavaria are exceptionally severe.

—ED.]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1889.

STATIONS. (Those in italics are outh of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0.100	°	°	inches		0.10
England, London	59·6	24	19·2	4	48·2	33·8	34·8	80	98·8	16·4	1·36	13	7·0
Malta	78·2	21	40·8	17	61·7	50·1	47·0	77	129·3	37·2	2·71	12	5·4
Cape of Good Hope ..	89·0	5	50·8	22	76·8	57·9	...	...	...	...	1·49	5	4·8
Mauritius	83·7	5, 27	72·0	7	81·4	74·8	72·3	84	137·3	64·1	17·09	26	7·7
Calcutta	98·3	27	60·8	6	91·6	69·7	68·0	62	154·5	51·0	·92	3	2·2
Bombay.....	94·3	6	70·0	3, 4	86·1	73·8	70·1	72	147·7	59·9	·00	0	2·3
Ceylon, Colombo.....	93 0	29	72·6	6	90·6	75·1	73·0	77	147·5	68·5	1 67	14	3·4
Melbourne	96·0	16	43·0	1	75·8	53·6	50·9	63	147·2	29·0	·24	5	5·0
Adelaide	102·0	16	49·6	20	81·6	60·2	51·3	50	151·0	40·9	·81	8	4·4
Wellington	73·0	3	43·2	26	65·5	52·9	50·7	73	131·0	35·0	3 97	12	4·3
Auckland .....	...	...	...	...	...	...	...	...	...	...	...	...	..
Jamaica, Kingston.....	92·5	29	60·0	2	88·6	68·7	69·3	73	...	...	5·43	...	...
Trinidad	95·5	12	62·0	27	90·6	70·1	70·5	72	158·5	54·0	4·16	...	...
Toronto	54·8	23	13·1	11	39·3	26·5	25·3	73	...	5·0	·99	9	6·1
New Brunswick, Fredericton	51·8	23	— 7·7	1	39·7	20·4	23·3	70	...	...	3·68	10	5·5
Manitoba, Winnipeg ...	61·8	23	—14·1	13	38·2	15·4	22·6	78	...	...	·35	9	3·9
British Columbia, Victoria	64·0	26a	30·0	3	56·9	39·5	...	...	...	...	1·50	14	...

a And 29.

REMARKS, MARCH, 1889.

MALTA.—Mean temp. 54°·8; mean hourly velocity of wind 14·3 miles. Sea temp. ranged from 58°·5 to 60°·6. TS on 23rd, H on 6th and 17th. R nearly four times the average; wind 40 per cent. above average. J. SCOLES.

Mauritius.—Mean temp. of air 0°·1 below, mean dew point 2°·6 above, and R 9·32 in. above their respective averages. Mean hourly velocity of wind 12·4 miles, or 2·1 above average; extremes 31·1 on 11th and 1·7 on 3rd. Prevailing direction, E.S.E. to E. L on 4 days; T on 5 days. Local inundations from 9th to 11th and on 17th.

C. MELDRUM, F.R.S.

COLOMBO.—Thunderstorms on 7 days and L on 7 other days.

J. C. H. CLARKE, LT. COL. R.A.

Melbourne.—Mean temp. of air 0°·7 above average; temp. of dew point 1°·2, humidity 5, amount of cloud 0·6, and R 1·87 in. below averages. Prevailing winds S.E., S.W., and S.; strong on 5 days. Heavy dew on 10 days and distant T on the 18th.

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

Adelaide.—Pressure ·043 in. and temp. slightly above the average of 32 years. R a quarter of an inch less than the average.

C. TODD, F.R.S.

Wellington.—Generally showery during the month, with intervals of fine weather. Prevailing wind N.W., strong on 8 days; gales on 8th and 22nd. Mean temp. 2°·9 below, R 1·15 in. above average.

R. B. GORE.

SUPPLEMENTARY TABLE OF RAINFALL,
 SEPTEMBER, 1889.

[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 Hall.	...	XI.	Castle Malgwyn	2·77
„	Margate, Birchington...	1·06	„	Rhayader, Nantgwillt..	3·17
„	Littlehampton	·77	„	Carno, Tybrith	2·60
„	Hailsham	·74	„	Corwen, Rhug	1·63
„	Ryde, Thornbrough .....	...	„	Port Madoc	2·97
„	Alton, Ashdell.....	1·05	„	I. of Man, Douglas	2·78
III.	Oxford, Magdalen Col...	1·49	XII.	Stoneykirk, ArdwellHo.	2·86
„	Banbury, Bloxham	2·05	„	New Galloway, Glenlee	2·13
„	Northampton	2·19	„	Melrose, Abbey Gate...	1·17
„	Cambridge, Beech Ho...	2·76	XIII.	N. Esk Res. [Penicuick]	1·50
„	Wisbech, Bank House..	2·38	XIV.	Ballantrae, Glendrisaig	2·99
IV.	Southend	2·36	„	Glasgow, Queen's Park.	1·22
„	Harlow, Sheering	2·85	XV.	Islay, Gruinart School..	3·51
„	Rendlesham Hall	1·83	XVI.	Dollar.....	1·00
„	Diss	3·00	„	St. Andrews, PilmourCot	·79
„	Swaffham	2·76	„	Balquhider, Stronvar..	1·57
V.	Salisbury, Alderbury...	1·16	„	Dunkeld, Inver Braan..	·77
„	Warminster	1·44	„	Dalnaspidal H.R.S. ...	1·93
„	Bishop's Cannings	1·35	XVII.	Keith H.R.S.	1·93
„	Ashburton, Holne Vic...	2·50	„	Forres H.R.S.	·98
„	Hatherleigh, Winsford.	1·09	XVIII.	Strome Ferry H.R.S....	4·31
„	Lynmouth, Glenthorne.	1·54	„	Fearn, Lower Pitkerrie.	·94
„	Probus, Lamellyn	1·72	„	Loch Shiel, Glenaladale	5·73
„	Launceston, S. Petherwin	1·95	„	N. Uist, Loch Maddy ...	4·07
„	Wincanton, Stowell Rec.	1·87	„	Invergarry	2·59
„	Taunton, Lydeard Ho...	1·53	„	Loch Ness, Drumnadrochit	1·19
„	Wells, Westbury	1·31	XIX.	Lairg H.R.S.	1·20
VI.	Bristol, Clifton	2·27	„	Forsinard H.R.S. ....	...
„	Ross	2·06	„	Watten H.R.S.	2·50
„	Wem, Clive Vicarage ...	2·12	XX.	Dunmanway, Coolkelure	3·34
„	Cheadle, The Heath Ho.	3·43	„	Fermoy, Gas Works ...	1·39
„	Worcester, Diglis Lock	1·49	„	Tipperary, Henry Street	1·38
„	Coventry, Coundon	3·01	„	Limerick, Kilcornan ...	1·10
VII.	Ketton Hall [Stamford]	2·28	„	Miltown Malbay.....	3·22
„	Grantham, Stainby	2·39	XXI.	Gorey, Courtown House	1·60
„	Horncastle, Bucknall ...	2·01	„	Navan, Balrath	1·33
„	Mansfield, St. John's St.	2·24	„	Mullingar, Belvedere ...	2·03
VIII.	Neston, Hinderton	2·96	„	Athlone, Twyford	1·45
„	Knutsford, Heathside ...	3·36	„	Longford, Currygrane ...	2·39
„	Lancaster, South Road.	2·95	XXII.	Galway, Queen's Coll...	2·59
„	Broughton-in-Furness ..	4·96	„	Clifden, Kylemore	4·40
IX.	Wakefield Prison	1·07	„	Crossmolina, Enniscoe..	2·19
„	Ripon, Mickley	·79	„	Collooney, Markree Obs.	3·18
„	Scarborough, West Bank	1·00	„	Ballinamore, Lawderdale	...
„	East Layton [Darlington]	·66	XXIII.	Warrenpoint	1·29
„	Middleton, Mickleton..	1·28	„	Seaforde	2·03
X.	Haltwhistle, Unthank..	1·82	„	Belfast, New Barnsley ..	3·31
„	Shap, Copy Hill	1·12	„	Bushmills, Dundarave...	3·72
XI.	Llanfrechfa Grange	2·98	„	Stewartstown	2·13
„	Llandoverly	2·82	„	Buncrana	3·24

SEPTEMBER, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						TEMPERATURE				No. of Nights below 32°	
		Total Fall.	Difference from average. 1870-9	Greatest Fall in 24 hours.		Days on which -01 or more fell.	Max.		Min.				
				Dpth	Date.		Deg.	Date	Deg.	Date.			
											In shade.	On grass.	
		inches	inches.	in.									
I.	London (Camden Square) ...	1·77	—	·74	·73	24	10	80·3	11	35·1	23	0	4
II.	Maidstone (Hunton Court) ...	1·27	—	1·04	·57	3	8	...	...	...	...	...	...
III.	Strathfield Turgiss	1·39	—	·91	·83	24	11	80·0	12	30·8	18	3	6
III.	Hitchin	1·69	—	·79	·61	24	13	74·0	11	38·0	17	0	...
IV.	Winslow (Addington)	2·40	—	·08	1·03	24	11	80·0	11	31·0	23	1	5
IV.	Bury St. Edmunds (Westley) ...	3·48	+	·79	1·05	24	10	...	...	...	...	...	...
V.	Norwich (Cossey)	3·29	+	·21	·91	24	10	70·0	1a	32·0	17e	3	...
V.	Weymouth (Langton Herring) ...	·88	...	...	·42	23	7	72·0	4	40·0	25	0	...
"	Barnstaple	1·64	—	2·64	·56	23	7	83·0	13	37·0	23	0	...
"	Bodmin (Fore Street)	1·89	—	3·30	·86	23	12	...	...	...	...	...	...
VI.	Stroud (Upfield)	1·69	—	1·56	·70	23	10	80·0	12	38·0	20f	0	...
"	Churchstretton (Woolstaston) ...	1·63	—	1·84	·78	23	14	77·0	12	38·0	25	0	1
"	Tenbury (Orleton)	1·49	—	1·86	·86	23	10	81·6	12	29·5	18	2	4
VII.	Leicester (Barkby)	2·29	—	·41	1·06	23	13	80·0	11	30·0	17	4	5
"	Boston	1·87	—	·74	·58	23	10	78·0	11	28·0	22	...	...
"	Hesley Hall (Tickhill)	1·24	...	...	·62	23	10	75·0	10b	32·0	22g	2	...
VIII.	Manchester (Plymouth Grove) ...	2·65	—	1·22	·54	26	13	76·0	10	35·0	25	0	2
IX.	Wetherby (Ribston Hall)	1·15	—	1·93	·36	2	6	...	...	...	...	...	...
"	Skipton (Arncliffe)	2·69	—	2·89	·57	18	15	72·0	7	33·0	22	0	...
"	Hull (People's Park)	1·38	—	1·61	·35	23	13	...	...	...	...	...	...
X.	North Shields	1·51	—	·81	·30	11	12	70·5	10	32·0	22	1	4
"	Borrowdale (Seathwaite)	8·31	—	4·91	2·43	26	14	...	...	...	...	...	...
XI.	Cardiff (Ely)	2·11	—	2·69	1·20	23	9	...	...	...	...	...	...
"	Haverfordwest	3·05	—	2·00	2·07	23	13	71·2	12	32·5	22	0	4
"	Plinlimmon (Cwmsymlog) ...	4·18	...	...	1·56	19	13	...	...	...	...	...	...
"	Llandudno	2·22	—	1·53	·45	18	13	72·2	12	42·2	18	0	...
XII.	Cargen [Dumfries]	1·80	—	2·61	·66	18	11	73·4	6	30·0	22	1	...
"	Jedburgh (Sunnyside)	1·39	—	1·20	·41	27	8	66·0	5c	32·0	22	1	...
XIV.	Old Cumnock	3·50	—	·99	·80	18	15	74·0	1	22·0?	21	6	...
XV.	Lochgilthead (Kilmory)	3·59	—	2·17	·87	18	14	...	...	...	...	...	...
"	Oban (Craigvarren)	2·37	...	...	·71	18	17	70·0	6	33·3	24	0	2
"	Mull (Quinish)	3·85	...	...	·84	17	21	...	...	...	...	...	...
XVI.	Loch Leven Sluices	·80	—	2·43	·40	19	5	...	...	...	...	...	...
"	Dundee (Eastern Necropolis) ...	·60	—	2·34	·25	18	7	69·8	10	34·0	24	0	...
XVII.	Braemar	1·03	—	2·91	·27	18	13	70·0	6	30·0	24	1	11
"	Aberdeen (Cranford)	·99	...	...	·38	18	15	70·0	9d	34·0	25	0	...
XVIII.	Lochbroom	3·98	...	...	·76	19	15	...	...	...	...	...	...
"	Culloden	1·15	—	1·75	...	...	...	68·0	7, 10	33·0	25	0	7
XIX.	Dunrobin	1·87	...	...	·46	10	10	66·5	9	34·0	26	0	...
"	S. Ronaldsay (Roeberry)	2·07	—	1·16	·66	10	16	63·0	4	38·0	24	0	...
XX.	Cork (Blackrock)	·99	—	3·16	·48	23	12	70·0	8, 14	39·0	24	0	...
"	Dromore Castle	2·45	...	...	·63	23	14	75·0	12	41·0	29	0	...
"	Waterford (Brook Lodge) ...	·85	...	...	·35	23	10	69·5	3	39·0	18h	0	...
"	O'Briensbridge (Ross)	1·23	...	...	·18	23	13	71·0	1	40·0	30	0	...
XXI.	Carlow (Browne's Hill)	·81	—	2·45	·21	18	11	...	...	...	...	...	...
"	Dublin (Fitz William Square) ...	1·04	—	1·37	·35	23	13	69·7	11	38·9	25	0	1
XXII.	Ballinasloe	1·44	—	2·52	·38	10	16	69·0	12	35·0	25	0	...
XXIII.	Waringstown	2·17	—	1·18	·53	11	15	74·0	5	35·0	22i	0	4
"	Londonderry (Creggan Res.) ..	3·81	...	...	1·15	26	20	...	...	...	...	...	...
"	Omagh (Edenfel)	2·51	—	1·53	·50	26	18	69·0	12	38·0	22	0	...

a And 11, 14. b And 11. c And 9, 14. d And 10, 11. e And 18, 22. f And 25. g And 23.

h And 23, 25, 26. i And 24.

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

METEOROLOGICAL NOTES ON SEPTEMBER, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—We have seldom experienced a finer September. Coming after a showery August, unsuitable for harvesting, it gave full recompense for the shortcomings of that month. A sharp touch of frost occurred on the 17th, 18th and 19th, and rough weather prevailed from the 24th to the 27th.

ADDINGTON.—Taken altogether, it was a fine month, and very warm from the 9th to the 13th. Little R fell until the 23rd, when there was a good steady downpour from about 10 p.m. on the 23rd, to the afternoon of the 24th, 1·96 in. falling in the two days. Frost occurred rather early, tender plants being injured on the 18th, and some quite destroyed on the 23rd.

BURY ST. EDMUND'S, WESTLEY.—The month was remarkable for the severe TS on the night of the 2nd, when an inch of R fell in a very short time; also for the 1·76 in., which all fell on the 24th, though measured in two days.

LANGTON HERRING.—The first half of the month was very warm, the mean temp. exceeding that of August. In the latter half, the temp. was low, and there were several nights on which there was white frost. The mean temp. at 9 a.m. was 0°·5 above the average. Solar halo on the 8th; fogs on the 9th and 13th; heavy dews on 11th, 13th and 15th.

WOOLSTASTON.—A perfect harvest month. The second week was very hot, the max. temp. on the 12th being the highest recorded during the year. Mean temp. 54°·5.

ORLETON.—The first half of the month was very fine and dry, with a temp. above the average. The remainder of the month, excepting the 26th and 27th, was much cooler than the average, with rough, cold and variable winds, the mean for the whole month being about 0°·4 below the average of 28 years. Frosts occurred on the mornings of the 18th and 23rd, and fogs on the mornings of the 2nd, 8th and 13th. The R nearly all fell after the 18th, and no T or L was recorded. The weather was favourable for gathering the hops, and securing the late harvest.

MANCHESTER, PLYMOUTH GROVE.—During the first 12 days summer weather prevailed, the 16th, 17th, 18th, 22nd, 25th, and 29th were fine autumn days, and the rest of the month was wet and cold. T, L and H on 20th.

HULL.—The weather was at times showery, but there were good long periods of fine bright autumnal weather.

WALES.

HAVERFORDWEST.—The month commenced with high temp., southerly wind, cloud, and some fog. After the 5th, the air cleared, and fine bright summer-like weather prevailed to the 17th; cold nights occurred about the 15th, with a decided fall of temp., which continued to the end of the month, a sharp frost occurring on the 22nd, followed by an unusually heavy R, 2·00 in. in less than 10 hours. Crops of all kinds splendid, and harvest got in in fine order; such a season has not been remembered for many a long year. Temp. at or above 70° on 4 days; much bright sunshine during the first 3 weeks.

SCOTLAND.

CARGEN.—The difference in the temp. of the first and second halves of the month was remarkable. For the first 14 days the mean temp. was 58°·8, being 2°·2 above the average for June, and 0°·4 above that of August. The latter half of the month was unusually cold, bringing down the mean temp. of

the month nearly 1° below the average. Cold nights occurred on the 21st, 22nd, and 23rd, frosting down vegetation ; a warm wave followed on the 27th and 28th. E. winds prevalent ; sunshine below the average.

JEDBURGH.—The weather during the month was seasonable and favourable for ingathering corn, which, except in high districts, was nearly completed at the close. The turnip and potato crops look well, and grass is abundant.

CRAIGVARREN, OBAN.—On the whole a fair month, with liberal showers of much benefit to stock and growth. Temp. high during the first half, and low during the second. Very early S on hills on 21st, with a cold wave full a week earlier than before noted.

LOCHBROOM.—The first half of the month was beautiful, enabling the farmer and the crofter to secure their crops in splendid condition ; but from the 16th to the end it was stormy and cold in the extreme, H rattling about our ears on many occasions, and S on the hills nearly down to our houses. Seldom have we seen so sudden a change as took place about the 17th.

INVERNESS, CULLODEN.—The month generally was fine, with a dry period from the 1st to the 20th.

ROEBERRY.—The first half of the month was fine, the second half cold and unsettled.

IRELAND.

CORK.—On the whole, a fine but frequently not a bright month. Mean temp. ($57^{\circ}6$) $4^{\circ}0$ below the average.

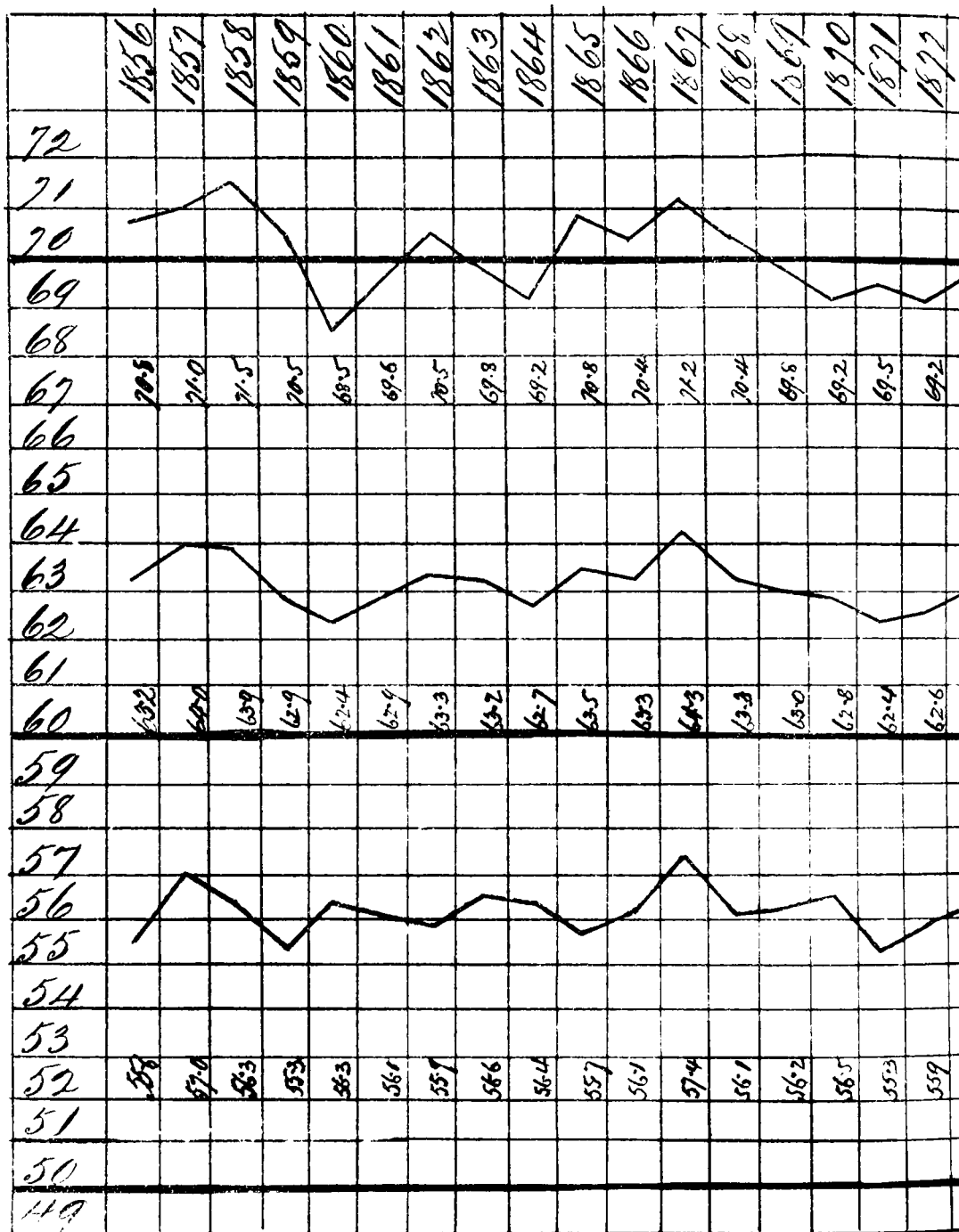
WATERFORD.—R 2'68 in. below the average. Mean temp. $56^{\circ}1$. Fog on 5th, 10th, 11th and 12th.

DUBLIN.—A fine month, with high mean pressure, winds from polar quarters—chiefly N.W.—a moderate R, and a normal temp. At the beginning, fogs were prevalent along the coast, and towards the close, strong and squally winds occurred on several days. High winds on 7 days ; gale on 18th. Mean humidity 87 ; mean amount of cloud 6'2.

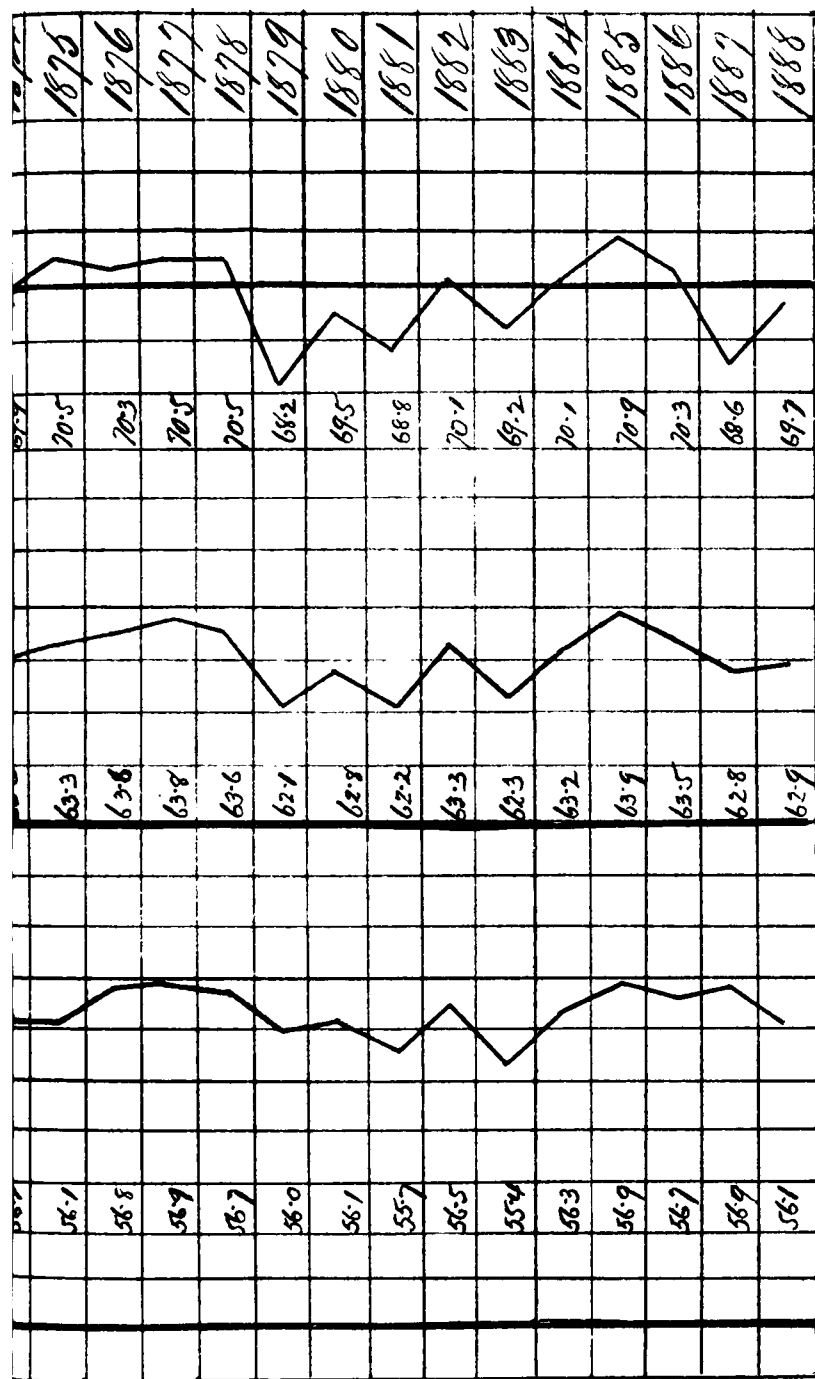
WARINGSTOWN.—Strong drying northerly winds prevailed during the last fortnight of the month, which prevented the R from materially retarding harvest operations.

EDENFEL, OMAGH.—With the exception of the 8th, 10th, and 11th, the first half of the month was fine, warm and favourable, and enabled the greater part of an excellent harvest to be secured in good condition. The remainder of the month was squally, wet and unsettled, with more or less heavy R on every day but the last. Swallows last seen on 27th.

Diagram shewing Temperature 1856 to



waves at Sydney N.S.W.
1888



Max. Temp.

Mean Temp.

Min. Temp.

H. C. Russell
aug 29 1888

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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THE FLOATING ISLAND IN LAKE DERWENTWATER.

BY PROF. RAPHAEL MELDOLA, F.R.S.

AS there still appears to be a certain amount of mystery attaching to this remarkable phenomenon, so well described by Mr. G. J. Symons in his interesting little work published last year,* I am induced to offer for the consideration of those interested in the subject some ideas which occurred to me on reading Mr. Symons's investigation, and which I have recently had the advantage of discussing with the author himself. It must be assumed that the majority of the readers of this Magazine are sufficiently acquainted with the results arrived at by Mr. Symons, to render a recapitulation of them unnecessary here.

The immediate cause of the rising of the mass of vegetable matter has been shown by the investigation to be the gases, consisting chiefly of marsh gas with a smaller proportion of nitrogen, entangled among the peat. The problem therefore resolves itself into ascertaining the source of these gases. If it could be shown with any probability that a subterranean source of the gases exists under the islands, the mystery would be at once solved, but there is unfortunately no evidence for such a belief, and it is generally admitted that it is unscientific to invoke unknown causes until all feasible explanations have failed. There is, moreover, much antecedent improbability against this view, since the emanation of marsh gas from fissures in strata as old as the Silurian is a phenomenon unknown, as far as I am aware, in this part of the world. I speak, of course, subject to correction by geologists on this point. It is true that some of the Canadian petroleum deposits occur in pre-Silurian strata, but when marsh gas can come to the surface from a petroleum deposit, it generally brings up hydrocarbon oils with it, and to my knowledge nothing of the kind has ever been observed on Derwentwater. The various theories which have been proposed to account for the phenomenon

* The Floating Island in Derwentwater, its History and Mystery, by G. J. Symons, F.R.S. Stanford.

have been so ably discussed by Mr. Symons that readers need only be referred to his work. Of these theories, the one which I hold to be the most natural, is that which attributes the flotation of the peat bed to the gases engendered by its own decomposition. This is substantially the view put forward in 1801 by "D. J. P." in the *Phil. Mag.*, vol. xi., and reiterated by Otley and Dalton in 1814-1830. The chief objections to this view, as I learn from Mr. Symons, are : 1st, that it does not explain why similar floating islands do not occur elsewhere where similar conditions, viz., a peat bed on a lake bottom, prevail ; 2nd, that it fails to account for the long succession of recorded appearances of the island from 1773 down to the present time.

Respecting the first objection it must be observed that the essential (mechanical) conditions may, after all, be of very rare occurrence. What is required is a bed of peat resting on a sufficiently friable foundation to enable it to tear away from its basement when the specific gravity is sufficiently reduced by the entangled gas. This condition has been shown to exist in the Derwentwater deposit, but it cannot be assumed from this that similar conditions should be expected to prevail in other lakes. The peat bed which forms the floating island appears to be resting on a loose delta-deposit. It is not unlikely that the currents from the inflowing streams, the Lodore and the Cat Gill Beck, may keep this deposit in the necessary condition of looseness, and may prevent the peat bed from ever becoming firmly anchored to the bottom. For these reasons this first objection does not appear to me to possess much weight.

The second objection is the one which has really been instrumental in causing me to venture to touch upon the subject. It has seemed improbable to some writers that the peat should continue to evolve gas for so long a period. Thus Otley (as quoted by Mr. Symons) says that on the view that the gas is produced by the decomposition of the vegetable matter, "the process of forming gas must apparently reach a maximum and then gradually cease." Now we may fully admit this as an abstract proposition, but it seems to me quite impossible to define this maximum. There is no *à priori* reason why a deposit of peat should not go on evolving marsh gas and nitrogen for a century or for two centuries, especially when, as in the present case, the bed is added to from time to time by growth on its surface. The whole question turns upon the point as to how long a mass of vegetation decaying under water could go on evolving marsh gas, &c. Unfortunately we have very few data to furnish exact information on this point, but I have made certain calculations which I submit to the consideration of the readers of the Magazine for whatever they may be worth.

In the first place, with respect to the specific gravity of peat I can get but very scanty information, but the best authorities that I have been enabled to consult give it as about 1.2 for the denser kinds. We shall not be far wrong if we suppose that 10

cubic centimetres of peat freed from adhering water weigh 12 grammes. According to the average of numerous analyses, peat of this kind contains about 4·5 per cent. of hydrogen not in the form of water, 40 per cent. of carbon, and about 1 to 1·5 per cent. of nitrogen. Supposing the whole of the hydrogen in peat to be evolved as marsh gas in the process of decay, one part by weight of hydrogen would yield four parts of this gas, so that 10 cubic centimetres of peat weighing 12 grammes and containing 0·54 gramme of hydrogen would yield 2·16 grammes of marsh gas. There is, however, no warrant for the belief that the whole of the hydrogen is converted into marsh gas, so that it will be safer to begin by assuming that only one half of the hydrogen—say 0·27 grammes—is evolved in this form. Then it will be found that this quantity of gas weighing 1·08 grammes at 0° C. and 760 mm. bar. occupies 1,500 cubic centimetres. At ordinary atmospheric temperature (15° C.) this volume becomes 1,582 cubic centimetres. The final result is that if we suppose only one half of the available hydrogen to be evolved as marsh gas, a given volume of peat would furnish over 150 times its volume of gas, so that if only one-tenth of the whole quantity of hydrogen were evolved as marsh gas there would still be a volume of gas greater than that of the volume of peat decomposed. The density of marsh gas as compared with water is approximately ·0007, so that the decay of an extremely minute quantity of peat would give enough gas to float the bed.

All these considerations tend to prove that the early explanation is the correct one, and that no great stretching of hypothesis is necessary to account for the facts. The circumstance that a moderately elevated temperature is most favourable to the appearance of the island is distinctly in accordance with the view here advocated, since the decomposition of vegetable matter under water is well known to proceed most rapidly in warm weather. The only point in which the present case differs from the ordinary evolution of marsh gas in stagnant ponds is that the mass of vegetable matter is sufficiently coherent to retain the gas bubbles, and to rise and sink as a whole. The periodicity of the phenomenon simply represents the intervals of time necessary for the bed to accumulate a sufficient charge of gas to raise it from its basement. When the mass rises, the gas, relieved from the pressure of water, gradually escapes, and the island sinks till the accumulated gas again diminishes the specific gravity of the whole to the critical point of flotation. The only observable effect upon the peat bed would be that in course of time it would become slightly richer in carbon and poorer in hydrogen; in fact, just the change in chemical composition which is known to take place in the transformation of peat into lignite.

THE AUTUMN CONGRESSES.

THE BRITISH ASSOCIATION AT MANCHESTER.

(Continued from page 136.)

THE DETERMINATION OF THE AMOUNT OF RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—There seem to be two or three errors (typographical ?) in the important paper of Prof. Cleveland Abbe in your October number. On page 133, the heading of the last column apparently should be—

$$6 \times \sqrt{\text{alt.}}$$

and the formula in the middle of page 134 should read $\sqrt{h_1}$ as well as $\sqrt{h_2}$, i.e.—

$$P = c_1 + \frac{1}{\sqrt{\frac{h_2}{h_1}} - 1} (c_1 - c_2)$$

There is a further misprint in the 12th line of page 135, for “deducted” read “deduced.”—Yours truly,

T. W. BACKHOUSE.

[Mr. Backhouse is, we believe, perfectly right.—ED.]

ATMOSPHERIC ELECTRICITY.

A paper on “Atmospheric Electricity,” by Prof. L. Weber was read, in which he gave results of experiments made by flying kites and by sending up balloons to which wires were attached leading to a galvanometer whose other terminal was put to earth. The results were given only for twelve bright summer days on which there were no clouds; the results on those days on which clouds prevailed having brought in various perturbations are reserved for discussion on a future occasion. The intensity of the currents was plotted, and it was found that the higher the kite went the more intense the current became. Up to 300 ft. the current was in a negative direction.

Prof. C. Michie Smith also read a paper entitled “Notes on Atmospheric Electricity, and the use of Sir W. Thomson’s Portable Electrometer.” In the course of his remarks he said that usually they had in Madras during September frequent magnificent displays of sheet lightning, and he had often made electrometer observations from the top of his house while these displays were in progress. In some cases an evident effect was produced on the electrification of the air, but in general it was found that the electrification was normal. This pointed to the conclusion that so-called sheet lightning might be divided into two classes. There was the reflection of distant lightning seen on the clouds or on the sky, but there was also, and it could be easily distinguished from the former, a series of discharges going on between two neighbouring masses of cloud.

These discharges often took the brush form. At other times, fine flashes might be seen lighting up the whole mass of the cloud, and at times a large series of discharges almost parallel and simultaneous pass between the two cloud banks. Such discharges taking place at a considerable distance did not sensibly affect the electrometer. On the other hand, when the sheet lightning was simply the reflection from distant flashes, the electrometer was usually strongly influenced. From his own experience of thirteen years of the portable electrometer, he found that the instrument must be very differently treated in damp tropical climates to what was necessary in this country. The observer must be content with much less complete insulation. In the first place, the pumice must be charged with a much larger quantity of acid—as much as it would absorb without showing a moist surface. This involved more frequent drying, and he found that about once a fortnight was long enough to leave it. The greatest difficulty, however, was in charging the instrument at all. It was almost hopeless to attempt it with the small electrophorus supplied with it, and even when an electrical machine of any kind was used the greatest care was required in drying the charging end. Recharging was necessary every three or four days. He mentioned these things as he found that the neglect of the precautions had caused many people to think that the use of the portable electrometer in India was impossible.

SUNSHINE AND RAINFALL AT BEN NEVIS.

The registrations of the sunshine recorder at Ben Nevis Observatory showed 970 hours of sunshine during the year, the smallest number of hours for any month being 8 for November, and the largest 250 in June, being nearly half the possible sunshine. The number of hours for the four years now observed beginning with 1885, were 680, 576, 898, and 970. The contrast of the sunshine of 1886 with that of 1888 is thus very striking. The amount of the rainfall for the year was 132·46 in., the month of least rainfall, 3·76 in., being June, and the greatest, 20·60 in., being November. The number of days on which precipitation was nil, or less than the hundredth of an inch, was 118. The number of rainless days for the three last years have been 159, 128, and 118. From all the observations yet made, it is seen that a fall, equalling at least 1·00 a day, has occurred on an average of one day in nine. Atmospheric pressure was this year again above the annual average, the mean at sea-level being 29·889, or 0·055 higher. The lowest mean at the observatory, 25·035 in., occurred in March, and the highest, 25·590 in., in September; the difference being 0·555 in. At sea-level at Fort William, the extreme monthly means were 29·636 in. in November, and 30·132 in September; the difference being 0·496 in.

BLACK BULB IN VACUO.

Prof. McLeod, F.R.S., in a paper on the black-bulb thermometer *in vacuo*, concludes that the black bulbs should be as small as possible,

and very little of the stem blackened, and also that the case should be as thin as is consistent with strength.

DARK LIGHTNING FLASHES.

Mr. A. W. Clayden read a paper on dark flashes of lightning. The author exhibited a negative taken on June 6th last, which shows several reversed images of lightning-flashes. He described a series of experiments which he had carried on with the object of discovering whether the phenomenon could be imitated in the laboratory. The steps in the investigation were illustrated by a series of negatives showing photographs of electric sparks. The conclusions arrived at are, that photographic images of electric sparks can be reversed by the action of diffused light. Reversal is only produced when the exposure to diffused light is subsequent to (or possibly simultaneous with) exposure to the image of the spark. If the plate is first acted upon by diffused light, the sparks give a direct image unless the action has been considerable, in which case they seem to make no impression.

CONGRÈS INTERNATIONAL MÉTÉOROLOGIQUE.

In the notice of the programme of the above congress which we printed in July last we predicted that it could not be carried out, and our prediction was fulfilled. But nevertheless the Congress must be pronounced to have been a success, both for the eminence of many of the men who attended it, and because of the excellence of some of the papers. We have not a list of the members, but if we name in alphabetical order some of those who accepted the invitation of the French Meteorological Society, it will be seen that the gathering was an interesting and probably useful and important one :—

R. Billwiller...Switzerland	S. Hepites Bucharest
L. Cruls.....Rio de Janeiro	H. H. Hildebrandsson.. Upsala
G. G. Davis ...Buenos Aires	A. Paulsen .....Copenhagen
M. Dechevrens Zi Ka Wei, Shanghai	A. L. Rotch Blue Hill, U.S.A.
F. Denza .....Turin	G. J. Symons.....London
B. A. Gould ...Buenos Aires	Y. Wada .....Tokio, Japan.

Of French meteorologists nearly all the leading men were there.

The inaugural meeting was held in the Trocadéro, M. le Prof. Mascart opening the proceedings by welcoming the members on behalf of the Minister of Public Instruction. Mr. Symons then proposed that M. Renou, director of the Observatory at Parc St. Maur and President de la Soc. Mét. de France, be elected president of the Congress. This was carried by acclamation, and M. Renou took the chair and delivered an address. Subsequently the vice-presidents and other officers were appointed and the meeting was closed. The subsequent sectional meetings were held in the rooms of the Physical Society, 44, rue de Rennes.

We do not intend to report upon the work done, because we know that one of the editors of the *American Meteorological Journal* took very careful notes and that an interesting abridgment will appear in that journal. There is no advantage in printing twice where once will suffice, and we therefore advise our readers to buy the November and December numbers of, if they are not already subscribers to, that publication.

And we have another suggestion to make, but as it involves the expenditure of half a sovereign, everybody may not be willing to adopt it. The papers sent in were both numerous and important, more so than was anticipated when the arrangements were originally made and the membership fee, entitling the member to a copy of all the reports, was fixed at 12 francs. It is doubtful whether the subscriptions already received will meet the cost of all this printing, and as no more copies of the reports will be printed than are subscribed for, those who desire to help a good work, and also to receive a valuable report should send a money order on Paris for 10s. to M. E. Renou, Prés. Soc. Mét. de France, 7, rue des Grands Augustins, Paris.

The ordinary meetings commenced on Friday, September 20th, and continued until the 25th. Four special visits were made—(1) to the Bureau Central, where Prof. Mascart not only explained all the ordinary working of his establishment now at last very commodiously housed, but also showed several charming experiments illustrative of the formation and action of whirlwinds, waterspouts, and dust storms; (2) to the remarkable collection of self-recording apparatus shown in the Exposition by MM. Richard Frères; (3) to the Meteorological Observatory at Parc St. Maur, where the Congressists were received by M. Renou, and subsequently shown the magnetic instruments by M. Mourreaux; (4) to the private part of the Eiffel Tower, at the extreme top of which MM. Richard Frères have established quite a meteorological observatory.

THE SANITARY INSTITUTE.

The meetings of this body show one curious feature—they are always best in Cathedral cities. It is not for us to spend much time in explaining or moralizing about the fact. It may be due to the desire of the clergy to render healthier and happier the homes of their poorer brethren; it may be due to the fact that generally the struggle for life—or shall we say for money—is less fierce than in other towns; we know not, we chronicle the fact, and pass on to the meteorology. The section for Meteorology, Chemistry, and Geology was fortunate in having for president one of the oldest medical officers of health, and a past president and the council secretary of the Royal Meteorological Society. Dr. Tripe's Address, entitled "Winds, with some remarks on their sanitary effects," dealt not only with the great general movements of the atmosphere, the trades, &c., but also with the exceptional ones, such as the Simoon,

the Helm, the Southerly Burster, the Föhn, the Sirocco, Khamsin, Harmattan, Solano, and others. Tornadoes, the relation between velocity and pressure, Beaufort's scale, Krakatoa, the Eiffel Tower, the distribution of seeds, waterspouts, showers of fish, fog, the distribution of small-pox, the sites of hospitals, and many other subjects, were dealt with in this able and comprehensive address, which of course will be printed *in extenso* in the Transactions of the Institute.

The only other strictly meteorological paper was by Surgeon-Major Black, who gave an interesting epitome of the results of observations of air and sea, made by him during several recent visits to the sea-side towns of Brighton, Folkestone, Hastings, Boulogne, and Havre. Dr. Black did not put forward his observations as other than those which any visitor could make, but his results are interesting, if not strictly comparable, and we do not remember having seen the question of sea-bathing in relation to the temperature of sea and of air so ably discussed before.

CONGRÈS INTERNATIONAL D'HYDROLOGIE ET DE CLIMATOLOGIE.

It is said that there were 68 Congresses held in Paris this year; there were certainly too many, and it may have been to that, to cold, wet weather, or to lateness in the year, that the woeful contrast between the Biarritz and the Paris Congress was due. Instead of the hundreds assembled at Biarritz, the total list of members (including Parisians, and in some cases the wives and daughter) up to Oct. 3rd was only 79, and at the sectional meetings an audience of half-a-dozen was unusually large. To some extent quality atoned for numbers, as the following list will show:—Antoine d'Abbadie, Bonkowski-Bey (*Constantinople*), Bouloumié (*Vittel*), Donaciano Morales (*Mexico*), Duhourcau (*Cauterets*), Durand Fardel, Faralli (*Florence*), Fines (*Perpignan*), Gandy (*Bagnères de Bigorre*), Labat, Lemoine, Leudet, Marcaillhou d'Ayméric (*Ax*), Meunier (*Eaux Bonnes*), Poskin (*Brussels*), de Ranse, Renou, Rotch (*Blue Hill*), Schlemmer, Sénac Lagrange (*Cauterets*), de Valcourt (*Cannes*), Wada (*Japan*), Winternitz (*Vienna*).

It could, of course, not be otherwise than profitable to have the advantage of meeting men of such standing, but we are by no means sure that they would all feel gratified at contemplating the papers and discussions, good though some of them were.

The excursion to the Vosges was abandoned, the weather being unfavourable and late autumn having set in.

It was understood that the Italian delegates invited the Congress to assemble in Rome in 1892.

FINE METEOR DOUBLY OBSERVED.

To the Editor of the Meteorological Magazine.

SIR,—There was a magnificent meteor seen here on Monday, November the 4th, towards eight o'clock. I did not see it myself, but from the descriptions it must have been a fine sight. Many were startled by the sudden light shining on the ground, and looking up had just time to see the cause disappearing. My son was fortunate enough to see all its course for a long way across the sky.

Yours truly,

J. MATHISON.

Addington, Winslow.

To the Editor of the Meteorological Magazine.

SIR,—Did you see a very fine meteor at 7.55 p.m. on November 4th, in the N.W. at an altitude of 45° ? The sky was completely overcast, so that no stars were visible; the light of the moon could be seen, but not its outline, and the meteor shone through the clouds like a small moon, and was followed by a very brilliant train or attendant meteor. Had the sky been clear, I think that it would have been magnificent.—Yours faithfully,

E. WHITE WALLIS.

49, Clifton Hill, St. John's Wood, N.W., 5th November, 1889.

A COLD PERIOD.*

To the Editor of the Meteorological Magazine.

SIR,—The fall in temperature which has taken place in parts of Europe suggests the question, has a similar fall taken place in the Southern Hemisphere? And as a contribution to the answer I send a diagram (*see frontispiece*) showing the mean temperature at Sydney, 1856 to 1888 inclusive, and the maximum and minimum for the same period. It will be seen that as far as Sydney is concerned the past four years have a mean $0^{\circ}3$ above the average, and 1885 was the hottest year since 1867. Had the question been asked here in 1872, the answer would have been that the temperature had fallen steadily for the previous four years; if in 1878, that there had been a steady increase in temperature for the previous six years.†

Yours very truly,

H. C. RUSSELL, F.R.S.

Sydney Observatory, 26th August, 1887.

* See *Met. Mag.*, vol. xxiv., pp. 17 & 72.

† From 1856 to 1865 inclusive the exposure of the minimum was different from what it has been since, and the readings have been corrected to accord with those taken for the past twenty-three years, during which period thermometers have been exposed in the same shed.

REVIEWS.

Lehrbuch der Meteorologie für Studierende und zum gebrauch in der Praxis. Von DR. W. J. VAN BEBBER. 8vo., viii.-392 pages, 120 woodcuts, and 5 plates. Stuttgart : F. Enke, 1890.

WE protest against the custom of dating books wrongly, but as the bad example was, we believe, set by English publishers, it would be unfair to hold Herr Enke responsible, though he has dated an 1889 book 1890, and the evil will cure itself as the dates will soon become so unreliable as to pass without notice.

Taken altogether this is a very good book, and we cannot quote any English one similar to it. Of course, it is unequal ; meteorology is becoming too large a subject for anyone to be equally competent in all its branches. The author of the *Handbuch der Ausübenden Witterungskunde* is naturally strong upon synchronous observations and their application to weather forecasting, and his love of facts has led him to give a host of useful tables, many of them original, and the others judiciously selected. He is, however, too kind ; when he knows that people are doing wrong, he says nothing about it, shows that he knows it, but says nothing. For instance, on p. 125 he recognizes that the factor for Robinson's cups is considerably less than 3.0, and that therefore all published wind velocities are too great ; but he does not express any opinion upon the wisdom of continuing to publish figures which all well-informed persons know to be wrong. So also on pages 152 to 154 he shows that he is well aware that the force of wind increases with height above the ground, and yet he says nothing as to the absurdity of meteorological directors allowing architectural considerations to determine at what height their anemometers should be. As it is, there are hardly two anemometers in Europe fairly comparable. It is strange to observe how terribly weak Dr. van Bebbber is respecting instruments. His (Fig. 2), a Rutherford max. and min., such as was used in this country last century, would (as regards the max.) now and for thirty years past, have found its only proper place on a rubbish heap. We have not seen so bad an instrument at any station in France or England for at least 20 years. It is very curious to find such old-fashioned and defective apparatus engraved in the same book with some of Richard's best instruments, and in which other portions are of the highest character, and embody the results of the very latest researches, such as the chapters on "Cyclonic and Anti-Cyclonic Weather," and on "Weather Types." There is on the last page a funny illustration of the well-known tendency to make a second error if you try to correct one. On p. 234, the author (who does not often quote except from German sources) mentions twice Professor Osborne Reynolds as "Reynold" ; he has noticed this trivial error in the *Berichtigungen*, but says there that it should be "Reynholds."

We notice that of the numerical tables some begin the year with December, some with January. We hope that this merely arises from some being copied from older works. Surely Dr. van Bebbber

does not intend to oppose the decision of the various congresses ; if so, it will be for the official meteorologists who attended at Vienna, Rome, &c., to deal with the matter. We represent only the outside public, but on their behalf feel bound to protest against two sorts of year being used in one book.

In wie weit ist das heutige Klima Konstant. Von Prof. DR. E. BRÜCKNER. 8vo., 16 pages. Berlin ; D. Reimer, 1889.

THIS is a short paper, read before the German Geographical Society, on the very important subject of the variability of the earth's climate. It seems to us that the author rather changes the subject as he goes on. He seems to start with the idea of a change running during many centuries, quoting, *e.g.*, the prehistoric warm vegetation during the present Polar regions, and then drifts down to a discussion of a dry period occurring in some countries in 1856-60, in others 1861-65, and in others 1866-70. He tells us, however, that the large mass of data which he has collected will shortly be printed *in extenso*, and we therefore refrain from doing more than calling attention to the present paper and to the forthcoming book. We ought to mention that the author has not confined his researches to rainfall, but has studied the records of glaciers, of temperature, of the levels of lakes, of the freezing of rivers and of harbours, as well as those of the vintages, some of which go back hundreds of years. Dr. Brückner has set himself a Herculean task, and it will be to everybody's advantage if he can accomplish it.

Ergebnisse der Meteorologischen Beobachtungen im Systeme der Deutschen Seewarte, 1876-1885. Large 4to., 42 pages ; Hamburg, 1889.

Dr. Neumayer here gives us abstracts for the two lustra (1876-80 and 1881-85) as well as for the decade 1876-85 of the observations at nine coast stations in Northern Germany. The observations seem good, accurately reduced and printed, but we do not understand why the years begin with December. Surely that is not following the rules of the Vienna Congress. Why, even in this paper Dr. Neumayer says, "Nach den Beschlüssen des Wiener Kongresses beginnt das Beobachtungs-Jahr mit dem 1 Januar."* and yet he, a member of the Vienna Congress, breaks its rules all through this book. Doubtless there is some explanation of this apparent contradiction, and we shall be happy to publish it if any one will tell us what it is.

The mean sea level pressures agree very closely, all being between 29.922 in. and 29.953 in. The mean temperatures range from 44°.3 at Memel to 47°.4 at Borkum ; the absolute max. was 93° 6 at Neufahrwasser, and the absolute minimum was -13° 5 at the same station, giving it therefore a range of 107° 1. The mean amount of cloud is generally between 6 and 7 on the usual scale of 0-10. The mean rainfall is least (18.47 in.) at Warnem-Wustrow and greatest (25.85 in.) at Keitum. Large daily falls are rare, but there is one case of 3.37 in. in 24 hours on June 17th, 1879, at Hamburg.

* According to the decision of the Vienna Congress, the observing year begins with the 1st of January.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1889.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	63·9	19	32·4	16	54·4	39·5	39·9	81	104·4	25·1	2·06	20	6·9
Malta	79·4	24	45·7	1	66·3	52·8	50·8	77	131·3	40·5	·42	2	3·8
Cape of Good Hope. ...	78·0	26	49·1	17	68·8	55·7	...	...	...	...	5·12	10	6·4
Mauritius	82·5	4, 7	69·4	15, 30	80·3	72·1	68·0	78	133·3	60·7	4·65	23	5·8
Calcutta	101·6	25	66·6	3	96·4	76·7	73·0	60	159·2	59·2	1·31	4	2·1
Bombay	91·4	15	72·0	10	88·1	77·3	74·0	75	146·8	63·0	·00	0	1·9
Ceylon, Colombo	93·0	3	74·3	29	89·5	76·6	73·5	78	151·0	72·0	15·18	23	5·6
Melbourne	87·9	2	37·2	28	69·7	52·1	51·1	72	136·2	29·5	3·60	7	6·1
Adelaide	82·5	30	49·6	7, 28	70·6	55·4	53·4	71	136·7	39·3	5·65	15	6·3
Wellington	70·0	4	40·0	14	63·4	49·0	47·7	73	123·0	31·0	1·32	7	3·6
Auckland	74·0	8	46·0	24	67·7	53·3	52·5	75	138·0	40·0	1·04	13	5·8
Jamaica, Kingston	92·9	28	69·6	23	89·0	72·9	71·4	71	...	...	·91	...	...
Trinidad	95·0	29	65·0	15	91·0	70·4	76·1	81	160·0	58·0	1·05	...	...
Toronto	67·3	24	25·5	1	51·7	34·9	34·1	68	...	19·8	1·59	11	5·8
New Brunswick, Fredericton	69·0	26	19·9	7	53·4	33·0	33·9	63	...	...	2·78	10	6·5
Manitoba, Winnipeg ...	79·2	25	13·0	3	54·9	28·7	30·3	65	...	...	·99	9	4·1
British Columbia, Victoria	66·0	7, 8	32·0	19	60·3	40·7	...	...	...	...	1·83	8	...

REMARKS, APRIL, 1889.

MALTA.—Mean temp. 58°·4; mean hourly velocity of wind 13·2 miles. The Sea temp. rose from 59°·8 to 62°·2. TS on 6th. J. SCOLES.

Mauritius.—Mean temp. of air 0°·6, of dew point 0°·1, and R 0·67 in. below their respective averages. Mean hourly velocity of wind 12·0 miles, or 1·0 above average; extremes 25·8 on 14th and 2·0 on 29th. Prevailing winds E.S.E. and E.

C. MELDRUM, F.R.S.

COLOMBO. - Thunderstorms occurred on 17 days, and L was seen on 10 other days.

J. C. H. CLARKE, LT.-COL. R.A.

Melbourne.—Mean temp. of air, 1°·8 of dew point 1°·7, mean amount of cloud 0·2, and R 1·37 in. above average; humidity same as average. Prevailing winds W. and N.; strong on 6 days. Heavy squalls from W. on 7th and 8th. Heavy dew on 14 days. L on the 2nd.

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

Adelaide.—Mean temp. 1°·4 below the average. The principal features of the month were the two heavy general rainfalls and floods on the 1st and 15th, which caused a great deal of damage, and resulted in loss of life by drowning. The total R for the past four months is the greatest for the same period since the foundation of the Colony.

C. TODD, F.R.S.

Wellington.—Generally fine weather, and a small R; showers in the middle and at the end of the month. Prevailing wind N.W., strong on 9 days. Slight earthquake on the 8th. Mean temp. 0°·8 below the average. R less than half the average.

R. B. GORE.

Auckland.—A fine and dry but cool month. Bar. pressure considerably above the average of 22 years. Mean temp. about 1° below the average. R not one-third of the average.

T. F. CHEESEMAN.

TRINIDAD.—R ·85 in. below the average of 25 years.

H. C. HART.

SUPPLEMENTARY TABLE OF RAINFALL,
OCTOBER, 1889.

[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 Hall.	5·88	XI.	Castle Malgwyn	5·85
„	Margate, Birchington...	5·05	„	Rhayader, Nantgwillt..	7·28
„	Littlehampton	6·26	„	Carno, Tybrith	6·21
„	Hailsham	8·21	„	Corwen, Rhug	5·62
„	Ryde, Thornbrough	7·69	„	Port Madoc	4·93
„	Alton, Ashdell.....	5·09	„	I. of Man, Douglas	3·77
III.	Oxford, Magdalen Col...	2·36	XII.	Stoneykirk, Ardwell Ho.	4·29
„	Banbury, Bloxham	3·00	„	New Galloway, Glenlee	5·71
„	Northampton	3·07	„	Melrose, Abbey Gate...	4·79
„	Cambridge, Beech Ho...	...	XIII.	N. Esk Res. [Penicuik]	4·45
„	Wisbech, Bank House..	3·76	XIV.	Ballantrae, Glendrisaig	4·66
IV.	Southend	3·79	„	Glasgow, Queen's Park.	2·69
„	Harlow, Sheering	3·59	XV.	Islay, Gruinart School..	4·63
„	Rendlesham Hall	5·17	XVI.	Dollar	3·83
„	Diss	3·30	„	St. Andrews, Pilmour Cot	2·87
„	Swaffham	2·76	„	Balquhiddie, Stronvar..	6·11
V.	Salisbury, Alderbury...	3·74	„	Dunkeld, Inver Braan..	4·49
„	Warminster	3·67	„	Dalnaspidal H.R.S.	5·53
„	Bishop's Cannings	2·45	XVII.	Keith H.R.S.	2·51
„	Ashburton, Holne Vic...	7·35	„	Forres H.R.S.	2·39
„	Hatherleigh, Winsford.	3·61	XVIII.	Strome Ferry H.R.S....	3·81
„	Lynmouth, Glenthorne.	6·82	„	Fearn, Lower Pitkerrie.	2·93
„	Probus, Lamellyn	7·22	„	Loch Shiel, Glenaladale	5·56
„	Launceston, S. Petherwin	5·28	„	N. Uist. Loch Maddy ...	3·82
„	Wincanton, Stowell Rec.	4·66	„	Invergarry	2·91
„	Taunton, Lydeard Ho...	4·82	„	Loch Ness, Drumnadrochit	2·31
„	Wells, Westbury	3·92	XIX.	Lairg H.R.S.	1·00
VI.	Bristol, Clifton	2·26	„	Forsinard H.R.S. ....	...
„	Ross	3·77	„	Watten H.R.S.	3·07
„	Wem, Clive Vicarage ...	3·54	XX.	Dunmanway, Coolkelure	6·10
„	Cheadle, The Heath Ho.	3·08	„	Fermoy, Gas Works ...	4·02
„	Worcester, Diglis Lock	2·70	„	Tipperary, Henry Street	4·06
„	Coventry, Coundon	2·61	„	Limerick, Kilcornan ...	2·91
VII.	Ketton Hall [Stamford]	3·24	„	Miltown Malbay.....	3·80
„	Grantham, Stainby	2·59	XXI.	Gorey, Courtown House	6·33
„	Horncastle, Bucknall ...	4·30	„	Navan, Balrath	4·41
„	Mansfield, St. John's St.	3·94	„	Mullingar, Belvedere ...	5·29
VIII.	Neston, Hinderton	2·91	„	Athlone, Twyford	4·59
„	Knutsford, Heathside ...	2·90	„	Longford, Currygrane...	4·55
„	Lancaster, South Road.	4·99	XXII.	Galway, Queen's Coll...	4·00
„	Broughton-in-Furness ..	7·18	„	Clifden, Kylemore	7·02
IX.	Wakefield Prison	3·53	„	Crossmolina, Enniscoe..	7·23
„	Ripon, Mickley	4·14	„	Collooney, Markree Obs.	6·15
„	Scarborough, West Bank	5·13	„	Ballinamore, Lawderdale	4·63
„	East Layton [Darlington]	5·30	XXIII.	Warrenpoint	3·92
„	Middleton, Mickleton...	4·89	„	Seaforde	3·88
X.	Haltwhistle, Unthank..	3·80	„	Belfast, New Barnsley .	4·02
„	Shap, Copy Hill	7·05	„	Bushmills, Dundarave...	3·78
XI.	Llanfrechfa Grange	3·08	„	Stewartstown	3·08
„	Llandovery	5·31	„	Buncrana	5·81

OCTOBER, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which ·01 or more fell.	TEMPERATURE				No. of Nights below 32°	
		Total Fall.	Differ- ence from average. 1870-9	Greatest Fall in 24 hours.			Max.		Min.			
				Dpth	Date		Deg	Date	Deg.	Date		
I.	London (Camden Square) ...	inches 3·75	+ 1·05	in. .73	19	22	60·6	16	35·5	13	0	1
II.	Maidstone (Hunton Court)...	5·09	+ 2·63	.75	10	21	...	...	...	...	...	...
III.	Strathfield Turgiss	3·16	+ .42	.44	20	23	60·3	2	30·1	14	5	10
III.	Hitchin	3·41	+ 1·23	.69	19	23	57·0	7b	35·0	13	0	...
IV.	Winslow (Addington)	3·10	+ .48	.41	11	21	60·0	10c	30·0	14	2	5
IV.	Bury St. Edmunds (Westley)	4·35	+ 2·32	.64	22	22	...	...	...	...	...	...
V.	Norwich (Cossey)	3·02	+ .69	.50	16	17	...	...	...	...	...	...
V.	Weymouth (Langton Herring)	4·33	...	.52	18a	22	59·0	2d	39·0	13	0	...
"	Barnstaple	5·59	+ .14	.90	4	24	60·0	1e	...	...	...	...
"	Bodmin (Fore Street)	7·52	+ 1·30	1·56	18	26	...	...	...	...	...	...
VI.	Stroud (Upfield)	2·45	— .56	.52	19	23	68·0	21	32·0	12g	2	...
VI.	Churchstretton (Woolstaston)	4·01	— .59	.66	27	29	58·0	5	37·0	26	0	3
"	Tenbury (Orleton)	3·21	— .03	.61	27	25	61·2	17	30·0	14f	6	10
VII.	Leicester (Barkby)	2·99	+ .64	.41	27	27	60·0	2	29·0	13	4	9
"	Boston	3·10	+ 1·07	.95	16	24	60·0	21	31·0	14	1	...
"	Hesley Hall [Tickhill]	2·99	...	.42	11i	25	59·0	14	30·0	11	4	...
VIII.	Manchester (Plymouth Grove)	3·11	— 1·25	.53	7	21	58·0	21	34·0	10	0	3
IX.	Wetherby (Ribston Hall) ..	3·82	+ .46	.56	12	19	...	...	...	...	...	...
"	Skipton (Arncliffe)	8·59	+ 1·33	1·72	22	22	59·0	1	37·0	5	0	...
"	Hull (People's Park)	3·97	+ 1·17	.78	16	24	...	...	...	...	...	...
X.	North Shields	4·40	+ 1·89	.80	12	24	58·0	6	36·0	11	0	0
"	Borrowdale (Seathwaite)....	13·77	— 2·78	2·43	6	21	...	...	...	...	...	...
XI.	Cardiff (Ely)	4·21	— 1·02	.62	19	23	...	...	...	...	...	...
"	Haverfordwest	4·75	— 1·70	.98	18	24	59·9	5	28·5	13	4	7
"	Plinlimmon (Cwmsymlog) ...	7·94	...	1·22	4	21	...	...	...	...	...	...
"	Llandudno	3·36	— 1·23	.57	6	20	59·2	7	37·5	25	0	...
XII.	Cargen [Dumfries]	5·51	— .20	.98	6	21	58·6	5	30·0	26	1	...
"	Jedburgh (Sunnyside)	4·74	+ 2·07	.67	12	26	55·0	11	33·0	14	0	...
XIV.	Old Cumnock	3·91	— 1·25	.97	6	20	58·0	16	23·0	25	10	...
XV.	Lochgilphed (Kilmory)	5·56	— 2·76	.95	6	16	...	...	...	...	...	...
"	Oban (Craigvarren)	5·24	...	.90	10	18	57·0	16	33·2	28	0	1
"	Mull (Quinish)	5·26	...	.77	31	14	...	...	...	...	...	...
XVI.	Loch Leven Sluices	3·50	— .81	.50	5	18	...	...	...	...	...	...
"	Dundee (Eastern Necropolis)	2·70	— .47	.50	4	21	60·3	5	32·2	29	0	...
XVII.	Braemar	3·58	— .90	.61	19	22	55·0	2	24·3	14	7	16
"	Aberdeen (Cranford)	3·71	...	.58	17	25	60·0	11	30·0	28	4	...
XVIII.	Lochbroom	4·01	...	1·25	7	15	...	...	...	...	...	...
"	Culloden	2·36	+ .07	...	...	...	55·0	6, 30	27·0	25	6	21
XIX.	Dunrobin	3·12	...	.81	7	12	56·5	1	32·0	28	1	...
"	S. Ronaldsay (Roeberry)	3·38	— .30	.49	9	20	53·0	5	40·0	25h	...	...
XX.	Cork (Blackrock)	3·68	— 1·06	.86	18	20	62·0	16	30·0	28	2	...
"	Dromore Castle	4·94	...	.84	6	21	67·0	1	30·0	23	...	...
"	Waterford (Brook Lodge) ...	5·05	...	2·06	18	24	61·0	2	30·0	14	2	...
"	O'Briensbridge (Ross)	2·96	...	.53	18	20	57·0	1, 2	32·0	25h	4	...
XXI.	Carlow (Browne's Hill)	5·77	+ 1·66	1·25	18	28	...	...	...	...	...	...
"	Dublin (Fitz William Square)	4·85	+ 1·43	.94	19	22	57·4	7	35·2	14	0	4
XXII.	Ballinasloe	4·43	— .00	1·12	18	23	54·0	15	28·0	28	8	...
XXIII.	Waringstown	3·52	— .09	.64	4	25	60·0	2, 10	29·0	23	7	14
"	Londonderry (Creggan Res.) ..	4·46	...	.87	6	23	...	...	...	...	...	...
"	Omagh (Edenfel)	4·42	+ .10	.75	3	20	55·0	1, 2f	31·0	24	2	7

a And 19. b And 8, 17. c And 15, 17. d And 7, 11, 15, 16. e And 16, 29. f And 15. g And 13.

h And 26, 27, 28. i And 27.

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

METEOROLOGICAL NOTES ON OCTOBER, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—During the month the weather was changeable, with frequent R storms. On the whole the temp. was high and the atmosphere damp and muggy, with only a few days of fine weather with strong and drying winds.

ADDINGTON.—The month was characterised by frequent R, very little frost, and at times a very low barometer, particularly on the 7th, 9th, 19th, 20th, and 21st. Thunder on 3rd and 20th; heavy gale on 26th and 27th.

BURY ST. EDMUND'S, WESTLEY.—The total R for the month has been exceeded only four times in October since 1857. During a severe TS on the 3rd the church tower was struck by L and much injured.

LANGTON HERRING.—This was the wettest month since September, 1883, and the mean temp. was $0^{\circ}9$ below the average. L on the 11th.

WOOLSTASTON.—A pleasant autumn month, though there were only two days without rain. There was a severe gale on the 7th. Mean temp. $47^{\circ}1$.

ORLETON.—A cold, cloudy, damp, and rainy month, with a mean temp. about $2^{\circ}2$ below the average of 28 years, although the first 9 days were a little warmer than the average. The nights then became cold and frosty till the 15th, after which there was generally a cold, cloudy sky, with R every day, but not in large falls. Fogs occurred frequently. A solar halo was seen on the 14th and fine rainbows on the 17th, 19th, and 22nd. A storm passed over on the 8th, with some L and T, and distant T was heard on the 10th; on the 17th a strong gale blew. The bar. was generally low and unsteady during the latter half of the month.

LEICESTER, BARKBY.—An unusual number of days on which R fell, but no great bulk of R. T on the 3rd, 10th, and 20th; very few frosts. Swallow seen on 25th. Mean temp. $46^{\circ}2$.

MANCHESTER, PLYMOUTH GROVE.—During the month there were only about ten days of fine autumn weather, the remainder being wet, damp, and gloomy. Dense fog on the 11th and 17th. Mean temp. $47^{\circ}5$.

HULL.—With the exception of the 8th to 10th, 13th and 14th, 18th and 19th, and 29th to 31st, the weather during the month was wet, with frequent mists or fogs.

WALES.

HAVERFORDWEST.—There were a great many beautiful days for although R was recorded on so many, much of it fell at night. Temp. about the mean. Very stormy on the 7th. A fine frosty period occurred from 10th to 14th, followed by a week of very wet weather. Another frosty period occurred from the 23rd to 26th, and the month ended with damp and mildness.

SCOTLAND.

CARGEN.—A very wet and unsettled month. Mean temp. $46^{\circ}4$, or $1^{\circ}7$ below the average. Easterly winds prevailed for 19 days. Sunshine 20 hours less than the average. The beautiful appearance in the sky at sunrise showing bands of prismatic colours, as described in December, 1884, was seen on one or two mornings. T and L on 8th.

JEDBURGH.—A month of almost daily R. Trees shed their leaves with unusual rapidity.

MULL QUINISH.—A very fine month, excepting from 4th to 10th and the last three days.

LOCHBROOM.—A wonderful mixture of good, bad, and indifferent weather,

but there were many fine days and frosty nights. A very heavy storm with heavy R occurred on the 7th, followed by high floods, and the month closed with another great gale.

INVERNESS, CULLODEN.—The month was generally fine, little R falling after the 9th.

IRELAND.

CORK.—Fully two-thirds of the month was cool, cloudy and dark. A strong gale with heavy R blew on 17th and 18th, and there was much sheet L at night on the 21st. Temp. nearly two degrees below the average.

WATERFORD.—R '88 in. above the average. Mean temp. 47°·5. Swallows seen on the 15th, and starlings on the 20th. S.W. gale on 30th.

O'BRIANSBRIDGE, ROSS.—R nearly every day until 20th; then one week of fine bright weather, with slight frosts. A heavy gale blew from S.W. on the night of the 6th, uprooting large trees.

DUBLIN.—A cold, rainy, squally month, W. and S.W. winds prevailing at first, while E. and N.E. winds held from 18th to 29th. A gale of exceptional violence blew on the night of the 6th, the wind rising S.S.E. and subsequently veering to W. and W.N.W. There was another less destructive gale on the night of the 31st.

EDENFEL, OMAGH.—With the exception of the first two days and the fourth week—which were ideal autumn weather, clear dry and crisp—the month was persistently wet and unsettled, culminating on the nights of the 6th and 31st in gales of considerable violence; the former expended its greatest force to the south, and the latter to the north, of this station.

CLOUD PICTURES.

Many of our readers are aware that for years past Prof. Hildebrandsson, of Upsala, has devoted great attention to the study, the classification, and the photographic representation of clouds. Some years since he brought out a limited edition of a photographic atlas of clouds, which is still in great request. He is now about to issue a series of twelve chromolithographs reproducing oil paintings, of the principal forms of cloud, by Swedish and by German artists, and which paintings have been repeatedly retouched by the artists in consultation with Professors Hildebrandsson, Neumayer, and Köppen, and with Mr. Weilbach, of Copenhagen.

The chromolithographs will each be 12 inches by 9 inches (without reckoning the margin of the mounts); there will be twelve of them, and they will be accompanied by short explanations in French, German, and English.

As a grant in aid of the cost has been obtained, sets will be supplied by the publisher, G. W. Seitz, of Hamburg, at twelve shillings each set, or if 25 sets be ordered, at ten shillings per set.

We hope that for the credit of their country, for their personal pleasure, and for their instruction, several of our readers will treat themselves to a copy. They can either apply direct to the publisher, or, if they prefer it, we will do so, and may thereby save the 2s. per copy—though as there will be carriage to pay, the 2s. may dwindle to 1s., or become invisible.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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THE DOUBLY OBSERVED METEOR OF NOV. 4TH, 1889.

THE SHEEP STAMPEDE OF NOVEMBER 3RD, 1888.

We adopt this double title for a reason which will be stated at the end of the following notes upon the meteor.

The meteor appears to have been observed at several places, one as far North as Corbridge-on-Tyne, 250 miles from London, where Mr. White Wallis saw it. We append all the accounts which we have been able to collect, they are not sufficient to fix its path accurately, but seem to indicate a first appearance over Gloucestershire at an elevation of about 50 miles, and a disappearance over Northamptonshire at a lower level. The following notes are arranged from S. to N :—

As to the meteor on the 4th inst., I was walking home that night in a N.W. direction, at a spot about $51^{\circ} 20\frac{1}{2}$ N. and $0^{\circ} 35\frac{1}{2}$ W. On the road I halted to notice a little to my right (looking about due north) a light in the sky, like a small moon with a following equally luminous "tail;" its direction was from left to right its highest limit I should say was about 45° , and it made a *slightly* descending arc of about 60° , commencing a *little* W. of N. This would be a few minutes before 8 o'clock. The atmosphere was thick and foggy, so that all brilliancy was lost—in fact the meteor was dull—the motion did not seem very rapid, but the diameter of the meteor appeared much larger than any I previously recollect to have seen; the fog no doubt to some extent caused this appearance.

Chobham, Woking.

HY. HORNCastle.

On Monday, November 4th, 1889, a brilliant meteor passed to the S.W. of Rose Hill, from W. or S.W. to E., as far as could be seen over the Berkshire Downs. Some few days after I saw an account in the *Standard* of a stampede of sheep on the Berkshire Downs. Had the meteor anything to do with it, or did it frighten them?—EDWARD COBB.

Rose Hill, Iffley, Oxon.

I saw the meteor on the 4th November ; the finest I ever saw. I thought that it was a vivid flash of lightning until I looked up and saw the object, I should say travelling from W. to E.—W. LUCAS.

Hitchin.

Yesterday evening, November 4th, at 7.55 p.m., I was fortunate enough to observe a very brilliant meteor. It became visible almost exactly at the zenith, or a little west of it, and moved, as nearly as I could judge, due east (magnetic) ; it remained visible for about from one to two seconds, disappearing finally, rather low down on the eastern horizon. For the first half of its journey it was of a dazzling white brightness, and then it suddenly became a dull red spark. The light emitted from it, when brightest reminded me of the light from an arc lamp, and was very much brighter than any of the fixed stars. As it was so short a time in view, and there were no stars visible, I could only approximately estimate its point of appearance and path. There were a few clouds about, mostly in the west, and the moon was behind them.—PAUL A. COBBOLD.

Warwick School, November 5th.

Was not the meteor seen from Warwick School on November 4th, the same as that mentioned in the following from my daughter, written from the school at Brookfield, Wigton, Cumberland.

"On Monday night (November 4th) at 7.55 p.m., when out on the playground viewing the stars, I saw a most beautiful meteor. It seemed to be very near, and was in sight for quite a long time. It appeared just over Skiddaw—that is to say, due South—and went towards the South East. It had a long tail of light, and burst, and sent out beautiful colours, and disappeared near the horizon."

Ackworth, Yorks, November 16th.

WM. SCARNELL LEAN.

November 4th.—About 8 p.m., a brilliant meteor as large and as bright as Venus, passed from W. to E. 10° or 15° above S. horizon, with a bright train of sparks behind it. Motion slow, apparently horizontal. Only seen for one or two seconds. Probably the meteor mentioned in the November number of the *Meteorological Magazine*.—JOHN COPPIN.

Bingfield, Corbridge-on-Tyne.

THE SHEEP STAMPEDE.

We come now, and with some satisfaction, to the question which was left unanswered last year—Why did so many hundred sheep in the South Midland Counties break out of their folds on the night of November 3rd, 1888. Readers who will turn to our numbers for November and December of 1888, will find the facts there, and they

will find that we then hinted at an explanation which now seems probable. On p. 154, at the foot of the first letter upon the subject we said, "It is curiously near the locality where the bolide of November 20th, 1887, is supposed to have burst." In our second article we did not further press the appearance of a meteor as an explanation, because there was no record of one having been seen. But we now go back to it because we have—

November 2nd, 1886.—Meteor bursting over North Cornwall.

November 20th, 1887.—Meteor bursting in the neighbourhood of Oxford.

November 3rd, 1888.—Unexplained panic among sheep in Oxford and Berks.

November 4th, 1889.—Meteor passing Gloucestershire to Northamptonshire, and stampede of sheep on Berkshire Downs. (See Mr. Cobb's note, *ante* p. 161.

ON THE BLACK BULB THERMOMETER IN VACUO,

BY PROF. HERBERT McLEOD, F.R.S.

[The following useful paper was read at the British Association Meeting at Newcastle. It was briefly mentioned in our last, but by the courtesy of Prof. McLeod we have now the pleasure of giving it *in extenso*.—ED.]

This instrument which is generally employed for measuring solar radiation does not appear to give universal satisfaction, for it is said that no two instruments give the same result when placed side by side. No doubt the imperfection of the vacuum may account for this in a great measure, but besides this there appear to be other causes.

When such an instrument is exposed to the rays of the sun, a large proportion of the radiation passes through the enclosing case, also traversing the opposite side of the globe. Some, however, is absorbed by the blackened thermometer bulb, and this then begins to radiate heat of low refrangibility which is incapable of passing through the enclosing case; as a consequence the latter becomes heated, so that the thermometer bulb is in a warmer enclosure than at first. The quantity of heat thus radiated will be diminished the smaller the bulb of the thermometer, and some years ago I suggested to Mr. Hicks to make a thermometer with a very small bulb; such a one was made, and I am informed that it gave readings ten degrees *higher* than any other instrument; as this was exactly opposite to my expectation, perhaps I may be excused for not attempting any explanation. Some months ago I ordered two instruments with very small bulbs, one to be in a thick case and the other in a thin one. When the instruments came I found that one of the bulbs which appeared the thicker was devitrified and rough, and produced a very

marked shadow when held before a screen exposed to sunshine, so I was not surprised to find that this thermometer always indicated a slightly lower temperature than the one with the clear glass; it was returned to the maker, and I was then informed that the bulb was a thin one, and the devitrification was caused by blowing the bulb before the lamp. These thermometers were in use from May 20th to June 6th, and the means of the readings of the thermometer with the thick case was 119·2, while the mean of the readings of the other instrument was 116·8. This, therefore, supported the theory that I had formed on the subject. I then had one of the thermometers enclosed in a case of very thick glass. The thermometers were then tested with a thermopile to determine the quantity of radiant heat that would pass through the enclosing cases. The source of heat was an alko-carbon flame, and the cases of the thermometers were interposed in succession between the flame and the cone of the thermopile.

Case of thermometer with large bulb transmitted... about 26 per cent. of the
Thin case of thermometer with small bulb..... „ 23 [radiant heat.
Thick case of thermometer with small bulb „ 11½ „ „

These thermometers were exposed to the sun's rays for the first 27 days of August, and the means of readings are as follows :—

Large bulb instrument	125°·7
Small bulb with thin case..	119 ·9
Small bulb with thick case	118 ·3

Although the case of the instrument with the large bulb allowed a larger percentage of the rays from a low temperature source to pass through, yet the amount of heat radiated from the large bulb was so great that the case was warmed sufficiently to cause the instrument to read, on the average, nearly 6° F. higher than the small bulb instrument.

According to the theory enunciated above, the thermometer with the thick case should have read higher than the one with the thin case; it however, gave readings 1·6° F. lower, but it must be remembered that the thick case transmitted less than half as much of the radiation from the gas flame as passed through the thin case, so it must have stopped more of the radiation from the sun than the thin case, and notwithstanding this the temperature registered is very little less than that indicated by the other instrument.

The small bulb instrument has another advantage over the large bulb one inasmuch as it is much more sensitive, and so reaches the maximum more quickly than when a large bulb is used. This is shown by the readings on August 4th, when there were only some occasional gleams of sunshine, the large bulb registering 98·2° F., and the small bulb 101·8° F.

It seems to follow from these experiments that the black bulb should be as small as possible, have a dead black surface, and very little of the stem blackened; and also that the case should be as thin as is consistent with strength.

A series of experiments should be carried out with instruments of different sizes, and with cases of different thicknesses in order to set the matter at rest. Some investigations on this subject have been carried on at the Kew Observatory, but I believe they have been only partially published. An accident to our old instruments gave me the opportunity of having fresh ones constructed, and it seemed advisable to put the above results on record.

REVIEWS.

Étude sur la synthèse de la Repartition des Pressions à la surface du Globe. Par M. LEON TEISSERENC DE BORT. Paris: Gauthier-Villars, 1889. 4to, 23 pages and 4 double plates.

IN some of M. Teisserenc de Bort's earlier papers he has pointed out the relations between the distribution of air pressure and of air temperature—between isobars and isotherms. The present work is a step further in the same direction, but one which we despair of making clear to all our readers in much less space than the author has given to it, viz., the whole of three numbers of this magazine. We cannot do that, but we shall at the same time bring his work to the notice of experts in all parts of the world, and give our less advanced readers a general idea of its scope, by translating the author's own summary.

Summary.—We see then by this essay that the principal isobaric lines are explainable, and can be reproduced, by the following considerations :—

- (1). Originally the temperature of the whole atmosphere is assumed to have been equal at all parts of the earth's surface, decreasing gradually upwards, and its pressure on every part of the surface about 30 inches.
- (2). When the atmosphere had become sufficiently transparent for the heating effect of the sun to become sensible, a difference of temperature between the equator and the poles was produced, and hence resulted upper air currents from the equator towards the poles.
- (3). By virtue of the relative movement of the air due to inertia, the winds going towards the poles have a tendency to curve towards the E., and this tends to produce a gradient towards the poles. The surfaces of equal pressure thus approach the earth in proportion as the latitude increases, and more rapidly than the variation in density alone would produce. This prevents the principal barometric maxima occurring at the poles. There are thus formed in certain latitudes barometric maxima at places where the product of the height (comprised between the surfaces of

equal pressure of the higher regions and the earth), multiplied by the density of the air, is at its maximum. These maxima occur before reaching the Polar regions, because there the surfaces of equal pressure are too low. We find then between the equator and the poles, a sort of pad of air which is further increased by the retardation of the upper anti-trade, and the effects of the relative motion of the lower air which forms the trades and the west winds of middle latitudes.

- (4). In high latitudes the convergence of the meridians, by diminishing the breadth of the currents, compels them to increase their height, as their increase of velocity is rarely alone sufficient, hence the pressure becomes small between the middle and polar latitudes. These minima vary in their latitude according to variations in the gradients, and consequently in the velocity of the currents.
- (5). The differences in temperature which exist even in contiguous districts, and those also which in equal latitudes exist over land and sea, by changing the density of the lower strata of the atmosphere, destroy the regularity of the isobars, and lead to the formation between them of cyclonic and anti-cyclonic areas.

Thus are produced those grand centres of atmospheric action which give its true character to the general circulation of the atmosphere.

A WET TIME IN WEST AUSTRALIA.

We have been favoured with the following extract from a letter lately received, describing the exceptional winter of 1889 in West Australia :—

“Certainly the rainfall is most extraordinary, and is now beginning to be highly inconvenient. The squatters are wondering how and when they are going to get the wool off the sheep’s backs into London market, for it seems wool spoils and heats if shorn wet. and we have not had three consecutive fine days since May last, The hay and crops are splendid, but the grapes will be a failure as the blossom has been washed off the vines.

“A plague of caterpillars has also set in, attracted by the luxuriant vegetation.

“No living person has ever seen Australia so green as it now is, or the live stock so fat.

“It is *pouring* now, yesterday having been our only fine day for a week.”

Perth, Western Australia, October 23rd, 1889.

FLUCTUATION OF ANNUAL RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—In *British Rainfall* for 1886 you gave a table of the comparative rainfall for many years back, at the same time leaving spaces for three more years. Will you kindly inform your readers by what figure the rainfall for 1888 should be represented in the table? It does not seem to be explicitly stated in the last volume of *British Rainfall*. Perhaps 89 would be correct.

Yours faithfully,

G. VON. U. SEARLE.

30, Edith Road, West Kensington

[The calculations for the years 1882 to 86 are set out in full on p. 27 of *British Rainfall*, 1886, and we have pleasure in complying with Mr. Searle's request by giving the similar calculations for 1887 and 1888.—ED.]

		Chilgrove.	Nash Mills	Oxford.	Exeter.	Orleton.	Pode Hole	Boston.	Bolton.	Kendal.	Mean.
Mean.	1830-79 ..	33·61	26·82	23·40	30·33	30·00	25·57	22·66	47·39	51·48	—
Rain-fall.	{ 1887	25·31	20·44	18·98	22·18	21·07	15·13	14·67	27·92	32·37	—
	{ 1888	35·33	27·76	26·84	32·12	28·80	21·46	22·25	36·59	43·04	—
Ratios	{ 1887	75	76	81	73	70	59	65	59	63	69
	{ 1888	105	104	115	106	96	84	98	77	84	97

THE FLOATING ISLAND IN DERWENTWATER.

To the Editor of the Meteorological Magazine.

SIR,—With reference to the remarks by Prof. Meldola in your last number, I would call attention to the fact that at page 11, you state that the poles “could not resist the current setting northwards from the Lodore falls and from the Derwent,” so I have little doubt that these currents bring from these streams quantities of leaves, branches and brushwood, which get lodged partly underneath and partly against the island and its loose rooting. The island being anchored to the shore and bottom is prevented from being carried hither and thither as most floating islands are.

In hot summers the accumulated organic materials get more largely decomposed than at other times, and the gases evolved are carried by the current further underneath, and into the bowels of the island, so that when they accumulate enough to buoy up the island, it shows its top above the surface of the lake.

I do not think that without this reinforcement of decomposable matter, the island (*per se*) could have furnished sufficient material to insure upheaval for such a prolonged period.

Yours truly,

HENRY MUIRHEAD, M.D.

Cumbuslang, 21st November, 1889.

EXPLANATION BY DR. NEUMAYER.

To the Editor of the Meteorological Magazine.

SIR,—In your monthly Meteorological Journal for November of this year, you had, on page 155, the kindness to mention the recent publication of the Seewarte, "Ergebnisse der Meteorologischen Beobachtungen im Systeme der Deutschen Seewarte für die Lustren 1876-1880 and 1881-85, sowie das Decennium 1876-1885," and while giving due credit to the value of the observations and the publication generally, you criticised the mode of publishing the monthly results, placing December at the beginning of the series of the months for the year.

From the stipulations of the Vienna Congress it is evident that the mean values for the various meteorological elements should be compiled for periods from the 1st of January to the 31st of December, and for the single calendar months respectively. No special reference has been made to the single seasons of the year, leaving it to the option of the various directors to deal with them according to the means at disposal in each case. Stress must only be put on the fact, that the mean values are computed according to the stipulations of the Congress, and that the International scheme of publication is adhered to.

In explanation of the arrangement, placing the month of December first in the series instead of at the end of it, whereas the order is in other respects not disturbed, I may be allowed to refer to the fifth paragraph of the introductory remarks of the said work.

According to the explanation there given, the means for the period stated are to be invariably understood to be for the time from 1st of January 1876 to the 31st of December 1880, the 1st of January 1881 to the 31st of December 1885, and so on. The months of December invariably belong to the said respective periods for which the means are given, and the month of December was placed at the beginning merely for convenience sake, in order to have the winter months placed together in this series.

For climatological purposes it appeared to me advisable to adhere to the seasonal arrangement, if such could be carried out without offending the rules of the Congress, and without impairing the value of the work generally.

In the tables which contain the values for the single elements for the whole decennium in question 1876-1885, no reference was made to the single seasons, and to the mean values for them, in consequence of which, the order of the months was the usual one, and a comparison of the mean values in them, with those of the respective months in the tables of the single lustra, shows at a glance that they are identical and derived according to the same principle.

After this explanation I do not suppose that you still believe that in publishing these results I have transgressed the stipulations

of the Vienna Congress ; on the contrary, I have invariably been most anxious to adhere to them.

Yours very sincerely,

DR. G. NEUMAYER,

Hamburg, 30th November, 1889.

[We are always glad to be favoured with communications from meteorologists of such high standing as Dr. Neumayer, and we are especially glad that he has made it perfectly clear that he not only has not broken the rule of the Congress, but is a warm supporter of it. We had noticed the paragraph to which he refers, and were aware that the values were the proper ones. We thought that the Congress had gone further, and had advised that monthly values should always be printed in their normal sequence, but it is evident that there is no such rule, which we much regret. Nothing is more liable to lead to mistakes than having annual tables, some beginning with December and some with January.—Ed.]

SALT HAIL.

To the Editor of the Meteorological Magazine.

SIR,—At page 137 Mr. Slatter says, “I allow that rain might be saline, but not hail.” One day, six or seven years ago, a misty west wind blew against a window of mine, and deposited on it a thin crust, some of which I scraped off, and tasting found it salt. My niece also tasted, and agreed with me as to its saltness. The nearest sea to my house is about twenty-five miles off, in the Firth of Clyde, above Greenock. If wind can carry salt moisture thus far, surely it may happen that in some cases it may be elevated enough to encounter circumstances that will transform the moisture into hail.

HENRY MUIRHEAD.

Cambuslang, 17th October, 1889.

A LUNAR RAINBOW.

To the Editor of the Meteorological Magazine.

SIR,—On the 9th instant my father and I were walking in the country about a couple of miles from Newquay, Cornwall, when we noticed a distinct lunar rainbow. The time was 7.15 p.m. and the rainbow was, as far as we could judge, due west. The sky was fairly clear, except for one very black cloud. It had just ceased raining when we observed the rainbow against the dark cloud. The moon was shining very brightly at the time. I did not notice for how long the rainbow was visible. My father did not observe any colour in the bow, but I fancy I did—faintly, but of this I am not quite sure.—Yours sincerely,

JNO. B. SNELL.

The Chestnuts, Chislehurst, 12th October, 1889.

ROYAL METEOROLOGICAL SOCIETY.

THE first Meeting of this Society for the present Session was held on Wednesday evening, Nov. 20th, at the Institution of Civil Engineers ; Dr. W. Marcet, F.R.S., President. in the chair.

Nine new Fellows were elected.

The following Papers were read :—

(1.) "Second Report of the Thunderstorm Committee." This is a discussion by Mr. Marriott on "The Distribution of Thunderstorms over England and Wales, 1871-1887," a period of 17 years prior to the appointment of the society's committee. The information used has been derived from various sources, the observers in communication with the Meteorological Office, Mr. Symons, and the Registrar General, and the Society's own climatological stations. By this means the average annual number of reporters for the 17 years was brought up to 143, and these were fairly distributed throughout the country. The stations were arranged according to the divisions adopted by the Registrar-General in the quarterly returns of births and deaths, but these divisions, 11 in number, are very unequal in area, Middlesex alone forming one division, while Herts, Buckingham, Oxford, Northampton, Huntingdon, Bedford, and Cambridge form another, and Monmouth and Wales make one division between them. The data have been tabulated for each month and year in the separate districts ; 1880, 1882, 1884, and 1872 were the years of greatest frequency, and 1887, 1874, 1879, and 1871 those of least frequency, the most striking feature in the frequency diagram being the sea-saw nature of the curves, years of greater and less frequency alternating regularly throughout nearly the whole period. The Welsh division has the greatest number of thunderstorms in the month of August, but in the other 10 divisions, July is the month of maximum frequency. February and December have the least number in all localities. The average yearly number of storms for the 11 divisions is 39, the division comprising Surrey, Kent, Sussex, Hampshire, and Berks having the highest average 58·4, and Wilts, Dorset, Devon, Cornwall, and Somerset next highest with 52·3. Middlesex is lowest with 17·9 per annum, Cheshire and Lancashire next with 28·6, and Yorkshire third lowest with 32·7. The southern counties, therefore, are most liable to thunderstorms, and, curiously enough, the four northern counties, Durham, Northumberland, Cumberland, and Westmoreland, follow with 50·1 per annum. The report further shows the summer and winter distribution in each district, the order of maximum and minimum frequency agreeing very nearly with the annual.

(2.) On "The change of temperature which accompanies Thunderstorms in Southern England," by Mr. G. M. Whipple, B.Sc., F.R.Met.Soc.

(3.) "Note on the appearance of St. Elmo's Fire at Walton-on-the-Naze, September 3rd, 1889, by Mr. W. H. Dines, B.A., F.R.Met.Soc.

(4.) "Notes on Cirrus formation:" by Mr. H. Helm Clayton. The author, who has made a special study of cloud forms and their changes, gives a number of notes and drawings on the formation of cirrus under various conditions, *e.g.*, in a previously cloudless sky; cirrus bands with cross fibres; cirrus from cirro-cumulus clouds; cirrus drawn out from cumulus clouds; 'mares-tail' cirrus, &c. Curved cirrus clouds, when accompanied by decreasing barometric pressure frequently indicate that a storm of increasing energy is approaching.

(5.) "A comparison between the Jordan and the Campbell-Stokes Sunshine Recorder:" by Mr. F. C. Bayard, F.R.Met.Soc. As a result of a year's comparison between these two instruments, the author found that the Jordan Photographic recorder registered 30 per cent. more sunshine than the Campbell burning recorder.

(6.) "Sunshine:" by Mr. A. B. MacDowall. This is a discussion of the hours of sunshine recorded at the stations of the Royal Meteorological Society.

(7.) "On Climatological Observations at Ballyboley, co. Antrim:" by Prof. S. A. Hill, B.Sc., F.R.Met.Soc. This is the result of observations made during the five years 1884-88.

BERMUDA AS A STORM-WARNING STATION FOR THE ATLANTIC.

It is proposed that a meteorological station shall be established at the Bermuda Islands after the completion of the telegraph service between them and Nova Scotia. Many vessels leaving Halifax, the masters being unaware of the approach of storms from the West Indies, are dismantled before they have been out three days. The establishment of the proposed meteorological station would, therefore, be of great value, and the Canadian Government has willingly consented to bear half the cost.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1889.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	81·2	24	42·7	2	66·2	49·3	49·5	79	125·9	32·8	3·22	14	6·3
Malta	85·4	26	54·2	5	71·7	59·0	56·7	79	136·3	48·4	·58	4	4·2
Cape of Good Hope. ...	81·8	13	44·0	9	65·9	52·1	...	...	...	...	5·35	12	7·8
Mauritius	80·6	2	60·0	25	78·1	66·3	64·7	79	129·6	52·0	1·51	13	4·4
Calcutta	101·8	2	70·4	22	94·9	79·2	77·9	74	161·2	68·9	3·53	8	3·4
Bombay	93·7	23	74·9	26	91·6	81·3	77·4	75	146·8	68·9	·67	1	3·2
Ceylon, Colombo	90·1	2	72·8	...	87·5	77·7	74·1	80	149·0	70·5	15·60	28	8·0
Melbourne	78·1	1	39·4	8	62·1	48·9	48·4	77	124·0	29·0	·94	11	6·5
Adelaide	75·5	1	37·5	26	63·7	50·3	48·9	74	134·9	29·6	4·09	14	5·8
Wellington	67·0	3, 5	36·0	18	59·3	46·6	45·3	76	135·0	26·0	·92	13	4·1
Auckland	68·0	7	42·5	18	62·3	51·3	49·7	74	124·0	35·0	5·41	17	6·8
Jamaica, Kingston	93·8	11	71·4	7	90·4	74·6	72·4	71	...	...	1·47	...	...
Trinidad	96·0	10	68·0	14	91·8	72·0	72·0	68	161·5	59·0	6·34	11	...
Toronto	80·8	18	30·7	29	63·2	44·6	45·5	70	...	22·5	3·14	15	6·5
New Brunswick, Fredericton	91·7	19	32·0	12	68·9	43·8	47·5	68	...	...	3·45	14	5·1
Manitoba, Winnipeg ...	81·1	6	19·3	1	64·9	34·1	36·1	61	...	...	1·72	11	5·2
British Columbia, Victoria	79·0	11	37·0	22	65·3	46·5	...	...	...	...	1·01	7	...

REMARKS, MAY, 1889.

MALTA.—Mean temp. 63°·6; mean hourly velocity of wind 11·1 miles. Sea temp. rose from 60°·6 to 70°·2. TS on 25th. J. SCOLES.

Mauritius.—Mean temp. of air 1°·0 below, mean dew point 0°·4 below, and R 3·06 in. below their respective averages. Mean hourly velocity of wind 6·9 miles, or 3·3 below the average; extremes 18·6 on 8th and 0·0 on 21st. Prevailing direction S.E. by E. to E.S.E. C. MELDRUM, F.R.S.

COLOMBO.—TSS occurred on 12 days; L was seen on 4 other days.

Melbourne.—Mean temp. of air 2°·4, of dew point 2°·3 above the average; humidity 1, cloud 0·1, and R 1·19 in. below average. Prevailing winds N. and S.E.; strong on 10 days. Heavy dews on 14 days; hoar frost on 2 days; fogs on 4 days. Hail on 13th and L on 2 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Pressure ·047 in. above and temp. slightly below the average; R an inch in excess. Weather generally mild, with light showers but heavy general rains on 19th and 30th. C. TODD, F.R.S.

Wellington.—Fine up to the 9th, with N.W. winds, strong on 6th; from 10th to 19th light showers, with moderate S. winds. The remainder of the month generally fine, with winds from N.W. and S. towards the end. Fog on two days. Total R 3·49 in. below the average; temp. 0°·9 above average. R. B. GORE.

Auckland.—A rainy, unsettled month, the R being quite 1·25 in. above the average. Mean temp. slightly below the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
 NOVEMBER, 1889.

[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 Hall.	1·24	XI.	Castle Malgwyn	3·21
„	Margate, Birchington...	·71	„	Rhayader, Nantgwiltt..	2·62
„	Littlehampton	·77	„	Carno, Tybrith	2·46
„	Hailsham	1·30	„	Corwen, Rhug	2·04
„	Ryde, Thornbrough	1·75	„	Port Madoc	3·67
„	Alton, Ashdell	1·48	„	I. of Man, Douglas	2·67
III.	Oxford, Magdalen Col...	·88	XII.	Stoneykirk, Ardwell Ho.	1·94
„	Banbury, Bloxham	1·38	„	New Galloway, Glenlee	4·26
„	Northampton	·76	„	Melrose, Abbey Gate...	·82
„	Cambridge, Beech Ho...	1·17	XIII.	N. Esk Res. [Penicuik]	1·00
„	Wisbech, Bank House..	1·10	XIV.	Ballantrae, Glendrishaig	3·22
IV.	Southend	·84	„	Glasgow, Queen's Park.	1·75
„	Harlow, Sheering	·93	XV.	Islay, Gruinart School..	4·21
„	Rendlesham Hall	1·15	XVI.	Dollar	1·07
„	Diss	1·63	„	St. Andrews, Pilmour Cot	·70
„	Swaffham	1·43	„	Balquhidder, Stronvar..	3·31
V.	Salisbury, Alderbury...	1·12	„	Dunkeld, Inver Braan..	·95
„	Warminster	1·63	„	Dalnaspidal H.R.S.	2·99
„	Bishop's Cannings	1·10	XVII.	Keith H.R.S.	2·33
„	Ashburton, Holne Vic...	3·36	„	Forres H.R.S.	1·54
„	Hatherleigh, Winsford.	1·01	XVIII.	Strome Ferry H.R.S....	4·96
„	Lymouth, Glenthorne.	1·85	„	Fearn, Lower Pitkerrie.	1·21
„	Probus, Lamellyn	3·71	„	Loch Shiel, Glenaladale	7·71
„	Launceston, S. Petherwin	2·27	„	N. Uist. Loch Maddy ...	3·12
„	Wincanton, Stowell Rec.	1·33	„	Invergarry	4·88
„	Taunton, Lydeard Ho...	1·30	„	Loch Ness, Drumnadrochit	2·89
„	Wells, Westbury	1·89	XIX.	Lairg H.R.S.	2·21
VI.	Bristol, Clifton	1·22	„	Forsinard H.R.S. ....	...
„	Ross	1·09	„	Watten H.R.S.	1·71
„	Wem, Clive Vicarage ...	1·23	XX.	Dunmanway, Coolkelure	5·63
„	Cheadle, The Heath Ho.	1·25	„	Fermoy, Gas Works ...	2·12
„	Worcester, Diglis Lock	·98	„	Tipperary, Henry Street	2·12
„	Coventry, Coundon	1·18	„	Limerick, Kilcornan ...	2·07
VII.	Ketton Hall [Stamford]	·76	„	Miltown Malbay..	3·62
„	Grantham, Stainby	·52	XXI.	Gorey, Courtown House	1·25
„	Horncastle, Bucknall ...	·65	„	Navan, Balrath	1·56
„	Mansfield, St. John's St.	·69	„	Mullingar, Belvedere...	1·69
VIII.	Neston, Hinderton	2·66	„	Athlone, Twyford	1·68
„	Knutsford, Heathside	2·35	„	Longford, Currygrane...	2·05
„	Lancaster, South Road.	2·29	XXII.	Galway, Queen's Coll...	1·77
„	Broughton-in-Furness ..	3·51	„	Clifden, Kylemore	6·49
IX.	Wakefield Prison	·83	„	Crossmolina, Enniscoe..	2·22
„	Ripon, Mickley	·79	„	Collooney, Markree Obs.	2·54
„	Scarborough, West Bank	2·20	„	Ballinamore, Lawderdale	...
„	East Layton [Darlington]	1·05	XXIII.	Warrenpoint	1·82
„	Middleton, Mickleton ..	1·26	„	Seaforde	1·47
X.	Haltwhistle, Unthank..	1·21	„	Belfast, New Barnsley..	2·26
„	Shap, Copy Hill	2·78	„	Bushmills, Dundarave...	2·57
XI.	Llanfrechfa Grange	1·67	„	Stewartstown	2·13
„	Llandovery	2·52	„	Buncrana	1·98

NOVEMBER, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which 1/10 or more fell.	TEMPERATURE				No. of Nights below 32°	
		Total Fall.	Difference from average. 1870-9	Greatest Fall in 24 hours.		Max.	Min.							
				Dpth.	Date.				Deg.	Date.	Deg.	Date.		
		inches	inches.	in.					Deg.	Date.	Deg.	Date.	In shade.	On grass.
I.	London (Camden Square) ...	·89	— 1·55	·38	24	8	60·3	8	27·8	28	41	10	...	
II.	Maidstone (Hunton Court)...	·89	— 2·01	·38	23	7	...	...	...	...	...	...	...
III.	Strathfield Turgiss	·64	— 2·11	·36	24	8	59·3	15	26·2	29	71½	...	...
III.	Hitchin	·97	— 1·64	·39	3	10	55·0	8, 9	27·0	27f	61	...	...
IV.	Winslow (Addington)	1·00	— 1·50	·40	24	8	57·0	8	25·0	29	71	...	...
IV.	Bury St. Edmunds (Westley)	1·64	— 1·10	·45	3	9	...	...	...	...	...	...	...
V.	Norwich (Cossey)	1·51	— 1·80	·40	27	9	...	...	26·0	13a	110	...	...
V.	Weymouth (Langton Herring)	1·48	...	·41	24	10	58·0	15d	28·0	28	3	...	...
"	Barnstaple	2·81	— 1·34	·53	2	15	59·0	23	28·0	29	...	...	...
"	Bodmin (Fore Street)	3·30	— 2·03	·82	24	20	...	...	...	...	...	...	...
VI.	Stroud (Upfield)	1·12	— 1·82	·44	24	8	58·0	8	24·0	27	7	...	...
"	Churchstretton (Woolstaston)	1·35	— 2·09	·37	22	12	58·5	8	27·0	28	4 9	...	...
"	Tenbury (Orleton)	1·02	— 1·84	·29	24	11	62·0	7	25·2	29	6 9	...	...
VII.	Leicester (Barkby)	·86	— 1·47	·20	24	13	59·0	8	20·0	28	9 16	...	...
"	Boston	·59	— 1·78	·30	27	7	65·0	10	23·0	29	7	...	...
"	Hesley Hall [Tickhill]	·41	...	·08	2a	12	63·0	7	27·0	28	7	...	...
VIII.	Manchester (Plymouth Grove)	1·89	— 1·19	·40	14	16	61·0	7	28·0	26g	5 8	...	...
IX.	Wetherby (Ribston Hall) ...	·67	— 2·09	·36	15	7	...	...	...	...	...	...	...
"	Skipton (Arncliffe)	2·39	— 3·36	·56	1	14	56·0	9	24·0	27	9	...	...
"	Hull (People's Park)	·56	— 2·61	·10	24b	13	...	...	...	...	...	...	...
X.	North Shields	1·02	— 2·43	·29	14	10	61·0	7	25·5	27	9 10	...	...
X.	Borrowdale (Seathwaite)	6·82	— 5·00	1·15	24	17	...	...	...	...	...	...	...
XI.	Cardiff (Ely)	2·12	— 2·08	·76	23	12	...	...	...	...	...	...	...
"	Haverfordwest	3·14	— 2·00	·81	2	21	56·0	6	28·3	28	4 7	...	...
"	Plinlimmon (Cwmsymlog) ...	3·43	...	1·02	24	14	...	...	...	...	...	...	...
"	Llandudno	1·38	— 2·53	·77	22	15	62·0	22	33·8	27	0	...	...
XII.	Cargen [Dumfries]	2·06	— 1·85	·66	1	13	58·6	10	22·6	27h	7	...	...
XIV.	Jedburgh (Sunnyside)	·64	— 2·37	·14	21	7	60·0	10	26·0	27	8	...	...
XV.	Old Cumnock	3·75	+ ·28	1·16	1	18	56·0	7	...	...	6	...	...
XV.	Lochgilphhead (Kilmory)	4·09	— 1·27	·70	1	21	...	...	...	...	...	...	...
"	Oban (Craigvarren)	3·26	...	·62	24	25	54·8	7	30·0	27	2	...	...
"	Mull (Quinish)	4·78	...	1·18	30	21	...	...	...	...	...	...	...
XVI.	Loch Leven Sluices	1·10	— 2·45	·30	5c	7	...	...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	·70	— 2·43	·35	22	6	60·9	10	23·9	26	6	...	...
XVII.	Braemar	2·28	— 1·49	1·33	1	12	59·8	9	25·3	26	11 19	...	...
XVII.	Aberdeen (Cranford)	1·08	...	·22	24	14	62·0	7	29·0	26	7	...	...
XVIII.	Lochbroom	6·81	...	2·75	1	19	...	...	...	...	...	...	...
XVIII.	Culloden	1·86	— ·84	...	...	...	58·0	7	28·0	26i	3 18	...	...
XIX.	Dunrobin	2·10	...	·54	1	11	60·2	9	27·0	27	7	...	...
XIX.	S. Ronaldsay (Roeberry)	1·92	— 2·16	·37	1	20	54·0	6	17·0	27	3	...	...
XX.	Cork (Blackrock)	2·49	— 2·12	·56	24	16	60·0	8	27·0	28	3 5	...	...
"	Dromore Castle	4·13	...	·75	24	17	69·0	17	30·0	28	...	...	...
"	Waterford (Brook Lodge) ...	1·92	...	·49	24	15	55·5	8	24·0	29	5	...	...
"	O'Briensbridge (Ross)	2·30	...	·73	24	19	58·0	12e	30·0	28	1	...	...
XXI.	Carlow (Browne's Hill)	1·83	— 1·09	·57	22	18	...	...	...	...	...	...	...
XXI.	Dublin (FitzWilliam Square)	·93	— 1·35	·36	22	9	59·7	7	29·6	28	2 11	...	...
XXII.	Ballinasloe	1·55	— 1·45	·47	24	16	54·0	8	26·0	27h	8	...	...
XXIII.	Waringstown	2·18	— ·53	·36	17	18	57·0	7, 18	26·0	27	7 12	...	...
"	Londonderry (Creggan Res.) ..	2·77	...	·58	26	19	...	...	...	...	...	...	...
"	Omagh (Edenfel)	2·00	— 1·05	·50	26	18	55·0	7	26·0	28	4 8	...	...

a And 14. b And 26, 27. c And 23. d And 16. e And 13, 14. f And 30. g And 27.

h And 28. i And 27, 28.

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

METEOROLOGICAL NOTES ON NOVEMBER, 1889.

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 has been unusually open and mild, and fogs have been rare. Roses are still in bloom out of doors, the hawthorn has bloomed again, cherry trees are full of bud, and poppies and the yellow rag-wort (*Senecio Jacobæa*) in full flower. Violets and primroses are in flower in gardens. Bar. exceedingly high on 19th (30·652); 23rd, anticyclone giving way and a gale from S.W. to N.W. Close of the month very cold and winterly.

HITCHIN.—A very dry month; highest bar. since January.

ADDINGTON.—One of the driest Novembers since 1871, twice only a less quantity registered, viz.: 1871 (0·87 in.), 1879 (0·76 in.) It was also unusually mild until quite the end, the 27th being the first really cold day, with a max. temp. of 35°. Bar. high during the month, particularly from 17th to 21st.

BURY ST. EDMUND'S, WESTLEY.—The month was mild and foggy till the 25th. Deep snow on the 27th, and cold for the time of year till end of month.

WEYMOUTH, LANGTON HERRING.—On the whole a very fine, mild month. The small amount of R for this month has increased the deficit for the eleven months to 23 per cent. Mean temp. 2°·6 above the average; mean min. 2°·3 above the average. There were several foggy days; on the 24th very stormy.

WOOLSTASTON.—The early part of the month was warm and sunny, the 8th being quite a summer's day. The last ten days were very cold, S falling on 25th and 26th. Mean temp. 43°·7.

ORLETON.—The weather was generally cloudy, dull, and warm, and frequently foggy, with only two frosty mornings till the 25th. The bar. was very high and steady till the 24th, when a sudden decrease of pressure took place, followed by a strong gale of wind and a low temperature till the end of the month. The mean temp. of the whole month was 2°·2 above the average of the last 28 years. R much less than the mean of the month. A light fall of S occurred early in the morning of the 27th; a solar halo on the 5th. Wind generally light till the 24th, but afterwards strong and cold.

LEICESTER, BARKBY.—The first S fell on the 26th. Mean temp. 42°·1, mean max. 48°·6, mean min. 35°·5.

MANCHESTER, PLYMOUTH GROVE.—The first three weeks the weather was mild, damp, and foggy; no dense fog during the month. A fall of S on the 26th. Last five days winterly weather and very cold.

HULL.—The weather during the month was generally fine, sometimes with fog and with a little frost and S towards the end.

WALES.

HAVERFORDWEST.—Mildness, with constant R, characterised the first week; the first two days very stormy with T and L, followed by a sharp frost at night on the 4th; shade temp. 30°·5. Mild, but generally gloomy weather generally characterised the month until the 20th, when the weather began to get cold and wet. The 26th was very cold and gloomy, with a strong easterly current of air, followed on the 27th by a heavy snowstorm, S falling to the depth of 7 in. over the whole of the Precelly range, and remaining more or less to the end of the month.

SCOTLAND.

CARGEN.—A calm, foggy month generally. Sunshine (68 hours) considerably below the average; mean temp. of the month ($43^{\circ}7$) $2^{\circ}2$ above the average; mean bar. pressure (30.080 in.) a quarter of an inch above the average; for five days (16th to 20th inclusive) the pressure ranged from 30.548 in. to 30.590 in.

JEDBURGH.—Up to the beginning of the last week the mildness has been most unusual for the season. Primroses are in full bloom, wallflowers, &c. The frost of last week has been beneficial, as it has checked the growth of root crops.

OBAN, CRAIGVARREN.—A very general R, though less than the normal amount for the month. Growth continued throughout. A little S fell at the close, with a cold spell of weather.

ABERDEEN, CRANFORD.—Blinding snow showers on evening of 23rd; snow on the ground averaged 3 in. deep on the morning of 24th.

LOCHBROOM.—The month began with as two stormy and rainy days as ever remembered—the heaviest R for years, and ended with a very stormy and wintry week, but the rest of the month was summer-like.

INVERNESS, CULLODEN.—The weather throughout particularly fine. Temp high, and from the 1st to the 17th and 18th no R fell. Some sunsets very beautiful.

ROEBERRY.—Very fine until 24th, afterwards coarse and unsettled. S on 26th, T on 29th.

IRELAND.

CORK.—Changeable and humid, and at times foggy, with a steady high bar.

WATERFORD.—Mean temp. $46^{\circ}2$; average R for the month 3.73 in., the fall was therefore 1.81 in. below the average; hail on the 26th, aurora on the 27th, lunar rainbow on the 29th.

O'BRIANSBRIDGE, ROSS.—A very mild month. Thermometer fell to or below frost only on one night. Dense fog on the 23rd.

DUBLIN.—The month was calm, dull, and comparatively mild and rainless—a contrast to November of last year, which was the wettest and most stormy November experienced in Dublin for 25 years. At the close of the month a spell of wintry weather was experienced. Mean temp. above the average. A lunar halo on the 4th, a solar halo on the 14th; high winds on 5 days; gale on the 1st; more or less foggy on 9 days. L on 25th; hail on the 1st; sleet and snow 26th and 27th. An aurora borealis was seen on the night of the 26th. At the beginning of the last week a sudden change from autumn to winter.

OMAGH, EDENFEL.—The month commenced with gales and rain, but from the 3rd to the 21st there followed a period of abnormal mildness, calmness, and humidity—stagnancy would better describe its condition—with an atmospheric saturation evidenced by an almost daily measurable quantity in the gauge. Many shrubs and plants burst into leaf and flower for the second time, and the song of the non-migratory song-birds was quite general. The fourth week, however, was a rude awakening and was winter pure and simple, with an average of six inches of S and steady night frosts.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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THE EIFFEL TOWER AND ITS USE.

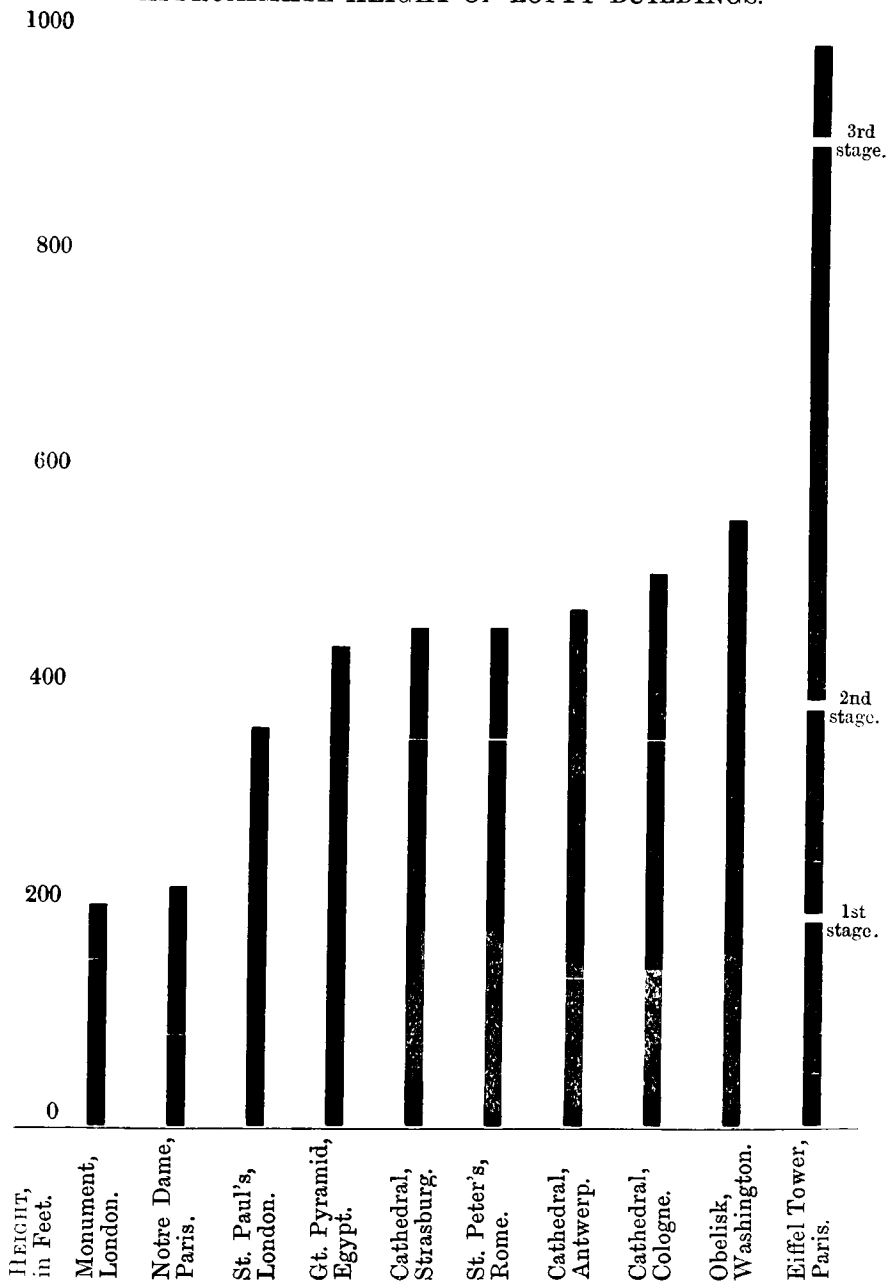
WE did think of giving a sketch of the Eiffel tower in illustration of the following remarks, but we found that to represent the meteorological apparatus even on the smallest scale visible without a magnifier, our view of the tower must be eight feet long, so we gave up the idea.

Almost everybody has either seen the tower or an engraving of it, and almost everybody admits its elegance and the skill shown in its design. It would be interesting to disinter from the press of 1886, a list of the authorities in the "world of light and leading," who then proclaimed the proposal as a mistake, an abomination—a disgrace to Paris, &c. But they are silent now; the tower was built, the world went and saw it, and thought and talked more about it, than about all the other wonders in the monster show.

A company has been formed to erect a somewhat similar tower in the metropolis, and it has received almost as many sneers and as much ridicule as did M. Eiffel's. Perhaps those sneers may be regarded as an augury for good. There are many respects in which a lofty tower might be of enormous utility in London—we mention only two subjects, fires, fogs.

Here we have to deal with M. Eiffel's tower solely from a meteorological standpoint—but before going into that branch of the subject we have prepared a diagram giving approximately the relative heights of some of the loftiest buildings in the world. We do not, however, vouch for the correctness of the heights, because we can find no two tables which agree—*e.g.*, in some cases the height is reckoned above the floor of the *crypt*—and there is a tradition that the 404 feet sometimes attributed to St. Paul's Cathedral, is the height of the cross above the Thames!

APPROXIMATE HEIGHT OF LOFTY BUILDINGS.



The public were taken by the lifts up to the 3rd Floor, at the height of 896 ft., but the tower reaches more than 80 ft. above that, and terminates with an iron floor about 4 ft. in diameter,

surrounded by a breast high iron railing, to which are attached a series of meteorological instruments—all supplied by Messrs. Richard Frères. We are not sure that we remember them all, but from memory we give the list as follows :—

Anemometers recording direction, velocity and inclination of wind—thermometer screen with max. min. dry and wet thermometers—recording thermograph, hygrometer and rain gauge—many of these instruments recorded their indications at the ground level, telegraph wires carrying the indications to MM. Richard's case in the *Palais des arts libéraux*. From near the centre of this little platform rose the lightning conductor, and above all (even above the rain gauge !) floated the national flag.

THE TOWER STRUCK BY LIGHTNING.

A very ridiculous idea took possession of some Parisians, they thought that there were more thunderstorms than usual, and declared that the Eiffel Tower produced them. If it had any effect it would probably be to dissipate, rather than to create, storms. But one day it was announced that the tower had been struck by lightning. As it is probably the best lightning conductor in the world, there was no reason why it should not be struck, but strong reason why it should be none the worse for it—and that is what proved to be the case, as is shown by the following account :—

As many exaggerated reports have been circulated concerning the effects of the flash of lightning which struck the Eiffel Tower on the evening of the 19th of August, M. Mascart has drawn up a report upon the phenomenon, which was observed amongst others by M. Foussat, the chief of the electric service, who happened to be on the upper platform of the tower at the time.

The tower is protected by a central rod at the summit and by eight other rods on the balustrade of the third platform. The discharge of lightning occurred at 9.40 p.m. and struck the principal conductor at the summit ; it was accompanied by a terrific noise, resembling the detonation of several pieces of artillery. Some red metallic droplets, were detached from the point of the conductor, and were probably due to the combustion of particles of volatilised iron. The lightning-conductors on the platform appeared to have luminous “brushes” at their points, and a considerable decrepitation was noticed. The official who looks after the light was near his apparatus and two men were at work with the machinery, while M. Foussat was leaning against the balustrade, and it is remarkable that neither of these four persons experienced the least inconvenience at the time of the flash, neither were any of the meteorological instruments damaged.

Almost immediately after the tower was struck, a strongly-electrified cloud (it was raining at the time) surrounded the lantern of the tower, and, no doubt, this circumstance gave rise to the impression, which many observers at some distance from Paris

experienced—namely, that the upper part of the Eiffel Tower, immediately after the discharge, appeared to be enveloped in a *luminous* electric cloud, which almost entirely eclipsed the light from the lantern.

M. Mascart considers that there was nothing very extraordinary connected with the phenomenon; that it has conclusively proved that the tower has perfect communication with the earth, and that the safety of the edifice has been definitely established.

THE ANEMOMETER ON THE EIFFEL TOWER.

The *Comptes rendus* of the Paris Academy of Sciences, of Nov. 4th, 1889, contains a note by M. A. Angot, on the mean hourly velocity of the wind at the summit of the Eiffel Tower, measured during 101 days ending with October 1st, by means of an Anemometer placed at 994 feet above the ground, and compared with the results of a similar instrument at the Paris Meteorological Office, placed at 66 feet above the ground. The average velocity on the tower was 16 miles an hour, being over three times the amount registered at the Meteorological Office, where it was only 5 miles an hour. At the lower station the diurnal variation showed a single minimum about sunrise, and a single maximum about 1 p.m. On the tower the minimum occurred about 10 a.m., and the maximum about 11 p.m., while the characteristic maximum of lower regions about the middle of the day was hardly perceptible on the tower. It is remarkable that this inversion, which is usual upon high mountains, should occur at so small a height as that of the Eiffel Tower. The ratio of increased velocity was constant at about 5·1 between midnight and 5 a.m.; it then decreased rapidly and became 2·1 at about 10 a.m., and maintained this value until 2 or 3 p.m., when it again rose regularly until midnight.

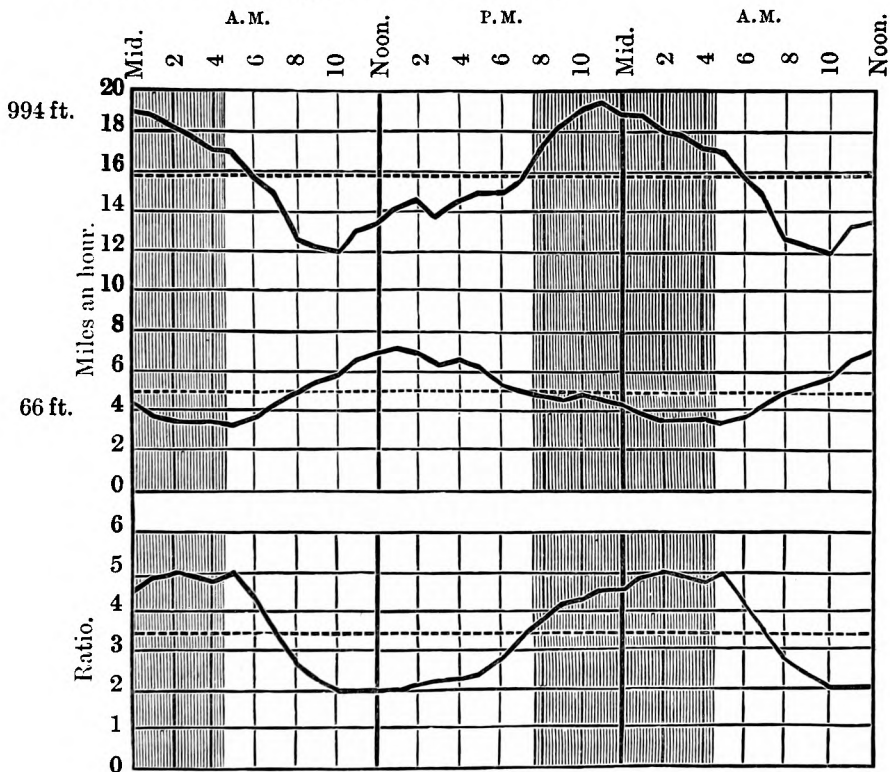
We append the table given by M. Angot, but have converted the wind velocities from metres per second into the equivalent in miles per hour.

Mean Velocity of the Wind upon 101 days between June 18th and September 30th, 1889.

Hour.	Eiffel Tower.	Bureau Central.	RATIO.	Hour.	Eiffel Tower.	Bureau Central.	RATIO.
Midnight...	19·0	4·1	4·6	Noon	13·5	6·9	2·0
1 a.m. ...	18·8	3·9	4·9	1 p.m. ...	14·2	7·1	2·0
2 „ ...	18·1	3·6	5·0	2 „ ...	14·4	6·9	2·1
3 „ ...	17·8	3·6	4·9	3 „ ...	13·9	6·3	2·2
4 „ ...	17·2	3·6	4·8	4 „ ...	14·4	6·4	2·3
5 „ ...	16·7	3·4	5·0	5 „ ...	15·0	6·2	2·4
6 „ ...	15·8	3·7	4·3	6 „ ...	15·1	5·5	2·7
7 „ ...	14·7	4·2	3·5	7 „ ...	15·6	4·7	3·3
8 „ ...	12·5	4·7	2·7	8 „ ...	17·3	4·5	3·8
9 „ ...	12·2	5·4	2·3	9 „ ...	18·2	4·4	4·1
10 „ ...	12·0	5·9	2·0	10 „ ...	19·2	4·6	4·2
11 „ ...	13·3	6·5	2·0	11 „ ...	19·6	4·4	4·5

We always hold that diagrams form far the best mode of communicating facts, and the above results are so unexpected that we have tried to make them quite clear. It will be seen that M. Angot's discussion referred to the period between the middle of June and the end of September—for this period sunrise may be roughly taken as about 5 a.m. and sunset as 7 p.m., and in the diagram, shaded space represents the time when the sun was below the horizon—shade = night, white = day.

The diagram represents the average velocity of the wind at the two positions for the 101 days, and it has a further peculiarity, which when understood is a convenience, but unless understood is perplexing—the diagram contains 36 hours—i.e., *the morning hours are repeated after midnight*. This enables one to study the general character of any part of the curve much better than if the night had been given only in two disjointed halves. When one wishes to study the daylight phenomena, one can cover the 3rd 12 hours; when to study those of the night, the 1st 12 hours.



At the Bureau Central, at 66 ft., scarcely a $\frac{1}{4}$ of a mile from the base of the tower, the wind velocity shows the same law as is found at the majority of European observatories, namely, a maximum

velocity shortly after noon and a minimum just before sunrise, the one being double the other.

On the tower the wind is, on the average, much stronger than down below, which is of course readily explained by the absence of retardation by friction against trees and buildings; but what is not easily explained is the further fact that the time of maximum and of minimum are almost reversed—the max. occurring about midnight and the min. about 10 a.m. The sharpness of the effect of sunrise on the winds motion is apparent in all three curves, but especially in the lowest one, which gives the ratio of the velocity at 994 ft. to that at 66 ft. During the night the wind was generally five times as strong as below, but no sooner does the sun rise than the ratio falls rapidly until during the heat of the day it is only twice, and then as the sun declines it rises gradually to its former point of 5 to 1, the average being rather more than three to one.

The Eiffel tower has much yet to teach us, but, besides having in its construction afforded work to thousands, pleasure to the tens of thousands who ascended it, and considerable profit to the builders, it will, we believe, keep off serious accidents from lightning from about 70 acres of Paris; it has already taught us much as to the nature and causes of wind velocities, with perhaps an indirect hint as to factory chimnies, and we know that there is much yet to come with respect to temperature and other phenomena. So much for what we were told would be “a useless abomination.”

ON THE BLACK BULB THERMOMETER IN VACUO.

To the Editor of the Meteorological Magazine.

SIR,—In reading Prof. McLeod's valuable paper on the black bulb thermometer in vacuo, I was somewhat surprised that one so evidently conversant with work in Physics had omitted all mention of the dimensions of his thermometers (small and large even in the matter of thermometer bulbs, being decidedly vague). I should be obliged if you would allow the suggestion to appear. That the insertion of the diameters of the bulbs of the thermometers, and also of the bulbs of the vacuum jackets in a subsequent issue of the *Met. Mag.* would add necessary detail for future experimenters in using Prof. McLeod's results. It would also provide ordinary observers with a standard for estimating the value of their own black bulb thermometers.

Faithfully yours,

H. SOWERBY WALLIS.

25, Northwood-road, Highgate,
December 20, 1889.

Stephen Joseph Perry.

ALTHOUGH astronomers are disappointed with the results of the expeditions to observe the last total solar eclipse, that which has most saddened both them and meteorologists is the loss away in British Guiana, of Father Perry, a man respected, and we think we may say loved by all who knew him. Our only hesitation on that point being produced by the remembrance of the action of the Meteorological Council towards the observatory which Perry ably and carefully directed for nearly 30 years.

The obituary notice in the *Times*, though brief, was so much to the point that we reprint it.

Stephen Joseph Perry was born in London in 1833, and, after studying at the Catholic colleges of Douay and Rome, entered the Society of Jesus in 1853. Between this latter date and 1860, he went through a special course of mathematics at Paris, and was appointed professor and director of the observatory at Stonyhurst College in 1860. The only occasions on which he has been absent from Stonyhurst for any length of time were for studying theology at St. Beuno's College (four years) and to take part in scientific expeditions. Among these expeditions we may mention the magnetic survey of France in 1868-9, the transits of Venus in 1874 and 1882, when he was stationed at Kerguelen and Madagascar respectively ; and the eclipses of 1886, 1887 and 1889 at the West Indies, Russia and the Salut Isles. He was elected fellow of the Royal Society in 1874, and he belonged to several other learned societies. He commanded the respect of all who were acquainted with his personal character and his scientific work, by his utter self-abnegation when there was work to be done, being always ready to volunteer regardless of the intense sufferings from sea sickness which the expeditions cost him. His death will be a subject of great regret, not only to the small circle of students at Stonyhurst, whose affections he had won, but to men of all classes in North Lancashire to whom he was well-known."

On this we have but two comments to make (1) the peculiar happiness of the phrase "utter self-abnegation," no words in the language better describe Father Perry's character. (2) North Lancashire, and even England will not alone "greatly regret" his loss, we know full well how warm a welcome awaited him in many a home across the seas.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1889.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	84·5	6	46·9	1	72·7	53·4	52·4	74	126·3	39·6	2·03	6	5·6
Malta	99·0	26	58·2	1	81·4	65·4	62·2	72	150·1	52·0	·00	0	1·5
<i>Cape of Good Hope</i> ...	74·8	30	37·0	6	62·7	47·3	...	...	...	...	3·42	9	3·8
<i>Mauritius</i>	77·7	4	58·0	18	75·5	65·0	61·0	75	124·4	48·5	1·53	14	5·2
Calcutta	98·4	7, 8	72·5	4	91·3	78·6	78·9	82	161·0	32·8	15·35	21	7·3
Bombay.....	93·6	4	76·0	21, 27	87·7	80·0	77·8	83	144·0	73·8	19·89	24	7·3
Ceylon, Colombo.....	87·4	5	73·8	28	85·1	77·1	72·5	78	147·2	71·8	2·33	16	7·7
<i>Melbourne</i>	66·0	2	37·6	27	57·3	46·9	45·3	77	119·2	28·9	2·78	16	7·0
<i>Adelaide</i>	68·3	4	38·5	25	59·1	48·6	47·9	80	119·9	29·9	4·75	22	7·1
<i>Wellington</i>	60·0	1	31·5	13	53·2	42·9	41·7	79	107·0	25·0	4·04	22	5·0
<i>Auckland</i>	68·0	8	40·0	15	58·9	49·6	49·0	81	111·0	32·0	10·41	25	8·0
Jamaica, Kingston.....	...	...	...	...	...	...	...	...	...	...	...	...	...
Trinidad	92·0	1a	67·0	26	88·7	70·9	71·5	75	158·0	60·0	11·66	21	...
Toronto	78·3	20	44·2	6	68·5	52·0	54·0	81	...	38·2	3·56	17	6·8
New Brunswick, Fredericton	85·2	30	41·0	18	73·7	52·8	56·3	74	...	...	2·89	15	6·5
Manitoba, Winnipeg ...	95·6	28	33·3	3	79·5	46·8	46·9	58	...	...	·45	9	4·6
British Columbia, Victoria	80·0	2	37·0	6	70·4	46·9	...	...	...	...	·77	5	...

a And 4, 25.

REMARKS, JUNE, 1889.

MALTA.—Mean temp. 71°·8; mean hourly velocity of wind 9·0 miles. The Sea temp. rose from 70°·1 to 74°·8. Sea fog on 23rd J. SCOLES.

Mauritius.—Mean temp. of air 0°·4 below, mean dew point 0°·4 above, and R 0·37 in. below their respective averages. Mean hourly velocity of wind 9·5 miles, or 2·0 below the average; extremes 24·9 on 27th and 0·0 on 18th. Prevailing winds S.E. by E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 3°·0, of dew point 1°·9; amount of cloud 4, and R 0·82 in. above average; humidity 3, and pressure 0·248 in. below average. Prevailing wind N.; strong on 12 days. Heavy squalls on 4 days; heavy dew on 6 days; dense fogs on 2 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Persistently low barometer during the greater part of the month, due to the continued presence of elongated areas of low pressure S of the continent. Temp. 2° above the average at night and 1° below in the day, giving an unusually small diurnal range. Cloud and R much above the average, and evaporation very small. C. TODD, F.R.S.

Wellington.—A dull wet unpleasant month with only a few fine days, and generally light winds from S.E., with frequent calms. Very cold and frosty on 13th, with H at night. R. B. GORE.

Auckland.—An exceedingly wet and stormy month, the R being the heaviest in June since 1860. Barometric pressure much below the average; mean temp. above it. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
 DECEMBER, 1889.

[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 Hall.	2·03	XI.	Castle Malgwyn	3·24
„	Margate, Birchington...	1·26	„	Rhayader, Nantgwillt..	4·25
„	Littlehampton	1·52	„	Carno, Tybrith ...	3·50
„	Hailsham	1·93	„	Corwen, Rhug	1·97
„	Ryde, Thornbrough	2·26	„	Port Madoc	7·20
„	Alton, Ashdell.....	2·64	„	I. of Man, Douglas	3·54
III.	Oxford, Magdalen Col...	1·04	XII.	Stoneykirk, Ardwell Ho.	3·66
„	Banbury, Bloxham	1·87	„	New Galloway, Glenlee	6·81
„	Northampton	1·55	„	Melrose, Abbey Gate...	2·17
„	Cambridge, Beech Ho...	1·21	XIII.	N. Esk Res. [Penicuik]	3·40
„	Wisbech, Bank House..	1·48	XIV.	Ballantrae, Glendrishaig	4·14
IV.	Southend	1·22	„	Glasgow, Queen's Park.	2·98
„	Harlow, Sheering ...	1·21	XV.	Islay, Gruinart School..	7·49
„	Rendlesham Hall	1·17	XVI.	Dollar.....	2·06
„	Diss	1·22	„	St. Andrews, Pilmour Cot	1·42
„	Swaffham	1·66	„	Balquhiddy, Stronvar..	8·03
V.	Salisbury, Alderbury...	2·15	„	Dunkeld, Inver Braan..	3·19
„	Warminster	2·01	„	Dalnaspidal H.R.S. ...	5·86
„	Bishop's Cannings	1·82	XVII.	Keith H.R.S.	1·53
„	Ashburton, Holne Vic...	4·88	„	Forres H.R.S.	1·25
„	Hatherleigh, Winsford.	2·81	XVIII.	Strome Ferry H.R.S....	8·50
„	Lynmouth, Glenthorne.	2·85	„	Fearn, Lower Pitkerrie.	1·23
„	Probus, Lamellyn	3·08	„	Loch Shiel, Glenaladale	13·61
„	Launceston, S. Petherwin	3·15	„	N. Uist, Loch Maddy ...	7·78
„	Wincanton, Stowell Rec.	2·31	„	Invergarry	7·55
„	Taunton, Lydeard Ho...	2·02	„	Loch Ness, Drumadrochit	2·25
„	Wells, Westbur,	2·19	XIX.	Lairg H.R.S.	·66
VI.	Bristol, Clifton	2·25	„	Forsinard H.R.S. ....	...
„	Ross	1·22	„	Watten H.R.S.	1·87
„	Wem, Clive Vicarage ...	2·02	XX.	Dunmanway, Coolkelure	7·83
„	Cheadle, The Heath Ho.	2·13	„	Fermoy, Gas Works ...	3·71
„	Worcester, Diglis Lock	1·43	„	Tipperary, Henry Street	3·18
„	Coventry, Coundon	2·25	„	Limerick, Kilcornan ...	...
VII.	Ketton Hall [Stamford]	1·66	„	Miltown Malbay.....	5·95
„	Grantham, Stainby	1·90	XXI.	Gorey, Courtown House	3·13
„	Horncastle, Bucknall ...	1·43	„	Navan, Balrath .....	...
„	Mansfield, St. John's St.	1·88	„	Mullingar, Belvedere ...	2·96
VIII.	Neston, Hinderton	2·62	„	Athlone, Twyford	3·48
„	Knutsford, Heathside ...	2·47	„	Longford, Currygrane...	3·29
„	Lancaster, South Road.	3·03	XXII.	Galway, Queen's Coll...	4·30
„	Broughton-in-Furness ..	8·12	„	Clifden, Kylemore	8·09
IX.	Wakefield Prison	1·73	„	Crossmolina, Enniscoe..	4·78
„	Ripon, Mickley	1·34	„	Collooney, Markree Obs.	4·98
„	Scarborough, West Bank	1·40	„	Ballinamore, Lawderdale	...
„	East Layton [Darlington]	1·22	XXIII.	Warrenpoint	3·01
„	Middleton, Mickleton..	1·45	„	Seaforde	2·32
X.	Haltwhistle, Unthank..	2·14	„	Belfast, New Barnsley .	3·25
„	Shap, Copy Hill	4·34	„	Bushmills, Dundarave...	4·29
XI.	Llanfrechfa Grange	1·95	„	Stewartstown	3·11
„	Llandovery	3·64	„	Buncrana	3·55

DECEMBER, 1889.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which -01 or more fell.	TEMPERATURE				No. of Nights below 32°	
		Total Fall.	Differ- ence from average. 1870-9	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date			Deg.	Date	Deg.	Date		
												inches.	in.
I.	London (Camden Square) ...	1.23	— .94	.30	21	15	53.2	17	22.8	29	14	23	
II.	Maidstone (Hunton Court) ...	1.54	— .86	.36	22	16	...	...	...	...	...	...
III.	Strathfield Turgiss	1.58	— .44	.25	22	16	53.9	17	18.6	2	23	28	
IV.	Hitchin .....	.85	— 1.20	.21	21	13	53.0	17	22.0	28	17	...
V.	Winslow (Addington)	1.34	— .77	.24	21	18	55.0	22a	15.0	29	20	23	
VI.	Bury St. Edmunds (Westley)	1.36	— .64	.34	21	17	...	...	...	...	...	...
VII.	Norwich (Cossey)	1.27	— 1.05	.30	8	12	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	2.38	...	.56	22	18	52.0	22	26.0	4	9	...
IX.	Barnstaple	2.44	— 1.32	.35	21	14	57.0	20	25.0	29	...	...
X.	Bodmin (Fore Street)	3.88	— 1.60	.78	21	19	...	...	...	...	...	...
XI.	Stroud (Upfield)	1.70	— .73	.61	6	17	55.0	17a	22.0	28	21	...	
XII.	Churchstretton (Woolstaston)	2.17	— .62	.40	6	17	52.5	16	24.0	4	15	22	
XIII.	Tenbury (Orleton)	1.83	— .68	.48	6	16	54.3	17	19.0	29	20	23	
XIV.	Leicester (Barkby)	1.85	— .07	.50	21	17	54.0	18	15.0	28e	23	26	
XV.	Boston	1.00	— 1.07	.25	8	10	52.0	17	20.0	29	22	...	
XVI.	Hesley Hall [Tickhill]	1.18	...	.43	6	14	55.0	17	21.0	29	22	...
XVII.	Manchester (Plymouth Grove)	2.30	— .15	.50	8	15	52.0	17b	27.0	7, 11	16	18	
XVIII.	Wetherby (Ribston Hall) ...	1.78	— .43	.54	7	10	...	...	...	...	...	...
XIX.	Skipton (Arneliffe)	3.74	— 1.54	.48	17	17	50.0	19	24.0	14	21	...	
XX.	Hull (People's Park)	1.40	— 1.12	.38	8	14	...	...	...	...	...	...
XXI.	North Shields	1.42	— 1.67	.53	6	13	57.5	25	25.0	29	17	20	
XXII.	Borrowdale (Seathwaite)	16.33	+ 2.60	3.86	19	20	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	2.57	— 1.34	.74	21	16	...	...	...	...	...	...
XXIV.	Haverfordwest	4.03	— 1.10	.72	19	18	52.1	15	25.4	4	10	18	
XXV.	Plinlimmon (Cwmsymlog) ...	5.00	...	.86	22	18	...	...	...	...	...	...
XXVI.	Llandudno	2.98	+ .13	.67	19	13	55.2	17	29.0	4	4	...	
XXVII.	Cargen [Dumfries]	3.90	— .63	.59	19	18	53.0	9	23.6	28	12	...	
XXVIII.	Jedburgh (Sunnyside)	1.54	— .91	.23	19	13	55.0	8a	25.0	14f	12	...	
XXIX.	Old Cumnock	5.01	+ 1.13	.75	19	21	52.0	17	21.0	10g	13	...	
XXX.	Lochgilthead (Kilmory)	7.92	+ 1.74	1.35	8	23	...	...	...	...	...	...
XXXI.	Oban (Craigvarren)	8.38	...	1.22	8	25	52.3	17	30.8	29	5	...	
XXXII.	Mull (Quinish)	9.14	...	1.16	30	26	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	2.40	— 1.26	1.20	20	11	...	...	...	...	...	...
XXXIV.	Dundee (Eastern Necropolis)	1.15	— 2.12	.25	20	11	54.8	17	23.3	12	13	...	
XXXV.	Braemar	1.86	— 1.57	.51	19	13	52.0	17	15.7	12	17	20	
XXXVI.	Aberdeen (Cranford)	2.25	...	.35	22	20	54.0	9, 17	24.0	11h	12	...
XXXVII.	Lochbroom	5.64	...	.68	17	20	...	...	...	...	...	...
XXXVIII.	Culloden .....	.97	— .87	.26	19	...	54.0	9	25.0	5	8	24
XXXIX.	Dunrobin	2.10	...	.30	22	15	58.0	17	23.5	12	12	...
XL.	S. Ronaldsay (Roeberry)	3.05	— .31	.37	7	24	49.0	1	29.0	12	2	...	
XLI.	Cork (Blackrock)	3.95	— .81	.60	19	17	55.0	10c	27.0	11	5	...	
XLII.	Dromore Castle	5.82	...	.80	28	24	59.0	30	29.0	11	...	...
XLIII.	Waterford (Brook Lodge) ...	4.40	...	.84	28	20	55.0	9	23.0	12	4	...
XLIV.	O'Briensbridge (Ross)	4.62	...	.53	6	20	53.0	28d	30.0	...	8	...
XLV.	Carlow (Browne's Hill)	4.45	+ .94	.93	24	20	...	...	...	...	...	...
XLVI.	Dublin (Fitz William Square)	1.55	— 1.03	.27	19	15	56.6	17	30.9	6h	4	20	
XLVII.	Ballinasloe	3.81	+ .33	.57	28	21	50.0	17	24.0	6	14	...	
XLVIII.	Waringstown	3.11	+ .15	.63	6	19	56.0	17	26.0	13	14	19	
XLIX.	Londonderry (Creggan Res.) ..	4.16	...	.65	23	23	...	...	...	...	...	...
L.	Omagh (Edenfel)	4.39	+ .99	.52	23	22	51.0	17	28.0	13	8	15	

a And 23. b And 18. c And 17. d And 29. e And 30. f And 29, 30. g And 27.

h And 12.

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

METEOROLOGICAL NOTES ON DECEMBER, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—Very variable temp., but on the whole above the average. From an agricultural point of view the weather of the entire year was exceptionally favourable. S on 5th and 6th.

ADDINGTON.—Great variations of temperature, the extreme range being 40° ; the max. six times above 50, and the min. three times below 20. R fell on a good many days, but in no great quantity. Not much foggy weather, but very dense fogs on 14th and 31st, the trees being beautifully covered with rime on the latter day.

LANGTON HERRING.—R $\cdot 62$ in. below the average of 14 years. Sudden and great changes of temp. were a notable feature, and the mean at 9 a.m. was 1° below the average. A fine solar halo was observed on the 4th.

WOOLSTASTON.—A cold month, with sudden and abrupt variations of temp. Mean temp. $37^{\circ}\cdot 7$

ORLETON.—With the exception of the 9th and 10th the first 15 days were cold and frosty, with an average temp. of about $32^{\circ}\cdot 5$; the weather then became warmer and very changeable, with a S. or W. wind and frequent R, but not in heavy falls, till 25th, when frost set in again, and after a very fine day a cloudy sky and cold wind followed. Fogs were very frequent. Pressure was high and generally steady during the greater part of the month. Mean temp. nearly 1° below the average of 28 years. S on morning of 7th two to three inches deep and six inches on the hills.

MANCHESTER, PLYMOUTH GROVE.—Very changeable throughout. Snow and sleet on the 7th; dense fog on the 14th.

HULL.—The weather was generally overcast or cloudy, often with fog or mist.

SEATHWAITE. - In the three days 17th to 19th $7\cdot 08$ in. of R fell.

WALES.

HAVERFORDWEST.—The first six days were fine, with sharp frost. From the 7th to the 23rd the weather was very changeable, every day wet and some sharp frosts. From the 24th to the end, cold, dry, frosty weather prevailed, with a considerable amount of bright sunshine. Temp. about or rather below the average of 20 years. Winds principally from S.W. and E.S.E. Lunar halo on 30th.

SCOTLAND.

JEDBURGH.—The weather was mild, and vegetation preserved its freshness, garden flowers such as primroses being in bloom all the month. The atmosphere was singularly still, with the exception of the 18th and 19th, when there was a moderate gale.

OBAN, CRAIGVARREN.—Temp. very low, but equable, throughout the month. Frequent R. Growth continued and wall-flowers remained in bloom.

LOCHBROOM.—The first and the last weeks of the month were both dry, but otherwise quite contrary, for the first was frosty and intensely cold; the latter like summer. The rest of the month was as wintry as it could be, every variety of rough weather occurring.

INVERNESS, CULLODEN.—The month generally was very fine. There were no fogs, and some of the sunrises and sunsets were exceedingly beautiful.

ROEBERRY.—Dull and damp, with winds generally from S. to S.W.

IRELAND.

CORK.—A fine average month without extremes.

DROMORE.—A very mild and open month.

WATERFORD.—R $\cdot 20$ in. above the average. Mean temp. $43^{\circ}\cdot 6$.

O'BRIENSBRIDGE, ROSS.—Mild and open weather throughout.

DUBLIN.—A quiet, mild, but damp month, with prevalent S.W. winds. The mean temp. $43^{\circ}\cdot8$, was $2^{\circ}\cdot7$ above the average. High winds on 13 days; gales on two days; fog on 7 days. L on 12th. A little sleet on the 28th.

WARINGSTOWN.—The whole month was unusually mild, but vegetation did not seem to be unduly forward. Snowdrops only just showing at the close.

OMAGH, EDENFEL.—The beginning of the month was very fine and mild, but from the 6th till the 23rd the weather was raw, cold, and wet, with constantly alternating frosts and thaws. Christmas day was mild and fine, the mean temp. being 46° , and the end of the month was raw and rainy.

THE ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting was held on Wednesday, December 18th at the Institution of Civil Engineers; Dr. W. Marcet, F.R.S., President, in the chair. Thirty-nine new Fellows were elected. The following papers were read:—"Report of the Wind Force Committee on the Factor of the Kew Pattern Robinson Anemometer." This has been drawn up by Mr. W. H. Dines, who has made a large number of experiments with various anemometers on the whirling machine at Hersham. Twelve of these were made with the friction of the Kew anemometer artificially increased, seven with a variable velocity, and fourteen with the plane of the cups inclined at an angle to the direction of motion. In discussing the results the following points were taken into consideration—viz., the possibility of the existence of induced eddies, the effect of the increased friction due to the centrifugal force and gyroscopic action, and the action of the natural wind. The conclusion that the instrument is greatly affected by the variability of the wind to which it is exposed seems to be irresistible; and, if so, the exact value of the factor must depend upon the nature of the wind as well as upon the mean velocity. There is evidence to show that during a gale the variations of velocity are sometimes of great extent and frequency, and there can be but little doubt that in such a case the factor is less than 2.15. The one point which does seem clear is that for anemometers of the Kew pattern, the value 3 is far too high, and consequently that the published wind velocities are considerably in excess of the true amount.

"On Testing Anemometers," by Mr. W. H. Dines, B.A. The author describes the various methods employed in the testing of anemometers, points out the difficulties that have to be encountered and explains how they can be overcome.

"On the Rainfall of the Riviera," by Mr. G. J. Symons, F.R.S. The author has collected all the available information respecting rainfall in this district. He believes that the total annual fall along the coast from Cannes to San Remo, is about 31 inches, and that any difference between the several towns has yet to be proved.

"Report on the Phenological Observations for 1889," by Mr. E. Mawley. This is a discussion of observations on the flowering of plants, the appearance of insects, the song and nesting of birds, &c. Taken as a whole 1889 was an unusually gay and bountiful year.