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S Y M O N S ' S
MONTHLY
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XCVII.]

FEBRUARY, 1874.

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ON THE DIRECTION OF THE WIND IN VIOLENT STORMS.

IF meteorologists can claim credit for nothing else they can at any rate maintain that they keep theory in its proper place, viz., simply as a help to the grouping of facts, and that they are always ready to abandon even the most cherished hypothesis if facts prove that it is incorrect. Nothing more startling, and, both as regards human life and property, more serious has occurred for many years than the discussion now in progress as to the "Form of Cyclones."* We do not feel justified in expressing even the faintest opinion whether the form of a cyclone is that hitherto assumed of winds blowing *round* a centre as in Fig. I., or that assumed by Mr. Meldrum, viz., that they are of the incurving form shown in Fig. II.

FIG. I.

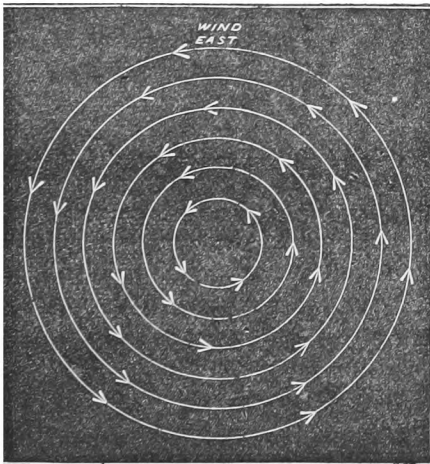
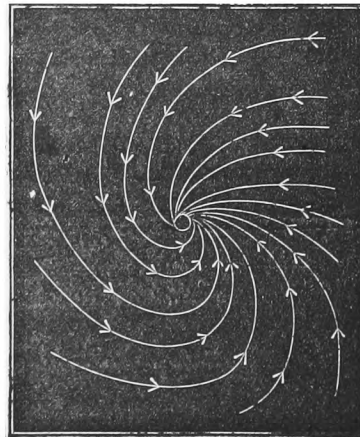


FIG. II.



* Mr. Meldrum's paper on this subject ("Notes on the form of Cyclones"), has been reprinted by the Meteorological Committee, and can be had of our publisher.

We pronounce no opinion whatever on the question, but as it has been raised we have a few very serious remarks to offer.

Meteorology cannot perhaps show a very glittering array of benefits conferred upon mankind, but one of its gems has certainly been the rules whereby the captains of ships could know the bearing of the centres of violent storms and how to avoid them—thereby saving innumerable lives and untold millions of property.

All at once, however, we are told that these rules are incorrect, that by obeying them a captain may actually steer into destruction, and, in fact, that our supposed gem is but an imitation.

We have in this country a meteorological office with a princely if not regal income, and a department of it under an able naval man. Is it possible to imagine any better application of the entire strength and resources of that office than to the immediate and thorough investigation of the rival theories, and the prompt and authoritative announcement of the result?

It appears to us that in the interests both of humanity and science it is the bounden duty of the authorities to put aside all other work and concentrate their strength on this question.

Delay may mean destruction, and there is no necessity for delay because ample materials exist, and it is merely necessary to examine with which theory the facts most frequently harmonize.

Moreover, it ought to be done quickly, for few things can do more to discredit meteorological work than for naval men to find even the leaders of meteorological research in doubt on so vital a point.

REVIEWS.

Observatoire d'Alger—Ire Partie. Panorama Météorologique du Climat d'Alger—Observations Météorologiques, Janvier, 1872. 33 Tableaux—1 Tableau graphique.

WE are indebted to M. Bulard, the Director of the Observatory of Algiers, for the remarkably elaborate work above noted, a work which we may as well mention, occupies for the record of a single month 33 folio sheets of tables, 16 folio pages of introduction, and a lithograph more than 12 feet long by about 2 feet wide.

We do not object to the size which M. Bulard has adopted for his diagram; it does not err so much in excess as the plates of the Meteorological Committee do in defect; but we do protest against the excessive size of page adopted for the daily record and the letter-press.

Amid such a mass of facts as those which M. Bulard has set before us, there are of necessity a great number of points upon which we should like to express our opinion, which would be sometimes favourable, sometimes the reverse. Before proceeding, we are, however, bound to record our sense of M. Bulard's enthusiastic zeal in his work, and the importance of the maintenance of the Observatory, and the publication, either in detail or in abstract, of the results, not only for

Algiers itself but also for the subordinate stations of Biskra, Batna, Constantine, &c. With this general commendation, and with best wishes for M. Bulard's success, we must proceed to remark upon a few of the points which seem worthy of notice.

It appears to us a mistake to make observations (except in order to catch special phenomena) at irregular times, *e.g.*, on January 1st the observations were made at 0.16 p.m., 0.54 p.m., 2.2 p.m., 3.18 p.m., 4.3 p.m., 5.0 p.m., &c. We are unaware of the reason *for* selecting such times, and there are certainly many reasons *against* such a course.

In the next place, we are certain that it is a needless refinement to give the sea level pressure to four decimals of a millimetre, the first entry 768.4188^{mm} can only be represented with equal precision by some such portentous entry as 30.253255 in. There are few observers whose reading is reliable to the third decimal ($\frac{1}{1000}$ th) of an inch, none to the fourth, and therefore *à fortiori*, none to the fifth or sixth, which alone represents the fourth decimal of a millimetre.

The method of separating, and yet grouping, the clouds is the best we have seen, but there is one curious mistake in this matter. The columns are headed 0-10, meaning, of course, as usual, that the sky is hypothetically divided into ten portions, whereas all the entries are made as decimals: thus a sky which is entered in the remarks as "Couvert" has the cloud entry 1.0 instead of 10, and a partially clear sky as 0.7 instead of 7. These prefixed cyphers and decimal points should all be struck out.

The daily sheets contain several columns new to Meteorological Tables, but which are certainly entitled to claim the consideration of those who may be drafting new forms, we may specially mention "Intensité des Montagnes à l'Horizon," also "Brumes" sub-divided into three columns, "Seches," "Humides," and "Position."

The description of the position of the locality where the observations are made is praiseworthy complete, as is also that of the instruments and their mounting, added to which the author promises in his next publication a photograph, showing them all in position. The only instrument respecting which the details are insufficient is the black bulb in sun.

As the author takes the precaution of verifying every year the zeros of all his thermometers and applying the necessary corrections, we are bound to assume that his hygrometer (a dry and wet, by Salleron, of Paris) is also correct. We mention this as a prelude, because without it sufficient weight might not be given to M. Bulard's remarks upon his hygrometrical results, which appear to us of sufficient general interest to justify translation *in extenso*.

"In order to calculate the relative humidity, we have used the hygrometrical tables published in France and other countries, but they are not sufficiently extended for our climate. We give here, simply as curious facts, the greatest differences between the dry and wet bulb thermometers during the most remarkable sirocos of the last 12 years.

INSTANCES OF EXTREME DRYNESS.							
Date.		Dry Bulb.		Wet Bulb.		Difference.	
1860, Sept.	14	...	101°·1	...	64°·6	...	36°·5
1865, Aug.	25	...	113 °0	...	68 °0	...	45 °0
1869, Sept.	10	...	94 °3	...	59 °0	...	35 °3
„ Oct.	8	...	77 °0	...	51 °8	...	25 °2
1871, July	22	...	99 °5	...	78 °4	...	21 °1
1872, July	29	...	98 °6	...	73 °4	...	25 °2

"With these extreme ranges we may already judge of the variations of which we shall have to speak when we come to treat of the Climate of Algiers."

"We may add that these extreme degrees of dryness might appear improbable if care had not been taken to observe under the best possible conditions, and if they had not recurred many times and at irregular intervals."

"It is also to be noted that M. Regnault's tables are not strictly applicable far beyond the limits in which the co-efficients of the formula have been determined. Such conditions as those we have quoted above never occur at Paris, and it would be both useful and interesting to determine by experiments, analogous to those of M. Regnault, the proper co-efficients for such extreme dryness, and this we intend to do."

M. Bulard has four rain gauges at the Observatory, but he only gives the record of a large one (20 in. in diameter); in fact, he evidently has no more respect for small rain gauges than the reviewer who called 5 inch gauges "pipkins."

M. Bulard does not seem to have heard of the Cyanometer*, though the desirability of such an instrument is evidently realized as fully by him as by ourselves, for he devotes a column to "L'intensité du ciel," "0 being the palest blue, and 10 the deepest azure which it is possible to see in each locality, for it will still be necessary to make a relative scale for the purest azure of Biskra for example, which is purer than that of Algiers, as is that of Algiers purer than that of Paris, &c."

It is probably worth while to endeavour to devise some form of cyanometer available for general use.

Our notice has run to such a length that we must defer to another opportunity comment upon the note on the Climate of Algeria, with which the memoir concludes.

Seventeenth Report of the Marlborough College Natural History Society, 8vo, PERKINS, Marlborough, 1873.

THESE School Societies are progressing with a vengeance, the only point in which we think there is room for improvement, is that we fancy the boys do not fully realise the advantage to themselves in after life which vigorous co-operation in the work of these School Societies would afford. We do not know that that is the case at Marlborough, on the contrary we are glad to see a famous list of workers in several of the sections.

Another matter in which, perhaps, an alteration would be an improvement is the question whether it would not be well to include other branches than come under the term "Natural History." Even

* Meteorological Magazine, vol. iv., p. 81.

of microscopic work we see no trace. A friend of ours has found his pupils really first-rate hands at the microscope, and in their leisure hours they have mounted some thousands of objects which would be an acquisition to any cabinet. Take again the whole realm of physics. We believe that there are few boys who would not take five times as much interest in an electrical machine which they had made "all by themselves" as in the most costly one which an Appa or a Ladd could supply—and this applies equally to chemistry, to glass blowing, model making, &c. Perhaps a vivid recollection of the success of some of our own efforts in such matters in schoolboy days, induces our special advocacy, and such presidents as Mr. Kitchener, of Rugby, and Mr. Preston, of Marlborough, are more able to appreciate the suggestion at its true value than those who, like ourselves, are unaccustomed to public school work.

In the present report there is a remarkable piece of concentrated hard work in what may, perhaps, be termed the department of Climatological Botany or Botanical Climatology. It is in fact a Botanical Calendar supplemented by Meteorological details. The best plan will, however, be to let it speak for itself by reprinting the table for one plant, merely supplementing it by mentioning that precisely similar information is given respecting one hundred and twenty-three others. Well may the writer describe the figures requisite to obtain the data given in these tables as "numerous," for he elsewhere says that they are the result of nearly twenty million figures. Truly meteorologists are a hard-working race.

1. *Anemone Nemorosa.* *Wood Anemone.*

	1865	1866	1867	1868	1869	1870	1871	1872	1873
	Ap	Mch	Mch	Mch	Feb	Mch	Mch	Feb	Mch
First flower	6	18	11	2	27	20	12	29	9
Mean Temperature of previous 6 wks.	37.3	37.0	41.1	40.8	42.4	36.0	42.1	42.9	35.4
Mean daily Rainfall of ditto	0.04	0.09	0.09	0.10	0.10	0.06	0.06	0.13	0.07
No. of Rainy days in ditto	19	25	30	19	24	19	23	33	21
<hr/>									
Average date for 9 years			Mch 12	Earliest flowering . . .				Feb. 27/69	
Mean Temp. of previous 6 wks. for 9 yrs.			39.7	Latest flowering . . .				Ap. 6/65	
Mean daily rainfall ditto ditto			0.08 in.	Difference . . .				39 days.	
Mean no. of Rainy days ditto ditto			25						

Variations of the above from means.

	1865	1866	1867	1868	1869	1870	1871	1872	1873
First flowering	+25	+6	-1	-10	-14	+8	a	-13	-3
Mean Temp.	-2.4	-2.7	+1.4	+1.1	+2.7	-3.7	+2.4	+3.2	-4.3
Mean dy. Rainfall	-0.04	+0.01	+0.01	+0.02	+0.02	-0.02	-0.02	+0.05	-0.01
No. of Rainy days	-6	a	+5	-6	-1	-6	-2	+8	-4

Duration of flowering.

	Feb.	Mar.	April	May	June
1869	27	.....	.....	22	
1870		20.....	.....	.....28	
1871		12.....	.....	.....12	
1872	29	.....	.....	.....24	
1873		9.....	.....	.....31	

Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, 1870, under the superintendence of the Rev. R. MAIN, M.A., F.R.S.

THE principal feature in which this work differs from previous issues is in its containing a series of comparisons of a barometer at the top of a tower (about 100 ft. above) with the standard which is on the ground floor. It will be obvious to those conversant with barometric formulæ, that the difference between the corrected readings of these two instruments will vary according (1) to the temperature of the stratum of air between them, and (2) according to the total pressure at the time of observation. It appears to us, from the facts stated, that Mr. Main has hardly realised the care necessary to obtain results worthy of publication—for his upper barometer seems only to be one with a floating index, and, therefore, presumably a wooden one. No reference is made to the tables used for reducing the readings of the barometers to 32°, and as the ordinary corrections are only applicable to barometers with brass scales, if the upper one is of wood, nearly all the anomalies are probably explained by the proper corrections not having been applied. But in days like these, when accurate standards can be bought for five guineas or less, it appears to us waste of time to make experiments with any others.

The idea is an excellent one and worth prosecuting for a few years, but we trust Mr. Main will insist upon being provided with suitable instruments.

METEOR ON JANUARY 10TH.

To the Editor of the Meteorological Magazine.

SIR,—Perhaps a brief account of a brilliant meteor which I observed on Saturday the 10th of January may be acceptable for your valuable pages.

While returning from Beckermeth on the evening of the above date my attention was arrested at about 11.45 by a somewhat brilliant meteor, which shot downwards from an elevation of about 45° in the N.W. part of the sky.

The sky, generally, during the evening was very clear, and the air rather frosty; but near to where the meteor was seen there was a slight haziness or fog. Some little inference may be drawn as to the brilliancy from the mention that at the time, although I was looking in a directly opposite direction, my attention was immediately drawn to it.

Had I not seen the meteor *itself* I should have considered the flash to be one of *sheet* lightning.

The meteor totally disappeared, no sparks or other remains, as is sometimes the case, being seen.—Faithfully yours,

WILLIAM HENRY WATSON.

Braystones, near Whitehaven, January 16th, 1874.

THE WINTER.

To the Editor of the Meteorological Magazine.

SIR,—I shall have much pleasure in replying to Mr. Stow in your next number, if you will kindly allow me a page or so in which to do it.

GEORGE D. BRUMHAM.

February 7th, 1874.

To the Editor of the Meteorological Magazine.

SIR,—In your magazine for December last, page 179, the following prediction is made:—"I expect that the minimum temperatures of January and February at Greenwich will be considerably lower in 1874, although the mean of February may not be so low as last winter." (Lower than in 1873 is carefully pointed out).

January, 1873, at Greenwich, had a temperature of $42^{\circ}1$, which was $4^{\circ}1$ above the average of thirty-two years, and $5^{\circ}8$ above the average of 102 years.

Here the mean temperature of January, 1873, was $41^{\circ}3$, or $3^{\circ}5$ above the average of twenty years.

The mean temperature of January here this year has been $41^{\circ}2$, or just $0^{\circ}1$ below the temperature of last year. Any one looking at the excess of temperature in January at Greenwich this year as compared with the average of the last fifty years given in the weekly returns of the Registrar-General will see at once the utter failure of the prediction alluded to. There is no ground for a prediction of a colder February than last year, which, at Greenwich, was $4^{\circ}3$ below the average of 102 years, and examination of Mr. Glaisher's table, page 65 of No. 97 of the Quarterly Returns of the Registrar-General—shows that since 1771 there is no case of two successive February's greatly below the mean. The February of 1873 was the coldest since February, 1855, which was only $29^{\circ}4$, or $4^{\circ}9$ below February, 1873. I remember the February of 1855 well; since, to look at my thermometers here, I had to wade through snow two and a half feet deep, and on one road near here it was drifted over five feet deep, and a road had to be made through it like a railway cutting. Whether the present month will be colder or warmer than last year is mere guess work, and there is no reliable data whatever to base a prediction upon, and it is one of the very worst features of meteorology that there are continually persons who, as soon as they begin to acquire a few facts, boldly put out predictions of coming weather, and if they only predict long enough *invariably* fail.

Some little time back weather prophets seemed to centre in Birmingham, but recently they have removed to fields and pastures new, and apparently with Birmingham success.

If prediction was such a promising field one would expect that we should find some of the leading European meteorologists taking part in the glorious reputation to be obtained, but "mirabile dictu" they all carefully shun it as they might do a pestilence.

No one would rejoice more than myself to see any theory established by which the meteorological elements could be computed, and then compared with the actual observations, as in the case of astronomical observations, and until something of this kind can be done, prediction is mere moonshine, and the sooner it is put an end to for the reputation of all concerned the better.

It is by no means a pleasant office to take pen in hand on this question, but weather wisdom seems so much the pet object for foolish people to deal in that now and then they require to be put on their guard, the more especially as I note that some of your chief correspondents are given to dealing in this matter.—Very truly yours,

G. V. VERNON, F.R.A.S.

Old Trafford, Manchester, February 3rd, 1874.

OBSERVATIONS ON THE WEATHER AT CAMBRIDGE.

To the Editor of the Meteorological Magazine.

SIR,—I am inclined to believe that there is an error in date in Mr. Nutter's tables of the weather at Cambridge.

The minimum temperature of 1871 must have been on December 8th or 9th, not 19th. Mr. Pain, of Cambridge, has sent me his readings, and I find the minima of the 9th and 19th to be—

December 9th, 16°		December 19th, 43°
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The 19th had a notably high minimum temperature, and the *Meteorological Magazine* of January, 1872, confirms this statement.

Your obedient Servant,

F. R. HAWKES-MASON.

THE ORTHOGRAPHY OF THE WORD EQUATORIAL.

To the Editor of the Meteorological Magazine.

SIR,—It seems that my note on this subject in your December number was not sufficiently explicit. I intended to convey my belief that the use of the termination *eal* for adjectives derived from substantives ending in *or* is without precedent. Of the seven adjectives which make up the second list in Mr. Moon's letter in last month's magazine, six are derived from Latin adjectives ending in *eus*, and the seventh is derived from a Latin substantive ending in *ea*, therefore *eal* is their natural termination. After further consideration I do not think that the number of words with this termination is sufficiently large to disprove my statement that it is an uncommon one for adjectives, and I see no reason why we should go out of our way to adopt it in the case of the word under discussion. Inasmuch as Mr. Moon's opinion in a matter of this kind is worth knowing, perhaps he will be good enough to tell us what that opinion is.

I am, Sir, yours faithfully,

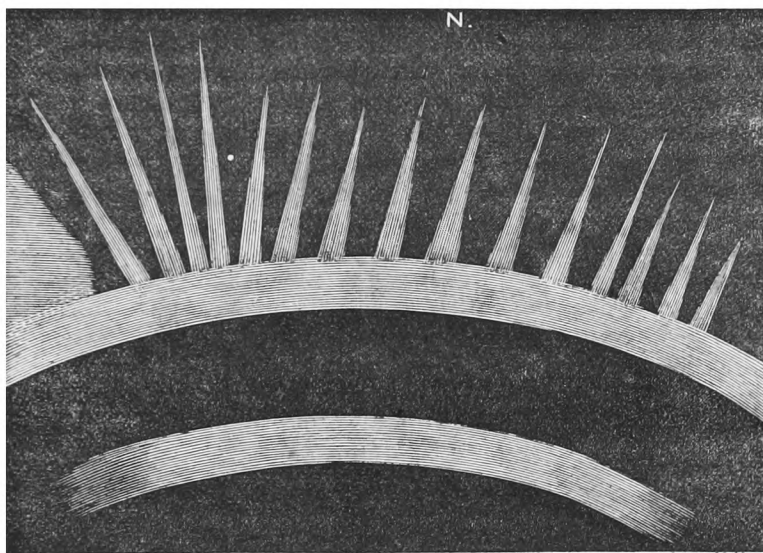
REGINALD BUSHELL.

Hinderton, Cheshire, February 6th, 1874.

THE AURORA BOREALIS OF FEB. 4, 1874.

To the Editor of the Meteorological Magazine.

SIR,—I have forwarded the enclosed rough sketch, and notes, of the Aurora Borealis, which I saw to great perfection on Wednesday evening last. About 7h. 45m. I noticed a strong auroral light north-



The white dot among the streamers is Alpha Cygni.

wards, and two or three minutes afterwards, a well defined arch, about 5° in diameter, stretched across the sky from E.N.E. to W.S.W. The upper convexity of the arch was at least fourteen degrees above the horizon. A few seconds afterwards some magnificent streamers, tinged with white, pink and greenish hues, suddenly ascended from the entire length of the arch, those to the westward ascending nearly to the zenith and certainly passed through the constellation Cassiopeia. These were very transitory and not repeated, to an equal height, during the continuance of the phenomenon. At the western end of the arch there was a very conspicuous patch of white aurora, about twice its diameter. At 7h. 54m. more streamers appeared, but less brilliant. At 7h. 57m. the arch descended several degrees towards the horizon, and soon afterwards some more short streamers ascended. At 8h. some splendid patches of pink aurora ascended from above W.N.W. nearly as high as Cassiopeia. At 8h. 7m. the arch was much broken up into scattered patches of white aurora, the light from which was sufficiently strong to cast a well marked shadow of the hand against the Observatory wall. At 8h. 9m. the more westward of these assumed a decidedly pinkish hue. At 8h. 10m. some fine streamers ascended from W.N.W. nearly to Cassiopeia. At 8h. 17m.

light much diminished along the entire length of the arch, which could still be traced from the original points. At 8h. 22m. a large patch suddenly overspread Andromeda, but its intensity was much lessened by the light of the rising moon. At 8h. 33m. the light was much fainter. At 8h. 35m. the arch was again well defined, but contracted to half its original diameter. At 8h. 40m. a second arch appeared just midway between the first and the horizon. At 9 p.m. both arches remained distinctly visible; but I did not observe any streamers after about 8h. 15m. At 9h. 10m., and afterwards, the arches gradually disappeared. On Thursday evening, at 8h. 30m., I noticed a faint arch, low down on the horizon, and a few short streamers were occasionally visible during the subsequent half-hour.

Yours truly, C. L. PRINCE.

The Observatory, Crowborough Beacon, Feb. 7th, 1874.

SIR,—An Aurora Borealis was seen here between 7 and 9 p.m. on Wednesday evening, the 4th inst. Pale yellow and white streamers shot up from the N., forming a low irregular arc, reaching from W.N.W. to N.E. and about 8 p.m. flashes of light exactly like sheet lightning, and quite as rapid, were seen in the dark blue sky above the arc. These lasted for nearly half-an-hour; then broad horizontal bands of faint light rolled up for a few minutes from the N.E., like waves across the streamers, and the aurora soon afterwards disappeared. I should like to know if any of the readers of your magazine observed the rapid lightning-like flashes, as I have never seen them before.

I am, Sir, yours truly,

W. C. HUGHES.

Grammar School, Sutton Valence, Staplehurst, Kent, February 7th, 1874.

SIR,—A beautiful display of Aurora Borealis was observed here last evening. It was first observed shortly before 6 p.m.; at 6.10 p.m. a broad band of bright white light extended from W. to N.N.E., rising to an altitude of about 45°, from which frequent streamers passed nearly to the zenith. The light was brightest in the N.N.E., and resembled that given by a large fire. The display continued with great brilliancy till 8.30 p.m., after which it faded away considerably, and at 9.30 p.m. nothing remained but a few bright streamers low down on the horizon in N.N.W. The evening was beautifully fine and clear, with a sharp frost; the barometer, which is again very high, standing at 30.44 in.

Yours truly,

THOS. PAULIN.

Winchmore Hill, 5th February, 1874.

[In connection with the above, the following extract from a letter from Mr. W. H. Watson, of Braystones, Whitehaven, Cumberland, is interesting and suggestive:—"Did you notice an aurora chiefly in the S.E., W., and S.W. on the 4th instant?" Braystones and Winchmore Hill are not 250 miles apart. Can the aurora have been between them?—ED.]

THE METEOROLOGICAL SOCIETY.

THE annual general meeting of the Meteorological Society was held January 21st, at 25, Great George-street; Dr. R. J. Mann, president, in the chair.

The date of the annual meeting having been altered in June last to January, the report of the Council was shorter than usual. The earlier portion of the report dealt principally with the various alterations made at the society's library at 30, Great George-street, and with the efforts which the Council have been making to render the operations of the society more extended, and rest upon a broader basis than heretofore. The Council took advantage of the presence of their foreign secretary, Mr. Scott, as one of the delegates from this country at the Meteorological Congress at Vienna, to request him to represent the society. The Congress was duly held from the 1st to the 16th of September, when Mr. Scott presented a report on the replies received in answer to a series of questions which the Council issued to the Fellows on several important points in connexion with the hours of observation, instruments, &c., and which has been printed in the report of the Congress. The report concluded by stating that the Council have to mark with some measure of satisfaction the maintenance of the numbers of the Fellows during a somewhat critical and transitional period in the society's history, when changes of detail have been entered upon with a view to increased energy of action, and when the beneficial results of the alterations have not had time to be practically felt. The President then delivered his address. After alluding to the loss which the society had recently sustained in the death of Mr. Beardmore, and marking the place that gentleman had filled as President as the transition era of the society's history, the President drew attention to a misconception that is largely entertained of the primary aims of meteorological science, and pointed out that, desirable as a comprehensive and reliable theory is, the immediate object of observational work is none the less certainly the determination of climate in different regions of the earth, and the investigation of the method by which the action of the great natural forces that determine temperature, direction and force of wind, and rainfall is influenced by physical conditions. This argument was supported by evidence of the valuable practical results that are secured in these particulars by the labours of meteorologists. The address then proceeded to note briefly the chief landmarks that had marked the yearly progress of meteorological science since the period of Mr. Beardmore's presidency, when the society, in its remodelled form, had just reached the half-way stage of its history. From this review it appeared that the photographic method of record has been largely extended, that the discussion of the Greenwich observations from 1848 to 1863 is being steadily pursued; that the influence of meteorological conditions upon the public health is carefully investigated in the metropolitan district; that telegraphic intercommunication of meteorological aspects is now

regularly made throughout the United States of America, and from the Meteorological Office of London through England, and through France to the shores of the North Sea and Baltic in one direction, and to Corunna in the other; and that storm warnings are displayed and fishermen's barometers maintained at 129 coast stations. The methodical investigation of the connexion of sun-spot periods with atmospheric phenomena, such as rainfall, aurora, and magnetic storms and earth currents, was also alluded to. Among other topics of special interest connected with the recent progress of meteorological science, the President dwelt, with especial favour, upon the discovery and establishment of Buys Ballot's Law, and Mr. T. Stevenson's Barometric Gradient; the extension of the influence which indicates this law to the great vertical circulation of the oceans, traced out by Dr. Carpenter and Professor Wyville Thomson, the marine charts, and especially the mapping out of the mid-Atlantic area of the Doldrum calms by Captain Toynbee; Mr. Meldrum's Mauritius investigations of the movements of cyclones of the Indian Ocean, the daily weather-charts of the Meteorological Office; Mr. Symons's examination of the rainfall of the British Islands, with a volunteer staff of nearly 1,700 observers systematically distributed; Mr. Draper's deductions as to the invariability of the climate of the United States, and to the orderly progress of storms across the entire breadth of the Atlantic; the establishment and work of International Meteorological Conferences, and the barometric compensation of clock rates for altering pressures and resistance of the atmosphere. The following gentlemen were elected officers and council for the ensuing year:—

President.

Robert James Mann, M.D., F.R.A.S.

Vice-Presidents.

Charles Brooke, M.A., F.R.S.

George Dines.

Henry Storks Eaton, M.A.

Lieutenant-Colonel Alexander Strange, F.R.S.

Treasurer.

Henry Perigal, F.R.A.S.

Trustees.

Sir Antonio Brady, F.G.S.

Stephen W. Silver, F.R.G.S.

Secretaries.

George James Symons.

John W. Tripe, M.D.

Foreign Secretary.

Robert H. Scott, M.A., F.R.S.

Council.

Percy Bicknell.

Arthur Brewin, F.R.A.S.

Charles O. F. Cator, M.A.

Rogers Field, B.A.

Frederic Gaster.

John K. Laughton, M.A., F.R.A.S.

Robert J. Lecky, F.R.A.S.

William C. Nash.

Rev. S. J. Perry, M.A., F.R.A.S.

Capt. Henry Toynbee, F.R.A.S.

Charles V. Walker, F.R.S.

E. O. W. Whitehouse, F.R.A.S.

JANUARY, 1874.

iv.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which ≥ 1 or more fell.	TEMPERATURE.				No. of Nights below 32°																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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* And 20. + 20 & 26. † 28. § 26. || 28 & 29. ¶ 18, 19, 26 & 27.

** 25. †† 18 & 25. ‡ 5 & 17.

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

METEOROLOGICAL NOTES ON JANUARY.

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.

LINTON.—A mild, fine month, with less than the average rainfall. Wind mostly S., S.W. and W.; the first 23 days changed to N.; the last week high only on 16th. Atmosphere often dull; but, on the whole, there were more bright days than usual in a mild season. Birds singing everywhere, but vegetation not so forward in a general way as might be expected in so mild a season.

SELBORNE.—A remarkably mild and damp month; the total rainfall, however, less than half the average of January in the previous 12 years, although some fell on 15 days. A little hail and a few flakes of snow on the 4th; dense fog on the 11th and 22nd. A sudden fall in temp. on 17th after 8 a.m.

BANBURY.—Fog on 9th, 11th, 22nd and 23rd; snow on 4th; high wind on 1st, 14th, 17th and 20th.

CULFORD.—Mild weather throughout the month; snow never having been seen; the mean temp. of the month, 39·7. Westerly winds prevailed during 29 days out of the 31. Apricot trees actually in bloom, and the thrush and black-bird singing as in April or May.

BODMIN.—This month, like the last, has been remarkable for its extreme mildness and absence of high winds.

SHIFNAL.—First half of the month rain daily, with two exceptions (5th and 6th), till 12th, and again from 15th to 20th, both inclusive. Although there were 12 frosty nights the max. temp. was high, averaging 45°·5, and very equable throughout. Slight S on one night only (4th); the wind varied from N.W. to S.W. A gale from S.W. on 3rd, and again on the 20th; fog with fine rime on 11th; fog again on the 22nd; bar. high through this month. Snow-drops showing on the 19th, and full out on the 30th. Aconites up on the 28th. Stock-dove cooing on 3rd; throistles singing from 23rd.

ORLETON.—Frequent R with a few fine days and occasional frosty mornings till the 24th; then fine and dry, with a high bar., to the end of the month; 30·39 on 28th. Great darkness till noon on 10th, with misty R and change of wind to N. Dense wet fog all day on the 22nd. The mean temp. of the month rather more than 4° above the average.

WIGSTON.—Snow on the 4th and 16th.

BOSTON.—Prevailing wind S.W. on 29 days. Temp. 3°·1 above the average of previous 10 years. Slight S on 5th; fog all day on the 10th.

GRIMSBY.—No real winter; roads dry almost all the month. Bats flew about in the evenings of several days; many very pleasant days; 3rd was the only day in the month on which the wind was easterly. Aconites in flower on the 12th. High wind in after part of 18th.

MANCHESTER.—S, H and R on 4th; snow also on 16th and 17th.

ARNcliffe.—S on 16th and 17th.

N. SHIELDS.—Lunar halos on 3rd, 4th and 6th; S on 3rd and 17th. Plants in flower on January 1st—White Alyssum, Lithospermum, Polianthus, Christmas rose, yellow jasmine (*Jasminum nudiflorum*), Chrysanthemum and stock. Plants in flower on the 31st—all the above but Chrysanthemum, and, in addition, auricula, snow-drops, flowering currant, pansy, yellow aconite, and blue periwinkle. Wonderfully fine, dry and mild month.

SEATHWAITE.—Thick S on 3rd; S on hill-tops on 15th and 24th. Total fall of R 20·82, being 4·46 above the average; hail showers on the 16th.

WALE S.

HAVERFORDWEST.—The general character of the month, fine, mild, at times very wet, no heavy gales, only two frosty nights, very high bar. from 24th to the end, with constant fog or drizzling R. The weather of this month would have

been all that could be wished for in April. Birds singing; crocuses and several other spring flowers in bloom. Hills capped with S on 17th.

CEFNFAES.—The month has been generally damp and wet; the temp. mild. Violets and primroses in blossom, and vegetation forward. Prevailing winds N.W.

LLANDUDNO.—The general character of the month has been dry and mild; though there has been more or less S on the distant hills since the 16th. Vegetation very forward; strawberries in bloom.

SCOTLAND.

DUMFRIES.—The first three weeks wet, with frequent storms, but the weather mild; from the 21st to the close extremely fine for the season. S on 2nd, 4th, 16th, 17th, 19th, and 23rd. Temp. at night $1^{\circ}2$ above the average, and by day $0^{\circ}3$ lower, mean temp. $41^{\circ}6$; rainfall below the average. Snow-drops, Hepatica and other flowers in bloom; roses have young shoots 6 inches in length; early pear blossoms bursting; farm labour unusually forward. Whins, or furze, in bloom by the road-side.

HAWICK.—The people here say that this is the mildest January ever known. Both skaters and curlers are sadly disappointed at the loss of the favourite amusement from the absence of frost.

KILMARNOCK.—Mean temp. $41^{\circ}9$; winds principally W. or S.W., and light. A gale blew up from S.W. on 18th with a velocity of 70 miles per hour, and a pressure of 24.2 lbs.; this was the greatest pressure during the month. There was some frost and S at the beginning of the month, and on the 17th and 24th H showers. The evenings were generally fine. Ozone well developed. Small pox still very bad in this parish.

CASTLE TOWARD.—A very damp month; R, more or less, on every day, but sometimes not measurable; weather stormy; high winds from W. and N.W. On the 4th a heavy fall of S, and again on 17th, followed by gales from the W. In consequence of the R and S but little has been done in digging, and agricultural work is getting behind; the pastures scanty, but sheep are healthy. Bar. high and steady towards the end of the month.

NOOKTON.—S on the 4th and 20th.

DEANSTON.—An exceedingly unseasonable month; temp. mild and vegetation too active.

LOGIERAIT.—A remarkably fine January; the ther. stood at or below 32° on 16 nights; but there was no continuous frost, and only one slight fall of S, which disappeared on the following day. Since the 23rd the weather has been more like March; the birds are singing and have begun building their nests.

BRAEMAR.—Aurora on 19th; S 8 inches deep on 2nd. Finest January on record; but frequent gales of wind.

ABERDEEN.—An exceptionally fine January; mild and dry, frequent high wind, chiefly N.W., W. and S.W.; bar. pressure and rainfall below the average, but mean temp. $3^{\circ}4$ above it. Terrible gale, 3 to 8 p.m., on 18th. Aurora every night but 17th and 18th from the 12th to the 20th, inclusive; several slight falls of snow, but the ground only white on the 24th.

CULLODEN.—3rd, imperfect solar halo; lunar halo on 9th; auroræ on 10th, and 11th, and a faint one on 15th; snow on 19th; stormy on the previous night.

PORTREE.—Stormy, wet month; fearful hurricane on 18th from S. to W., by which two young men were drowned in the harbour here, their boat being capsized and no help could be rendered. Lead, chimney cans and slates were stripped from roofs of houses, and spread in all directions. Notwithstanding the wet, cattle and sheep are healthy, and thriving on the pastures.

LOCHBROOM.—This month will equal any of its predecessors for the last six months for rain and wind, with all that tends to make disagreeable weather. A winter so stormy, rainy and changeable cannot be remembered; but it has been remarkably open for grazing purposes. Gooseberry bushes are budding fast, and some of the softer ornamental bushes are partially leafing—an unprecedented fact on the 2nd of February.

I R E L A N D .

DARRYNANE.—Prevalent wind N.W., a comparatively dry and very mild month, so much so that some aurecarias in my garden in the open air are coming into flower, and vegetation is very forward.

MONKSTOWN.—A remarkably mild and dry month. Vegetation in a most advanced condition; many roses, pear trees, &c., coming into flower. Max. and min. unusually high.

BALLYSHANNON.—The month has been unusually mild for the season, feeling often more like May than January. The spring promises to be an *early one*, if not cut short by frost; fruit trees are budding. During the month the temp. seldom went below 40° in the shade. Strong gale from S.W. with T and L on the 18th.

EDENFELL, OMAGH.—The finest and mildest January ever remembered here. Farming operations unusually advanced,

A FOG BOW.

To the Editor of the Meteorological Magazine.

SIR,—Having but recently become a careful observer of meteorological phenomena I do not know whether a fog-bow is one of sufficiently rare occurrence to be worth recording. The only authoritative work on such subjects within my reach this moment is very old; it, however, states that a Fog-bow is of very rare occurrence. Here is that account at all events.

On the 10th of the present month about 9.30 a.m. I first saw it. The sun had not risen much more than an hour, and was in S.E.; it could be seen through the fog to be brightly shining; the bow appeared, of course, in the N.W. It was obvious that the fog was a superficial one, not extending any great distance up in the air, and while dense and thick on the earth's surface got rapidly thinner as it extended upwards; in fact, it was quickly melting away under the warm rays of the sun in an unusually mild winter's day. As you looked at objects on a level with your eye, such as trees, buildings, &c., they were seen as is usual in a thick rural fog; as you looked at the sky the clouds, few and fleecy, were distinctly discernible. The bow was perfectly white, absolutely free from colour, a thick, dense, white, three quarters semicircle; above it was fairly sharp and well defined in its outline, less clear as it entered into the thicker strata of the fog, and when its limbs approached the surface of the earth they were gradually and imperceptibly merged and lost in the lowest and densest layers of the fog itself. The bow was as clearly as possible distinguishable from the surrounding mist; I mean that it was, beyond doubt, no accidentally formed condensation of the fog; it was quite white, the fog was murky, and the bow lasted fully fifteen minutes, from the time I saw it, without material alteration; it may have lasted longer, for it was fully formed when I saw it first. I could not detect any play of prismatic colours, though I carefully looked for such.—I am, Sir, your obedient servant,

THOMAS PALMER.

Cahir, Ireland, January 28th 1874.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

XCVIII.]

MARCH, 1874.

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

THE LAW OF STORMS.

By W. R. BIRT, F.R.A.S., F.M.S.

Author of the Handbook of the Law of Storms, the Hurricane Guide, &c., &c.

THE number of the Meteorological Magazine for February, 1874, opens with a short article "On the Direction of the Wind in Violent Storms," in which the following sentence occurs:—"All at once we are told that these rules are incorrect, that by obeying them a captain may actually steer into destruction, and, in fact, that our supposed gem is but an imitation." A knowledge of the "Law of Storms" cannot be complete unless it assists a captain to distinguish an ordinary from an abnormal cyclone, such as are shown in Figs. I. and II., Vol. IX., p. 1. Incurving storms have hitherto been suspected to exist only in the southern hemisphere, unless Mr. Meldrum's researches should prove them to be the rule and not the exception in the Indian Ocean; in that case suspicion would be converted into certainty. We are aware that Captain Toynbee suggested, at the meeting of the Meteorological Society in December, that the Atlantic hurricane of August 20 to 24, 1873, was of this character, and recommended that synoptic charts should be constructed in order to test so important a modification of the generally-received theory of the circular cyclone.

The object of the following remarks is to show that we need not *wait* for the result of an elaborate investigation before we can put into the hands of seamen a code of laws for avoiding the dangerous parts of incurving storms similar to that which he now possesses of the ordinary cyclone. The laws of the one follow as corollaries from those of the other. Fig. 1 shows the direction of the wind in a circular storm. Fig. 2 shows the direction of the wind in an incurving storm moving towards the north-east, supposing such incurving storms to exist in the northern hemisphere. On inspecting these figures it will readily be seen that the westerly winds are differently situated in each. They are consequently the *crucial* winds distinguishing the incurving from the circular storm. In an ordinary cyclone, westerly winds characterize its southern margin and its southern radius. In an incurving storm moving towards the north-east, westerly winds characterise the western radius. Not only are westerly winds found on

Fig. 1.

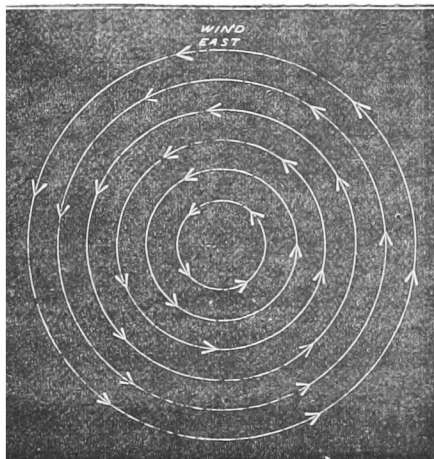
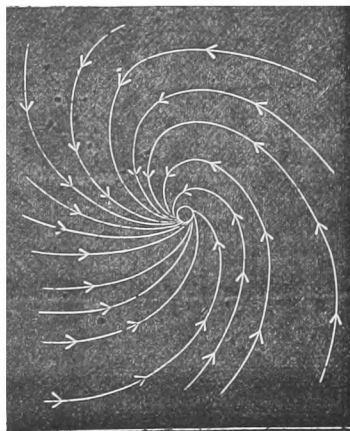
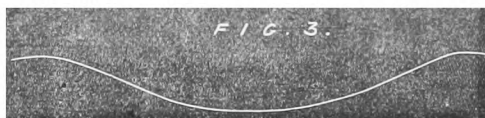


Fig. 2.



different radii of the two kinds of storms, but the barometer behaves differently with westerly winds in each. To a homeward bound vessel the westerly is a fair wind, and if the wind backs to south-west with a falling barometer the ship is gaining on a circular cyclone moving towards the north-east. If, on the other hand, the wind veers to north with a rising barometer, the cyclone is leaving the ship. Nothing during the last forty years has, we believe, affected the general principle that the barometer curve across the section or chord of a cyclone is of the form of Fig. 3, varying in depth according to distance from the centre.



Now, on the southern radius of a circular storm moving towards the north-east the ship is in the receding quadrant with a rising barometer, and if a captain sails or steams with a westerly wind at a safe distance from the centre, he will in all cases of circular storms experience a *rising* barometer, especially should his course be more eastwardly than that of the cyclone. *The case is, however, different in an incurving storm; he falls in with a westerly wind, and instead of finding any tendency in the barometer to rise, he observes that it falls very rapidly.* From this he ought at once to know, not that the generally-received theory is at fault, but that he is in a storm that does not conform to that theory, and also that, from what we know of incurving storms, he is actually sailing or steaming on the western radius of one, and no wonder that if by keeping on his course he should find himself in the dangerous vortex, much more dangerous than the vortex of a circular storm, because of the rapid changes of wind near it. Who knows that the fate of many a fine steamer has not been sealed by the captain

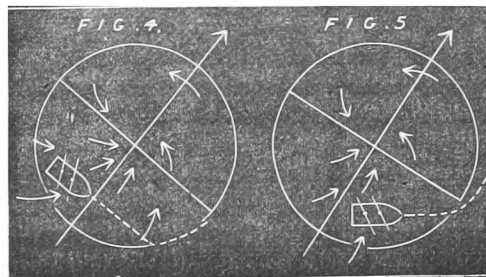
having mistaken the westerly radius of an incurving storm for the southerly radius of a circular one ; and if during the last twenty years a "Storm Service" had been instituted by our Government for the special purpose of at once discussing the data furnished by "logs" with the energy and ability of a Redfield, a Reid, a Piddington, a Thom and a Meldrum, would not England have discovered, not that the gem by which innumerable lives and untold millions of property had been saved was but an imitation, but that another gem had been added to it by which a captain on watching the wind in conjunction with his barometer would at once know in which kind of cyclone he was.

A question here arises, How is a captain to act when, having a fair wind from the westward for his voyage, he finds that every knot he advances its force increases and his barometer falls ? The reply is simple ; the circumstances in which he finds himself are such as to assure him that he is not in an ordinary cyclone (the circular motion of such a storm having been proved over and over again), but in a cyclone that does not conform to well-established rules, and just as if he were sailing or steaming on the axis line of a cyclone going south and finding his westerly wind increasing in force with a falling barometer, he would edge away to the south-east to avoid the centre, so in just the same way in an incurving storm with a westerly wind blowing directly to the centre he would, as in Fig. 4, break off his course, stand to the south-east, fall into the south-west wind, bring his barometer well up, and cross the receding semicircle on a chord parallel with a diameter at right angles to the course of the storm ; in fact, so far as a westerly wind in an incurving storm moving towards the north-east is concerned, the manœuvre is precisely the same as that for avoiding the centre when on the axis line of a circular storm moving south in the northern hemisphere.

It is necessary to bear in mind that the above deduction depends entirely upon the hypothesis that incurving storms in the northern hemisphere are of the reverse form of those given by Mr. Meldrum for the southern, the wind blowing directly to the centre being west in a storm advancing to the north-east in the northern, instead of east in a storm advancing to the south-west in the southern hemisphere. In both instances the westerly and easterly winds blowing *to the centre* occupy the left-hand segment of the receding semi-circle of the storm.

A most important matter of inquiry is the following :—According to fig. 4 the stream of air blowing directly to the centre *crosses* the left-hand segment of the receding semi-circle. Is it always so situated, or is the incurvature of such a character as truly to follow the advancing semi-circle *as a wake* ? If so, the most dangerous wind would be from south-west were the storm moving towards the north-east, and just as a commander would, to avoid the centre, edge away to the eastward in a circular storm on a south-east course ; so, in an incurving storm on a north-east course, he would, if sailing or steaming directly towards the

centre with a south-west wind, force increasing and barometer falling, avoid it by standing to the east, as in fig. 5.



It is not at all unlikely that between the circular storm on the one hand, and the incurving on the other, every possible phase may occur, but this by no means prevents rules for the guidance of captains being devised, taking the circular theory as the basis of such rules. To do so, however, would take up by far much more space than could be afforded in these pages; nevertheless, we have one or two remarks to offer. Such a code of laws relating to incurving storms should be framed without delay. Delay, as has been well said, means, in this case, "destruction," and nothing can excuse those who are in authority if they do not at once select the fittest meteorologist, or rather cyclonologist, for drawing up such a code. But few, if any materials are required, and the work may be accomplished very speedily. A further remark bears upon the examination of masters and mates by the Local Marine Boards in the "Law of Storms." The mode of distinguishing between circular and incurving storms should hold a prominent place in all such examinations. The examples given above do not amount to a tithe of those necessary for meeting the cases which may occur in the Northern Atlantic alone, but as an example of the rules that in our opinion ought to be framed we give the following:—

"If in the Northern Atlantic a homeward bound vessel experiences a westerly wind which *increases* in force, the barometer at the same time *falling* rapidly, the commander may conclude that instead of being on the southern radius of a circular storm advancing towards the north-east, he is really on the western radius of an incurving storm travelling in the same direction, and for avoiding the centre to which in this case the westerly wind is hurrying him, he must steer to the south-east, keep his barometer well up, and resume his course when he has reason to believe that the storm is well to the north of him."

To the Editor of the Meteorological Magazine.

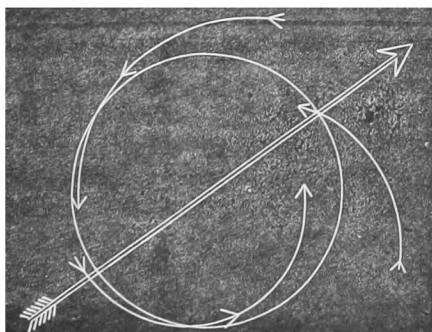
SIR,—One who has devoted fifteen years of pretty close study to a particular problem, and to questions connected with it, is entitled to a hearing thereon, even though his conclusions are opposed to those of men who are confessedly the highest authorities on the subject. But this is especially the case at a time when these authorities are at variance among themselves.

In our own latitudes, the wind commonly incurves only to a slight, but yet to an appreciable extent, towards centres of depression. I have found that at the aggregate of all European stations, the mean inclination of the surface wind towards the lower isobars, amounts to a little above 20° . At the place from which I write it is $28^{\circ} 22'$. At fifteen of the stations from which daily telegraphic returns are received at the English office, the collective mean deduced from daily observations carried on for several years is $20^{\circ} 51'$. The incurvation is commonly, however, considerably higher at inland than at maritime situations. It is also much greater in the front segment of an advancing cyclone than in any other position; and the mean inclination of south-easterly winds in the British Isles, is nearly four times as great as that of north-westerly winds. The amount of inclination is independent of, or at least bears no definable relation to, the intensity of the cyclone.

For a description of the method by which these results have been obtained, and by which any person who is at the pains to do so may verify them, as well as for a full discussion of them, which would be too lengthy for the pages of your magazine, I may be permitted to refer to the last July number of the *Journal of the Scottish Meteorological Society*.

Passing from what I claim to be ascertained fact, to what is almost purely theoretical, I may state my *belief*, that while in every part of the globe the winds incurve generally towards the districts of depression, this inclination will be found to be considerable only in the front segment of an advancing cyclone. If this view be correct, the rules hitherto accepted by naval men for the determination of the position of storm-centres will need only slight qualification. The question of indraft will then be divested of the immense practical importance which you attribute to it. It will, however, continue to be one of the highest moment in a scientific point of view, and too much labour cannot be concentrated upon it.

The accompanying figure represents, I think, the direction of wind in a cyclone progressing to N.E. more correctly than either of the diagrams which appear on page 1 of your last number. The circle is



intended to represent the isobaric, the smaller arrows the direction in which the winds are blowing, and the large arrow that in which the whole circulation is advancing. *Mutatis mutandis*, the representation will apply to cyclones advancing in any direction, or in either hemisphere.

Yours truly,

W. CLEMENT LEY.

Breinton, Hereford, Feb. 23rd, 1874.

THE AURORA BOREALIS OF FEBRUARY 4, 1874.

To the Editor of the Meteorological Magazine.

SIR,—In reply to an inquiry of Mr. Hughes in his remarks upon the Aurora of February 4, I particularly noticed the flashes so like distant sheet lightning; I did not observe these, however, for a longer time than 10 minutes (from 8.5 to 8.15); they appeared in W.N.W., where some clouds lay near the horizon: the coruscations extended to an altitude of 45° : I have often seen them as *rapid*, but never before so *bright* as to resemble lightning. I also noticed two features during this display to which allusion has not been made in your columns (1) the *dome* shape of the Aurora at 8 p.m. which was well defined for about 5 minutes, the corona being situate near the zenith, close to β Aurigæ: there was a considerable pink glow at this time. (2) I observed that a patch of brilliant white streaks of Aurora in the N. at an elevation of 45° , had a slow, steady motion among the stars from E. to W. (the streaks pointing from N. to S); this was at 8.30.

I am, Sir, yours truly,

G. WARREN.

Merton Villa, Cambridge, February 21st.

To the Editor of the Meteorological Magazine.

SIR,—Your suggestion that the main part of the aurora of the 4th inst. was between the North and the South of England, is undoubtedly correct, at least as regards the early part of the evening, for it appeared in the south here. If the same features were visible both here and at Crowborough, or at Guildford (whence J. R. Capron has sent me an account of the aurora), the lower part was probably about 50 miles above the earth, or at most 70; but if the same features were not seen from these places, of course their height must have been far less. The tops of the streamers may have reached a height of several hundred miles.

The chief features seen here were a broad arch, whose south edge was in Orion from 6.40 to 7.40 p.m.; a large bright protuberance from that edge, which moved westwards, and an arch of rays, which at 7.42 suddenly became extremely brilliant, and whose south edge was at the corona. After that, much of the aurora was in the north. I did not see the "lightning-like flashes" mentioned by W. C. Hughes (p. 10), unless they were of the same nature as the wave-like bands he mentions; flashes of that kind were very bright here.—Yours truly,

T. W. BACKHOUSE.

Sunderland, February 28th, 1874.

To the Editor of the Meteorological Magazine.

SIR,—Having seen the several communications respecting the aurora of the 4th February, and your notice of my previous remarks sent you, in the last number of your Magazine, I have much pleasure in sending you herewith a copy of my notes of the Aurora, taken at the time.

“At about 6.15 on Wednesday, the 4th February, an aurora commenced in the northern part of the sky, which gradually went down towards the south.

7.15.—An arch from W. to E., streamers shooting up from it.

7.25.—Light more diffused, a few streamers at N.W.

7.30.—An arch of light from W.S.W. to E. ; no streamers.

7.35.—Bright line of light from W.S.W. to E. ; no streamers.

7.40.—A faint irregular line of light, from W.S.W. to E.

7.45.—Diffused light.

7.50.—Same as 7.45.

7.55.—Streamers shooting down from zenith all round.

8.—Bright light at N.N.E., streamers N.N.E. and N. A sharp S.E. breeze.

8.10.—Streamers N.E.

8.15.—Streamers S.S.E. At 9 o'clock there was no perceptible aurora. Braystones and London, will, I think, be nearly 300 miles apart.

I am, Sir, faithfully yours,

WILLIAM HENRY WATSON.

Braystones, near Whitehaven, March 2, 1874.

[We see from a notice in our excellent contemporary, the Austrian *Zeitschrift*, that aurora was observed generally throughout West Russia and Sweden, also at Vienna as a faint yellow illumination of the northern horizon about 8 p.m., and at Prague between 7.30 and 9 p.m., although the sky was partially overcast, a white glimmer was noticed in N. and N.W., especially near the horizon. Magnetic disturbances were reported from the above localities, and also Tiflis and Barnaul in Asiatic Russia.—Ed.]

THE WINTER.

To the Editor of the Meteorological Magazine.

SIR,—A considerably deficient Greenwich rainfall in April and May, 1873, and scarcely any rain in the last thirteen or fourteen days of September, constituted my chief “grounds” for predicting that the winter of 1873-4, was “nearly certain to be rather severe.” Since 1834, a rainfall below 2.4 in. in the Spring period (April and May), has almost invariably been succeeded by a winter temperature (including March) in defect of the average. Such was the case in 1870-1, 1863-4, 1855-6, 1844-5, 1840-1, 1838-9, and 1837-8. The only exception was 1857-8, and even in that winter February and part of March were rather severe. The only years in which an extremely small rainfall (or no rain at all) appears to have been registered in the last thirteen or fourteen days of

September, near London, were as follow:—At Stratford, in 1810, when no rain fell in the last fourteen days; in 1837, when only .03 in. fell at Greenwich; in 1844, when only .01 in. fell; in 1870, when nothing fell, and in 1873, when no rain was registered in the last thirteen days of September, at Greenwich. A cold winter followed in each case. September, 1865, was a very dry month, but .16 in. fell on the 21st. It thus appears that 1873, furnishes the first instance of very dry weather in the latter half of September not being followed by a colder winter than usual. I do not, however, regret this, because it has led me to inquire into the cause of it, and in prosecuting that inquiry I have been led to take a wider survey and adopt a more comprehensive law. I have thus found that one source of error lies in limiting the rainfall data to Greenwich. I ought to have taken the mean of a number of stations extending over a large area. I also found that the rainfall of the summer months (as well as uniformity of mean temperature) modified the apparent influence of the spring rainfall on the coming winter. A law of great simplicity and accuracy, just such an one as I have long been searching for, came out in this way. The rule applies to every year without any exception. Your readers will find in the table plus against plus and minus against minus in uninterrupted succession for a quarter of a century back, which certainly exceeds anything of the kind I ever saw. I think I may fairly say that it is the best table I ever gave or have ever seen. This is very satisfactory. Some of your readers will probably like to see the law and table referred to. Under these circumstances I trust it will be no great encroachment on your space to publish them in your next number for their perusal.

GEORGE D. BRUMHAM.

Barnsbury, March 3rd, 1874.

P.S. With reference to Mr. Vernon's statements, allow me to say that I predicted a lower *minimum* temperature for February, 1874, as compared with February, 1873, not a lower mean. I distinctly said, "the mean of February, 1874, may not be so low as in last winter." Those forecasts were fulfilled. The minimum temperature of last month at Greenwich was considerably lower, and the mean not so low as in 1873. I think it would be advisable for Mr. Vernon to read what he attempts to discuss. In that case, with ordinary intelligence he would not have so grossly misrepresented what Mr. Glaisher says at page 65, of No. 97, of the Quarterly Returns of the Registrar-General. In point of fact he could not then have said, as he does on p. 7, of your last number, "that since 1771, there is no case of two successive Februaries greatly below the mean."

SIR,—I beg to be allowed to make one remark about the temperature of the month of February, which has been specially referred to by your correspondent, Mr. Vernon.

By the annexed table, taken from the Greenwich returns, it will

be seen that the month in question has, for ten out of the last fifteen years (1859-1873), been *above* the average, and for only five *below* it; and, moreover, that the excess in each of the ten years has, in nearly every case except 1873, been *greater* than the defect in each of the five years. Therefore, unless a secular change has come over the month of February in favour of a much higher temperature than the average of the last 102 years, is it not reasonable to expect that not only the temperature of the present month will be below the seasonal mean, (which, down to the present date, 23rd, bids fair to be the case), but also that it will follow suit for several years to come, or at any rate that the deficiency will greatly predominate over the excess?

I do not know on what grounds Mr. Brumham makes his predictions, nor do I believe in predictions of coming weather for any particular month, to the extent to which he goes; but surely he, as well as any other theorist, is entitled to fair play, and should not be so discouraged by being told that "predictions, if continued long enough, will *invariably* fail."

Mean Temperature of February.

		+ 4°·9 departure from average of 88 years			
1859	43°·1	+	2·6	"	89 "
1860	35·7	+	3·9	"	90 "
1861	42·1	+	2·8	"	91 "
1862	41·1	+	3·9	"	92 "
1863	42·1	+	2·3	"	93 "
1864	36·0	+	1·7	"	94 "
1865	36·6	+	2·2	"	95 "
1866	40·5	+	6·4	"	96 "
1867	44·7	+	4·6	"	97 "
1868	43·0	+	6·9	"	98 "
1869	45·3	+	2·3	"	99 "
1870	36·2	+	3·9	"	100 "
1871	42·4	+	6·3	"	101 "
1872	44·8	+	4·3	"	102 "
1873	34·3	—			

Yours truly,

C. O. F. CATOR.

Parkside, Beckenham, 23rd Feb., 1874.

To the Editor of the Meteorological Magazine.

SIR,—I am certainly surprised to read Mr. Vernon's letter attacking Mr. Brumham's predictions, both from the terms which he employs and also from his facts and arguments.

Mr. V. quotes Mr. Brumham's prediction, that the *minimum* temperatures of January and February will be below those of 1873, and then alleges as against it that the *mean temp.* of January is not less, and this he calls a refutation! However, I will help Mr. Vernon's argument to this extent, that the *minimum*, as well as the *mean*

temp. of January was *not* less than last year, and so far Mr. B.'s prediction was not fulfilled. But the minimum of *December* was *very much* less than that of 1872, and as the prediction had reference to the whole winter, more or less, I think this must be taken into account. But with regard to *February* Mr. B.'s ideas have been fully verified. He predicted a lower *minimum* and a higher *mean* temp. than that of 1873. The Greenwich minimum for February, 1873 was 25°; for 1874, 21° to this day. Unless the remainder of the month should prove *very* cold, he will also be right respecting the *mean* temperature.

I will next take Mr. Vernon's unaccountable assertion, that no two consecutive Februarys greatly below the average temp. have occurred since 1771. This is a simple mis-statement of fact, as the following instances will show, taken from Mr. Glaisher's tables :—

Feb., 1771	33·4	Feb., 1799	36·4
„ 1772	34·2	„ 1800	34·1
„ 1773	34·9		
„ 1777	35·8	„ 1843	36·0
„ 1778	35·6	„ 1844	35·2
		„ 1845	32·7
„ 1784	31·9	„ 1864	36·0
„ 1785	30·4	„ 1865	36·6

I do not, of course, know the exact value in degrees which Mr. V. attaches to the word “greatly,” but the above are some of the coldest Februarys on record, and just about equivalent on the average to the temp. of the month in question, viz., 34·4. We must also bear in mind that in consequence of the higher average of late years, the two Februarys, 1864 and 1865, were relatively very cold, although they would not have been so much so 70 years ago. Besides, even if this alleged fact were so, does Mr. Vernon mean to say it is anything more than a coincidence? Does he mean to say it is a law of nature that you do not get two cold Februarys in succession? Mr. V. rails against predictions, but here is a prediction with a vengeance! If he does not attach any importance to it, why does he adduce the fact (as he considers)? But Mr. V. does, in point of fact, put it forward as a prediction, because he gives as a reason against believing in Mr. Brumham's predictions of a cold February, the alleged circumstance (erroneous, as I have shown) that we have not had two cold Februarys in succession for the last 100 years. So much for the man who deprecates predictions!

Mr. Vernon may say prediction is “mere moonshine,” that there is “no ground for predictions,” &c., but I beg to observe that this is merely his opinion, and not by any means to be laid down in this lofty style as a dogmatic truth. I am, myself, after considerable study, of a directly opposite opinion. I have not, indeed, the slightest faith in almanack predictions, giving the exact weather for any particular day or week, but I am satisfied the *general character* of a coming

season may often be determined with a fair amount of accuracy by certain antecedent circumstances of rainfall and temperature. Will Mr. Vernon, for instance, venture to deny that a warm and dry April foreshadows a fine summer? or that a very dry and cold November foretells a mild winter? Let him go carefully into the figures of past years and see if it is not so.

It is quite a new idea to me that Englishmen are to wait for "leading European meteorologists" to show the way in any branch of science. Rather let us be more worthy of the old historic fame of England, whose sons have hitherto rather *led* than *followed* wherever the laws of nature were to be investigated. Mr. Vernon may depend on it, he will not be able "to put an end" to discussion in this way.

I will only add, that I have now been in the habit of seeing and hearing Mr. Brumham's predictions for some years, and, with very few and partial exceptions, I have found them remarkably correct; for instance, in the magazine for December, 1872, he predicted for that winter a mild December and January, and a cold February, which, I need not say, proved exactly the fact.

I am, Sir, faithfully yours,

F. TAYLOR.

19, Canonbury Park Square, London, 24th Feb., 1874.

THE ORTHOGRAPHY OF THE WORD EQUATORIAL.

To the Editor of the Meteorological Magazine.

SIR,—Your correspondent, Mr. Bushell, is correct in his surmise that his former letter was not sufficiently explicit; a circumstance which I much regret, as it led me into the impropriety of occupying valuable space in your excellent magazine with a letter which was irrelevant to the subject intended to be brought under discussion.

It now appears that the question was not respecting adjectives ending in *ial* simply, but in *orial*. This was not apparent in Mr. Bushell's former letter. Indeed, such an interpretation of his language seemed to me to be excluded by the fact of his having said, "We have *armorial*, *editorial*, *manorial*, and a hundred others after the same model;" for, as regards adjectives ending in "*orial*," we have not, I believe, half that number. I know of only twenty-seven. Of course, such adjectives could be created by the score; but I speak of those which have been accepted and are in use; and I doubt not that Mr. Bushell intended to do the same, though, perhaps, he used the expression "a hundred" for an indefinite number. It is so used sometimes. A little girl once told me that she had seen the Lord Mayor's show "a hundred" times.

I agree with him that there is not in the English language an instance of a noun that ends in *or* making *oreal* in the termination of the adjective formed from it. Unquestionably the proper spelling of the word under discussion is *equatorial*.

G. WASHINGTON MOON.

TEMPERATURE IN NORTH YORKSHIRE.

To the Editor of the Meteorological Magazine.

SIR,—Some of your readers may care to know that a minimum thermometer placed in a small louver board screen, attached to a wall on the top of Pen Hill (1,800 ft.) registered 15° between the 6th and 23rd of February, the maximum during the same period being 42° . Here (470 ft.) the minimum was $17^{\circ}8$ (on two nights), and the maximum $50^{\circ}2$. I mean to put a rain gauge on the top. On the 6th, when I placed the thermometers there it was 3° warmer in the shade, and 5° in the sun on the hill than in the valley, but on the 23rd it was 9° colder in shade and 7° in sun, the weather on both occasions being cloudless, calm, and clear. The frost from the 9th to the 12th was very sharp, the river being full of ice, and the waterfalls and rapids presenting a singular appearance. The temperature of the water fell to 32° .

I am, Sir, your obedient servant,
F. W. STOW.

Aysgarth, February 25th.

THE METEOROLOGICAL SOCIETY.

THERE was an unusually large number of Fellows present at the meeting of this Society on the 18th ult., and the papers and discussions amply repaid their attendance. The papers were "General Remarks on West Indian Cyclones," by Mr. F. H. Jahneke, which led to a long discussion, in which the president (Dr. Mann), Messrs. Eaton, Laughton, Scott, Strachan, Symons, Capt. Toynbee, and others took part. Two papers by Mr. Hicks upon special forms of thermometers were then read, of which we postpone our notice until our next, in which we hope to refer to a number of new instruments. Lastly, there was a paper by Mr. R. H. Scott, F.R.S., upon a water-spout in Argyleshire, which led to a very lively series of remarks on waterspouts in general. Several new Fellows were balloted for, and the meeting adjourned.

SCOTTISH METEOROLOGICAL SOCIETY.

THE half-yearly meeting of this Society was held at Edinburgh on January 29th, Mr. Milne Home, of Wedderburn, in the chair. The report of the Council was submitted, and also one from the Committee charged with the investigation of the relations between Meteorology and the herring fishery. Mr. T. Stevenson brought before the meeting a proposal for establishing chains of storm stations at short distances apart, and provided with good barometers, so as to determine more accurately the velocity of the wind due to any given gradient. For observations of this class special schedules have been prepared.

FEBRUARY, 1874.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which 0·1 or more fell.	TEMPERATURE.						No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		In shade	Max.		Min.		On grass					
				Dpth	Date.		Deg.		Date.	Deg.		Date.				
													inches	inches.	in.	
I.	Camden Town	·91	—	·31	·58	26	16	54·5	28	22·4	11	15	18			
II.	Maidstone (Linton Park).....	1·31	—	·20	·41	26	11	59·0	28	18·0	6	15	...			
III.	Selborne (The Wakes).....	3·43	+	1·72	1·39	26	13	50·0	27*	21·0	9	16	16			
IV.	Hitchen	1·41	+	·15	·74	26	12	49·0	14†	17·0	5	17	...			
V.	Banbury	1·95	+	·52	·85	26	15	52·0	14‡	20·5	6	15	...			
VI.	Bury St. Edmunds (Culford).....	·75	—	·67	·39	26	8	52·0	14‡	18·0	10	14	16			
VII.	Bridport	2·45	+	·39	·50	26	14	54·0	15	22·5	9	12	...			
VIII.	Barnstaple	2·81	+	·73	·36	25	17	54·5	15	30·5	20	...	...	
IX.	Bodmin	5·40	+	2·61	1·48	25	16	52·0	23	33·0	10	0	7			
X.	Cirencester	2·39	+	·78	·60	26	13	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall) ...	2·41	+	1·52	·60	26	16	50·0	14	21·0	11	14	16			
XII.	Tenbury (Orleton)	3·06	+	1·49	·84	26	14	54·2	14	21·0	9	14	14			
XIII.	Leicester (Wigston)	1·84	+	·50	·47	26	10	54·0	27*	21·0	5, 10	...	...	
XIV.	Boston	1·57	+	·36	·56	26	11	56·0	26	20·0	6, 7	14	...			
XV.	Grimsby (Killingholme)	1·02	...	...	·60	26	13	52·0	14	22·0	11	12	...	
XVI.	Derby	1·45	—	·03	·27	26	15	54·0	14	21·0	11	16	...			
XVII.	Manchester	1·59	—	·36	·50	26	11	54·0	28	20·0	11	14	18			
XVIII.	York	1·35	—	·03	·44	26	13	50·0	27	20·0	11	13	...			
XIX.	Skipton (Arncliffe)	3·12	—	·55	·75	26	16	...	...	...	...	...	...
XX.	North Shields	·96	—	·57	·45	26	13	50·0	26	22·7	11	14	16			
XXI.	Borrowdale (Seathwaite).....	10·50	—	·88	2·22	14	17	...	...	...	...	...	...
XXII.	Cardiff (Ely)	3·03	+	·96	·49	14	15	...	...	...	...	...	...
XXIII.	Haverfordwest	4·73	+	1·87	·93	28	12	51·6	26	26·0	9	8	15			
XXIV.	Rhayader (Cefnfaes).....	4·09	+	1·11	·90	26	10	51·0	...	19·0	...	...	...
XXV.	Llandudno	1·46	+	·11	·44	26	13	57·4	21	26·2	11	6	...			
XXVI.	Dumfries	1·35	—	1·20	·28	26	16	50·5	28	21·0	11	12	17			
XXVII.	Hawick (Silverbut Hall).....	2·16	...	...	·65	15	12	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill).....	1·06	...	...	·33	16	13	51·6	15	23·5	9	6	14	
XXIX.	Castle Toward	1·54	—	2·20	·40	17	14	50·0	13§	...	...	7	...	
XXX.	Leven (Nookton)	1·05	—	·65	·20	26	12	53·0	21	19·0	11	18	25			
XXXI.	Stirling (Deanston)	·99	—	2·01	·23	14	17	50·0	14	17·3	11	17	20			
XXXII.	Logierait	1·66	...	...	·84	26	11	52·0	21	18·0	11	14	...	
XXXIII.	Braemar	2·54	+	·56	1·80	26	8	48·0	21	19·5	11	15	24			
XXXIV.	Aberdeen	1·37	...	...	·56	26	21	52·6	5	24·8	11	10	19	
XXXV.	Portree	4·84	—	5·39	·97	27	21	...	...	...	...	...	...
XXXVI.	Loch Broom	1·76	...	...	·56	26	16	...	...	...	...	...	...
XXXVII.	Inverness (Culloden)	·52	—	1·36	·19	27	10	53·7	21	24·0	10	4	21			
XXXVIII.	Helmsdale	·77	...	...	·26	19	14	...	...	...	...	...	...
XXXIX.	Sandwick	1·39	—	1·09	·36	20	17	50·0	20||	27·3	11	3	12			
XL.	Caherciveen Darrynane Abbey	5·54	...	...	1·19	10	27	...	...	...	...	...	...
XLI.	Cork	5·41	...	...	1·17	11	21	...	...	...	...	...	...
XLII.	Waterford	2·98	+	·95	·46	25	17	52·0	14	33·0	28	...	...	
XLIII.	Killaloe	2·43	—	·47	·58	25	17	55·0	13	28·0	28	7	10			
XLIV.	Portarlington	1·54	—	·49	·29	26	23	52·0	20	25·0	8	6	...			
XLV.	Monkstown, Dublin	3·22	+	1·19	1·75	25	14	56·0	14¶	25·0	6	12	...			
XLVI.	Galway	2·68	...	...	·37	17	18	55·0	8	28·0	10	3	...	
XLVII.	Ballyshannon	1·63	...	...	·28	2	18	43·0	14	29·0	9	2	...	
XLVIII.	Waringstown	2·20	...	...	·81	25	15	55·0	14	22·0	9	11	16	
XLIX.	Edenfell (Omagh).....	1·32	...	...	·20	25	18	50·0	20**	22·0	8	14	...	

* And 28. † 15. ‡ 27. § 16. || 21. ¶ 22. ** 24.
 +Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON FEBRUARY.

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

ENGLAND.

LINTON.—A dry fine month up to the 26th and 27th. Frosts from 3rd to 13th, the sharpest being on 6th and 11th, with only a slight shower of S on 10th. Winds mostly north during the first half of the month, afterwards variable, but high on 17th and 26th; bar. high till 13th, then less steady. Excepting that the frosts rendered the roads very dirty, the month may be considered a fine and dry one, with never sufficient S to cover the ground.

SELBORNE.—A very damp, cloudy, and cold month; 18th, a few flakes of S at 8 a.m.; 26th, driving R from S.E. all day (1.39); 27th, T at 4 p.m., with H and R at Hartley, 1 mile distant. Fogs and white frosts frequent during the month.

BANBURY.—High wind and heavy R on 26th; fogs on 6th, 20th, 24th and 28th.

CULFORD.—The mean temp. of this month, as well as the max. and min. are all considerably below that of January, as is also the rainfall (.75); S only fell on one day (the 9th); easterly and westerly winds have been equally divided, each prevailing on 14 days. From the great mildness of January vegetation is in an unusually forward condition, which the diminished temp. of February has somewhat checked, although not to an injurious extent.

BRIDPORT.—Tremendous S.S.E. gale commenced at 6 p.m., on 25th, continuing the whole of the 26th and night; 27th, sun shone beautifully, but there was a HS; gales also on 11th and 14th.

BODMIN.—This month, like January, has been remarkable for its mildness.

SHIFNAL.—A true "February fill dyke," the wettest since 1848 (except 1872, when 2.89 in. fell); from 12th to 28th, inclusive, R daily with two exceptions (23rd and 24th); the fall of .60 (with S.E. wind) on 26th, greater than any since June 3rd last; but although rain fell on 15 days there was frost on 14 nights; ice on the 11th $1\frac{1}{2}$ in. thick. Aurora on the night of the 4th. Winds most variable throughout, coming from all points except N.E.; very strong from S.E. on 25th, 26th, and 27th. Crocuses open on the 19th; blackbird first heard on the 20th.

ORLETON.—The first eleven days were dry, and generally cloudy, with frequent frost, occasional fog, and high bar., on the morning of the 4th it stood at 30.41; The remainder of the month was rainy, with a variable temperature, the average was nearly 2° 5 less than the mean of the month. A fine display of aurora after sunset, till 8 p.m. on the 4th. No T heard or L seen.

WIGSTON.—Slight S showers on the 8th and 9th.

BOSTON.—The weather generally mild and open, except from the 4th to the 12th, when we had frost sufficient to allow of skating on the river for 2 days; on the 11th the min. temp. was only 20°, while on the 15th it never fell below 45°, a difference of 25° in four days; 4th, brilliant display of aurora in N.

GRIMSBY.—The fall of rain in December, January, and February to 26th only amounted to 1.64. The winter has been so unusually dry that the country will be ill-prepared for meeting the heat of summer. Crocuses began to flower on 1st, hepatics and snowdrops in full flower on 18th; apricot began to blossom on 24th, peach on 28th; rooks began to build on 26th.

MANCHESTER.—S on the 18th; high wind on 25th; stormy on 26th; lunar halo on 26th and 27th; aurora on 28th.

N. SHIELDS.—Blue hepatica in flower on 18th, yellow crocus on 19th, white crocus on 22nd, and purple crocus on 25th.

SEATHWAITE.—S on the tops of the hills on 15th and 25th.

WALES.

HAVERFORDWEST.—One of the wettest Februarys on my record during 25 years. Severe gale from the E. on the 10th and 11th, with extreme cold, the ther. not

ranging higher than 36° in the 48 hours, the mean being 33° . Some days very cold, but on the whole a fine month, many spring-like days; primroses in bloom, and other indications of an early spring. Great storm of R on the last day, the R falling in torrents from 11 to 12 p.m., the sudden flood doing much damage on the low lands, and in the lower parts of the town.

CEFNFAES.—The month has been temperate; stormy at the close; violent gale from S.E. on 26th. Lark heard on the 19th.

LLANDUDNO.—Thrush heard on 8th; primroses in the hedges on the 17th; T at 11 a.m. on 26th. A dry fine month.

SCOTLAND.

DUMFRIES.—The first three days mild and fine, then ten days with frost at night, but the days generally pleasant; the rest of the month showery, but the rainfall generally light, with frosts occasionally at night. Temp. $3^{\circ}7$ above average of month. Vegetation has been checked by frost, but is still unusually forward for the season.

HAWICK.—Very strong gales on the 13th and 14th, and a hurricane from the S.E. on 25th and 26th.

ANNANHILL.—Temp. rather below that of last month. R slight; land generally in good condition for spring work. Winds principally S.E. to S.W. A good deal of frost about the middle of the month; wind generally bleak and cold; evenings generally fine. Splendid aurora on 5th, at 9.15 p.m., a complete arch from E. to W., like a white rainbow or vapour. Small-pox still very bad, but not so fatal.

CASTLE TOWARD.—A dull, cloudy month throughout, with but few sunshiny days. Frosts about the 9th gave us an opportunity of filling our ice-house; a few stormy and very cold days at end of month, doing great damage to evergreen shrubs as well as forest trees, of which a great number were uprooted; bar. 30.65 on the 4th, being very steady till the latter part, when it fell to 28.95 . Pastures do not look well, but gooseberries and fruit trees are pushing forward fast.

DEANSTON.—A fine fair month, a good many frosty nights and some cold days, but for the most part it has been mild, and growth not much interrupted.

BRAEMAR.—Bright aurora on the 4th; aurora also on 5th and 6th; falling stars on 18th; lunar halo on 19th, and violent gale with S and sleet on 26th.

ABERDEEN.—Mean bar. pressure, temp., and S.W. winds above the average (17 years). The estimated pressure of wind, and the fall of rain have been below the average. Hoar frosts very frequent. Aurora on 4th, 5th, 10th, 12th, and 17th. A month of mild dry weather, with much sunshine and very little S. Terrible S.S.E. gale 1 a.m. to 6 p.m. on 26th.

CULLODEN.—Bright aurora on 5th; H on 8th and 17th; very slight S on 9th. Heavy gale on 26th; wind S.E., with frequent and rapid variations to S.S.E. and E.S.E. Horizontal movement between 9 a.m. and 3 p.m., 179 miles, and average 29.9 miles an hour, some of the gusts equal to a pressure of from 20 to 25 lbs. on the square foot. Bar. (corrected) fell to 28.68 in.; many trees blown down, and much destruction done to thatched houses.

PORTREE.—A cold stormy month; a continuous gale from 8 p.m. on 25th to 4 a.m. on 27th from S. to S.E. Less frost and S than usual this month. Cowslips and garden shrubs in full bloom. Sheep and cattle thriving well on the pastures.

LOCHBROOM.—This has been a particularly fine month; field operations are in a forward state, everything looks flourishing, and there are prospects of a good spring. On the 26th it blew a hurricane all day.

SANDWICK.—February has been milder and drier than the mean, but the 25th, 26th, and 27th, were exceedingly stormy, and I do not recollect marking so much wind in three days before; at 10.15 a.m. on each of these days the anemograph traced respectively 1037, 1368 and 1188 miles; this was the strongest S.E. wind that I have ever known; it is often very persistent as a strong breeze, but this

time it amounted to a storm of 71 miles an hour from noon till 7 p.m., on 26th. Aurora till 10 p.m. on 4th; ground white with S on 8th, and sprinkled with it again on 18th.

I R E L A N D.

DARRYNANE.—1st to 9th, fine and very mild, with light easterly winds. Very heavy gale from S.E. on 10th; 12th to 23rd, variable, and much colder, wind chiefly N. and N.W. Last five days wild and stormy; very heavy gale from S.S.W. on 26th, with H and T, and a tremendous sea running.

MONKSTOWN.—A mild, rather dry month, except the last week. Vegetation progressing rapidly. Great fluctuations in atmospheric pressure, from 30·6 on 5th, to 28·7 on the 26th; on the 25th heaviest fall of R (1·75) in 24 hours since January, 1864, except on the 22nd of July, 1873, when 1·95 fell. Prevailing winds S.E. to S.W.

BALLYSHANNON.—The month has been unusually fine, and so favorable for out-door work that farming operations are in a more than usually advanced state; a slight fall of S on the 11th, which soon disappeared.

WARINGSTOWN.—A remarkably fine and bright month.

OMAGH.—A continuance of the fine and mild weather which has marked the entire winter. Gale on 25th.

METEOROLOGICAL OBSERVATIONS AT MENTONE, FRANCE.

[We have been favoured with the following interesting abstract for the end of 1873, and hope in our next to give a similar one for the early months of 1874, together with an analogous communication from Col. Ward, who has been observing throughout the winter at Rossinière, Canton Vaud.—Ed.]

	OCT. 14-31 incl.		NOVEMBER.		DECEMBER.	
	Readings.	Date.	Readings.	Date.	Readings.	Date.
Barometer, highest reading ...	30·085, E.	27	30·282, M.	26	30·437, E.	8
Barometer, lowest ...	29·463, E.	30	29·564, M.	23	29·714, M.	28
Hygrometer, mean of degrees of dryness ...	...	...	2°·4	..	4°·0	...
Thermometer, mean max. (4ft. above ground).	...	...	67°·5	...	64°·9	...
„ absolute max. ...	78°·5	16	75°	7	71°·5	5
„ mean min. ...	...	...	44°·6	..	37°·3	...
„ absolute min. ...	46°	27	37°·5	13	28°·5	30
„ (6in.ab.gd). mean min. ...	...	...	43°·2	...	35°·9	...
„ absolute min. ...	44°·2	27	35°·7	13	26°·6	30
Solar Radiation, mean max. ...	...	...	..	..	100°·8	...
„ highest reading...	...	...	...	...	116°·7	28
Rainfall, total amount ...	7·986	...	8·022	...	120	...
„ greatest fall in 24 hours.	1·980	14	2·273	2	120	27
„ No. of days on which more than ·001 fell ...	11 days	...	11 days	...	1 day	...
Cloud, mean amount ...	5·3	...	4·7	..	2·7	...
„ No. of cloudless days ...	2	...	7	...	16	...
Wind, prevailing ...	...	...	N.-N.W.	..	N.-N.W.	...

Barometer, compensated aneroid—Negretti and Zambra. Hygrometer, verified at Kew. Rain Gauge (Howard's), one foot above ground.

Instrument Stand, four feet above ground; northerly exposure; observations taken at 9.0 a.m., and of Barometer also at 9.0 p.m., marked respectively M. and E.

Height above sea-level, 80 feet, calculated by Pocket Aneroid.

PHILIP WRIGHT, F.C.S.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

XCIX.]

APRIL, 1874.

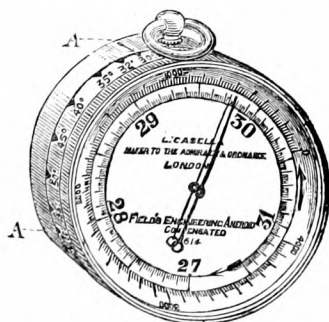
[PRICE FOURPENCE,
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NEW INSTRUMENTS.

THE pressure upon our space for many months past has prevented our keeping *au courant* with the above subject. Moreover, there has lately been a remarkably rapid succession of new instruments, designed especially by three of our principal makers. The first three instruments which we are about to mention have been already described in these pages, having been exhibited at the Bradford Meeting of the British Association. We refer briefly to them here for the double purpose of rendering this article complete, and supplying engravings of two of them.

Field's Engineering Aneroid.

The fundamental principle of this instrument is very good. It is that of not merely compensating the aneroid for temperature—that, with greater or less success, has been done before—but enabling the observer to make the instrument give altitudes corrected for the temperature of the air. For the precise *modus operandi*, we must refer our readers to Mr. Field's paper (*Meteorological Magazine*, vol. viii. p. 139), but roughly it may be described as merely turning the glass cap of the aneroid until the engraved figure on the outside, which most

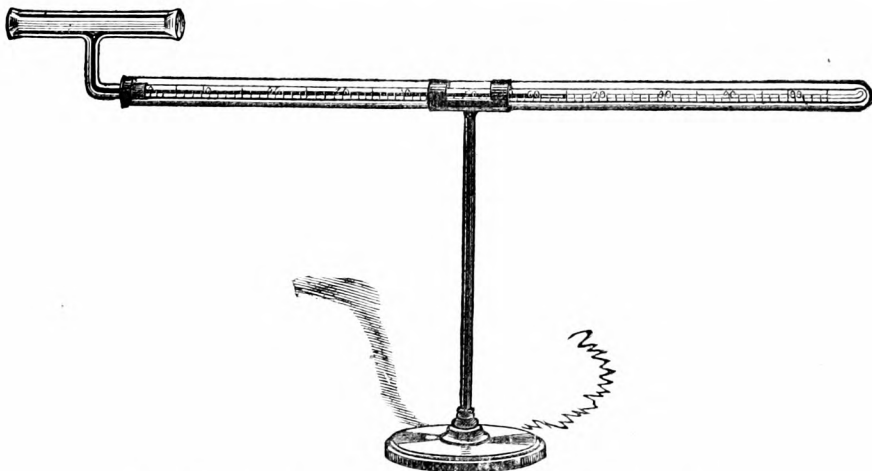


nearly agrees with the air temperature, is opposite the little black arrow at the top of the instrument. For reasons, upon which we cannot stop to enlarge, none but the very best selected aneroids can be

used for this arrangement. Therefore, in addition to the convenience of the scale, those who provide themselves with these instruments have a necessary guarantee that in addition they have an extremely good aneroid with the ordinary graduation. The size is that of the usual "watch aneroid," and the maker Mr. Casella.

Hicks's Double-cylinder Minimum Thermometer.

In a previous article we described the bifurcated bulb whereby Mr. Casella first gave great sensitiveness to alcohol thermometers. The present instrument affords another mode of doing the same thing, and is very successful, its sensitiveness being equal to that of a mercurial thermometer with a bulb one-third of an inch in diameter. The essential principle is, that instead of the alcohol being in a compact form, as in a spherical bulb, it is spread in a very thin layer between the double glass cylinders, by which means its sensitiveness is greatly increased.



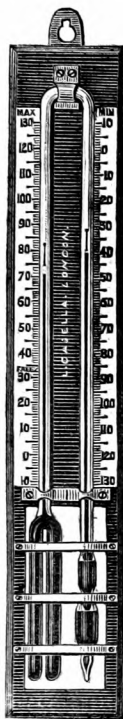
Negretti's Test-gauge Solar Radiation Thermometer.

The experiments of the late Mr. Nunes showed the necessity for great exhaustion in so-called vacuum thermometers, but there was no method by which the degree of exhaustion could be ascertained except by destroying the instrument. Messrs. Negretti and Zambra overcome this difficulty by a remarkably pretty application of a small mercurial test-gauge, which, being enclosed in the vacuum jacket before exhaustion, shows at any time the extent to which it has been carried.

Hicks's Electric Test for Vacuum Thermometers.

This is another and subsequent mode of effecting the same object as that just described. Mr. Hicks welds a platinum wire in each end of the vacuum jacket. It is then only necessary at any time to connect these with a small battery, in order to determine by the colour and stratification of the tube the amount and character of the residual air.

Casella's Mercurial Six's Thermometer.



This is essentially an *instrument de luxe*—it is undoubtedly that, for it is one of the prettiest instruments ever made. Moreover, it is certainly as much better, as it is prettier, than the old form of Six's thermometer, for its sensitiveness is exactly double that of one of the same size of the old construction. The new form differs from the old in nearly all respects, and yet preserves a general similarity. We must justify these contradictory statements by a brief description of the points of resemblance and difference. Both patterns contain both mercury and spirit; in both there are two vertical scales—one for max. and one for min.; in both the mercury is at the bottom of the columns; in both the indices are in columns filled with alcohol, and are pushed upwards by mercury; and in both patterns the scales for max. and min. read in opposite directions, the former upwards, the latter downwards. The differences are, however, very great, very essential, and, as far as we have tested, decided improvements. In the old pattern the indications primarily depended upon the expansion of alcohol contained in a single cylindrical bulb: in the new pattern the sensitive bifurcated bulb is used, and mercury is substituted for alcohol as the principal thermometric liquid.

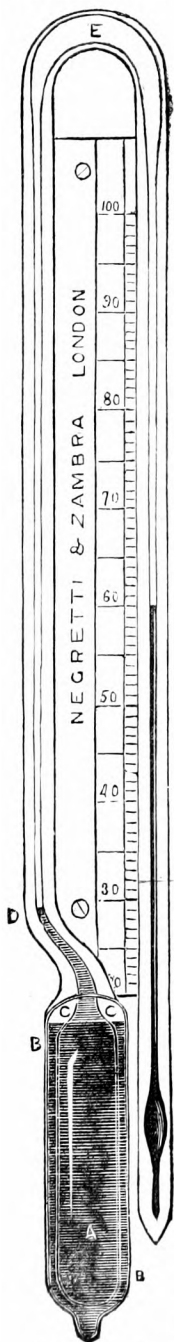
In fact, throughout the instrument the respective liquids are everywhere reversed, so that while in the old form there was only one short length of mercury, there is in the new only one short length of spirit. The maximum indication is the direct product of the thermometric liquid, while in the old one this was true of neither, and the max. column is on the opposite side. Difficulties of transport, and from the use of two liquids, will always limit the employment of this class of instrument, but for a window thermometer, and for the better class of conservatories, we know of none handsomer, more sensitive, or equally suitable.

Negretti's New Deep Sea Thermometer.

One of the "happiest thoughts" in the department of instrumental meteorology was that by Messrs. Negretti and Zambra of inserting a fibre of glass in the tube of a mercurial thermometer, so as virtually to make a trap door, and thereby constructing the only underangeable maximum. In its ordinary form as a horizontal maximum, this instrument is so well known that we need not dwell upon it. A special modification of it was arranged by Messrs. Negretti for Prof. Everett and some of the observers of the Underground Temperature Committee of the British Association, in which the thermometer was used

bulb uppermost, and the reading obtained by noticing the length of the column found at the bottom end of the tube—viz., that furthest from the bulb. The essential principle of this arrangement was, therefore, the measurement by a scale not starting from the bulb, of the amount of mercury forced past the trap-door by the expansion of that in the bulb.

Messrs. Negretti have now carried this principle much further, and produced a mercurial thermometer, which, by the very simple process of reversal, will bring from any time or place the actual temperature (subject, we think, to an uncertainty of $0^{\circ}2$ or $0^{\circ}3$) at the instant and place of its reversal. The annexed cut will enable our readers easily to understand the arrangement:—
A Bulb of thermometer; B Shield to protect from sea pressure; C Space for expansion of protecting liquid; D Glass fibre, or trap-door; E Enlargement to allow rapid passage; F Indicating tube.



Under ordinary circumstances all the mercury is in the bulb A, or between it and E, and the obstruction at D is so arranged as not to impede the passage of the mercury either upwards or downwards, and, therefore, it is evident that the length of column above D will at all times be a measure of the true temperature of the instrument. If the thermometer be turned bulb upwards, the column will break off at D and run into E, whence, on a second half turn, it will fall into the tube F, and remain there until the instrument is turned in the reverse direction by the observer. When we first considered this arrangement, we doubted whether the mercury would always break off cleanly at D, and at exactly the same point; but we have since tried several of the instruments, and find that they all act perfectly. There is, however, one cause which, as we have said, may lead to small errors of $0^{\circ}2$ or $0^{\circ}3$. It is the variation in the length of the indicating column due to alterations in its temperature; for suppose the instrument reversed at a temperature of 40° , and read in a temperature of 90° , it is evident that the indication on the scale will be higher than 40° by an amount equal to the expansion of the detached column by an increase of 50° in its temperature. The amount will be very slight, probably not more than we have stated. It could be entirely avoided, either by the very simple expedient of reading the thermometer in a temperature similar to that in which it was reversed, or by making the scale adjustable like a sympiesometer; but the amount is so small that we doubt if either is necessary.

It is evident that this instrument may be applied to a variety of

purposes—that it will supply data previously unattainable—and that it is a very valuable addition to the instruments of observation now available for meteorologists.

THE WINTER OF 1873 IN SWITZERLAND.

To the Editor of the Meteorological Magazine.

SIR,—As it may interest some of your readers to know my experiences of a winter in the Swiss mountains at an elevation of 3,000 odd feet, I annex a short weather table. My instruments are all by Casella, and (with the exception of the barometer) new, and verified recently at Kew. The barometer is one of Casella's best standard mercurial mountain barometers which I have had many years, and which was re-verified last year. The maximum and minimum thermometers (which are in a louvre stand) are "Phillips and Rutherfords'" grass ditto with divided bulb. Rain gauges two, one ordinary copper gauge with low rim to funnel; the other, which I have termed the snow gauge, has a rim six inches deep before funnel commences, and is similar to one Casella made for me years ago, and which you may remember seeing at my house in Wiltshire. I consider it the best form of rain gauge for this reason: in rain it and the one with the low rim to funnel work exactly together; in snow, especially with wind at the same time, the low-rimmed funnel is useless.

I have inserted six columns, showing the number of days on which the thermometer fell below 15, 10 and 5 degrees and those on which it did not rise above 15, 20 and 32 degrees. On one day, Dec. 13th, our maximum was 11°. This might alarm some people, but the cloudless skies and the extreme *stillness* of the air prevent the cold being felt. I regret not having a solar thermometer, for the heat of the sun is very great, as you will be able to judge from the maximum column. People are under the impression that at these elevations you are buried in snow and fogs, and I had more than one warning of the risk I ran in bringing my family here. All I can say is, we have never passed a pleasanter winter or felt the cold so little. Although we consist of nine, some of whom are young children, coughs and colds, or even a day's illness, have been entirely unknown.

It really is almost worth while to spend a winter in these regions if only for the purpose of seeing the beautiful forms ice and snow can take. Cascades and water ducts for supplying mills become masses of beautifully-shaded ice and icicles like Bohemian glass or Parian marble, while at ten degrees of Reaumur the whole surface of the snow on ground, trees, and plants, becomes covered with crystals which sparkle both in sun and moonlight in a wonderful way. The longer the intense cold continues the larger these grow. I cannot give you their shapes, but they are some of them to be found in Professor Tyndall's interesting work, "The Forms of Water," under the head of "Snow Crystals."

Each day from the beginning of December (when the cold weather was ushered in by a violent thunderstorm) till this moment, my children have skated on a rink I made by flooding the stable-yard, repeating the process each evening, so that a perfect piece of fresh ice presented itself every morning. Time therefore has not hung heavily. Rossinière is well known as a charming place in summer, with abundance of wild flowers, and I can well recommend Madame Reymond and her comfortable chalet to any one in search of health and fine air.

The mean amount of humidity at 9 a.m. for the last four months, as calculated from a small Alpine dry and wet bulb of Casella's, is 82, but as it is not verified I have not inserted the amount in the table, particularly as from the dryness of the air here I doubt the humidity being so great even at that early hour.—I am, dear Sir, truly yours,

MICHAEL FOSTER WARD, F.M.S.

Rossinière, Canton Vaud, March 6, 1874.

Monthly Means, &c. of Meteorological Observations taken at Rossinière, Canton Vaud, Switzerland.

Lat. 46°28' N., Long. 7°5' E. Height above Sea Level, 3,019 feet, English.

Readings taken 9 a.m. local time—31 min. in advance of Greenwich time.

1873.	Bar. reduced to 32° Fahr.	Thermometer.												
		Extremes.			Means.				Days on which Ther. fell to or below			Days on which Ther. did not go above		
		Max.	Min.	Grass	9 a.m.	Max.	Min.	Grass	15°	10°	5°	15°	20°	32°
	in.													
October	26·896	67	22	18	40·9	47·7	36·3	33·5	...	...	...	...	...	...
November ...	26·895	51	13	5	33·3	41·9	28·8	24·4	4	...	...	...	...	4
December.....	27·190	42	1	—6	19·4	25·6	15·5	9·6	18	11	5	5	11	23
1874.														
January	27·168	51	5	0	24·2	35·0	18·0	15·0	14	4	1	...	3	8
February	27·014	52	—2	—10	25·0	29·5	17·6	14·0	12	3	2	...	...	2

1873.	Amount of Cloud. 0—10	Absolutely Cloudless days.	Prevailing Wind.										Rain Gauge	Snow Gauge	Days on which R or S fell.
			Calm.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	1ft. 6in. above ground.			
October	3·8	19	1	...	15	...	...	...	1	14	...	1·415	2·085	7
November ...	4·8	15	6	...	...	...	...	...	4	12	8	4·250	4·650	6
December ...	1·0	25	23	...	5	...	...	...	1	1	1	0·830	1·106	3
1874.															
January	2·0	22	14	...	16	...	...	...	...	1	...	0·750	1·110	5
February ...	1·7	19	22	2	2	...	...	...	2	...	...	0·200	0·500	2

HALOS, CORONÆ, BAROMETER, AND ZODIACAL; LIGHT.

To the Editor of the Meteorological Magazine.

SIR,—I beg to subjoin a list of the halos and coronæ observed here during the month of March. I do not remember ever seeing so many in one month. The solar halos, too, were remarkably well seen, the spectrum being very distinct. The lunar and solar halos were all of about 22° radius. The lunar coronæ were magnificent on the 29th and 30th. The order of the coloured rings, beginning with that nearest the moon, was as follows :—white, yellow, orange, brown, blue, green, yellow, orange. The diameter of the outermost was about 10°. During the furious gale which raged here on the 2nd of April the barometric column was much disturbed; from 9 a.m. until 2 p.m. its oscillations were readily seen. At noon they were greatest, and the space traversed by the top of the column in the up and down movement frequently amounted to $\frac{1}{10}$ th of an inch.

Solar halos on the 21st and 25th; Lunar halos, on the 24th, 26th, 28th, 30th, and 31st; Lunar coronæ, on the 29th and 30th.

The zodiacal light was finely seen on the 10th, 11th, 18th, and 19th.

I am, Sir, yours truly,

JOSEPH GLEDHILL, F.G.S., &c.

P.S.—No solar halos were seen in January, and but one in February 11th); one lunar halo was seen in January, on the 2nd, and one in February, on the 28th. Three lunar coronæ were observed in January, and but one in February.

The Observatory, Skircoat, Halifax, April 2nd, 1874.

WINTER MEAN TEMPERATURE FORESHOWN BY BRITISH RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—The law and table to which I referred in my last letter are as follows :—“When the mean rainfall of the Spring period (April and May) at nearly fifty stations is below 4½ inches, the following winter is colder than the average, unless the rainfall of the Summer period (July and August) is above 6½ inches. And if the Spring rainfall is above 4½ inches, the Winter will be warmer than the mean, unless the rainfall of July and August is below 3½ inches.”

The following way of putting it, however, is still more simple :—“When the mean monthly rainfalls of April, May, July, and August, at nearly fifty stations, are together above 10·30 inches, the Greenwich mean temperature of the following December to March (inclusive) will be above the average also; and when below 10·30 inches, will also be below the average in Winter mean temperature.” Any of your readers who have all the volumes of your “Magazine” and “British Rainfall,” can check my figures as far back as 1862. The mean falls I have given for 1860 can be checked by casting up the monthly totals on page 314 of “Beardmore’s Manual of Hydrology,”

and dividing by the number of stations, which, in that case, amounts to sixty-one. In the Magazine for September, 1868, there are more total falls omitted in the (August) table, than will be found for any other month in question. I have therefore added two important returns to that table, viz., 13·70 inches for Borrowdale (Seathwaite), and 10·17 inches for Portree. These amounts should be added, by those of your readers who may feel disposed to check my figures. Mr. Vernon can do with this "theory" what he says he desires (at least as far back as 1862 and 1860); he can "compute the meteorological elements," and then "compare them with the actual observations (at Greenwich), as in the case of astronomical observations," and prove to himself that "prediction" is not "mere moonshine." All he has to do is to cast up the total falls of April, May, July, and August, as given in your Magazine, &c., divide by the number of totals, whatever it may be, for the particular month, add the four results together, and "compare" the gross total thus obtained with the Greenwich mean temperature of the following December to March. I shall feel pleased if he will in this (his own way) test the accuracy of my theory.

The following is the table:—

YEAR.	Mean of the total Rainfalls (at nearly 50 stations) of			Difference of the mean of the total Rainfalls of April, May, July and August, from 10·30 inches,	Difference of Greenwich mean temp. of Dec. to March inclusive from the average (39°30') of 50 years.	Years of Winter.
	April and May.	July and August.	April, May, July and August.			
	in.	in.	in.	in.	°	
1873	3·50	8·44	11·94	+ 1·64	+ 1·87	1873—74
1872	5·15	7·46	12·61	+ 2·31	+ 1·00	1872—73
1871	4·72	7·06	11·78	+ 1·48	+ 2·95	1871—72
1870	3·64	3·38	7·02	— 3·28	— 0·73	1870—71
1869	5·70	3·05	8·75	— 1·55	— 1·30	1869—70
1868	4·71	5·95	10·66	+ 0·36	+ 3·17	1868—69
1867	7·33	7·31	14·64	+ 4·34	+ 1·12	1867—68
1866	3·69	6·82	10·51	+ 0·21	+ 0·57	1866—67
1865	4·87	8·04	12·91	+ 2·61	+ 2·27	1865—66
1864	3·84	3·60	7·44	— 2·86	— 2·30	1864—65
1863	3·82	4·87	8·69	— 1·61	— 0·05	1863—64
1862	7·55	7·55	15·10	+ 4·80	+ 3·55	1862—63
1861	2·40	9·18	11·58	+ 1·28	+ 1·75	1861—62
1860	4·19	6·02	10·21	— 0·09	— 0·30	1860—61
1859	4·26	5·57	9·83	— 0·47	— 0·98	1859—60
1858	5·66	6·01	11·67	+ 1·37	+ 3·42	1858—59
1857	5·16	5·17	10·33	+ 0·03	+ 0·35	1857—58
1856	5·87	6·05	11·92	+ 1·62	+ 0·15	1856—57
1855	3·24	6·44	9·68	— 0·62	— 0·38	1855—56
1854	3·64	4·92	8·56	— 1·74	— 3·43	1854—55
1853	3·45	6·30	9·75	— 0·55	— 0·23	1853—54
1852	3·31	7·06	10·37	+ 0·07	+ 1·15	1852—53
1851	3·42	7·64	11·06	+ 0·76	+ 1·82	1851—52
1850	5·57	6·60	12·17	+ 1·87	+ 2·25	1850—51
1849	5·56	6·60	12·16	+ 1·86	+ 0·10	1849—50
1848	3·92	8·67	12·59	+ 2·29	+ 3·15	1848—49

In conclusion I will make a few remarks suggested by the above table :—

(1.) When the total (mean) fall of April, May, July, and August has been below 8·60 inches, we have always had a very severe winter, as in 1870-71, 1864-5, and 1854-5.

(2.) When the total (mean) fall of the aforesaid months is less than 10·60 inches, but above 8·60 inches, the following winter is partly very severe. Such was the case in 1869-70, 1866-67, 1863-4, 1860-61, 1857-8, 1855-6, 1853-4, and 1852-3.

(3.) The mildest Winter (1862-3) occurred after the greatest Spring and Summer rainfall (15·10 inches). See Table.

(4.) In consequence of other influences, such as uniform monthly mean temperatures, a hot May (for in the last fifty years we have always had a mild winter after a very warm May, such as those of 1868, 1865, 1862, 1848, 1847, 1841, 1834, and 1833), a warm Autumn, &c.—I say in consequence of these other influences, the degree of Winter mean temperature is not always in proportion to the amount of the previous Spring and Summer rainfall; but I think the correspondence is sufficiently near, as a whole, to justify what I said in my last letter, “that the Table is the best (of the kind) I ever gave, or have ever seen.”

GEORGE D. BRUMHAM.

Barnsbury, April 4th, 1874.

SEVERE COLD IN MARCH.

To the Editor of the Meteorological Magazine.

SIR,—I send you the thermometer readings that occurred here during the remarkably cold period which occurred between the 8th and 13th of March.

Date.	Min.	Max.	Snow in Inches.
9th	33°	38°·5	2
10th	22°	35°	2
11th	19°	33°·5	1
12th	16°·5	42°	0

So intense was the cold on the 10th and 11th that the snow remained unmelted throughout the day—a very rare occurrence in March. Blinding snow-drift on the 11th up to 10 a.m., and the minimum of the following night (16°·5) lower than I have ever recorded for March. On the 23rd the thermometer reached 65°·5—a range of 49 degrees in 11 days.

Faithfully yours,

WM. CARTER.

Bucknall, Lincolnshire, April 1st, 1874.

P.S.—The paucity of easterly wind during the last four months is noteworthy. Between the first of December and the 1st of April the wind has blown from E. and N.E. on three days only.

To the Editor of the Meteorological Magazine.

SIR,—A fall of light, dry snow, to the depth of 3 or 4 inches, on the 10th was followed by severe cold. Two mercurial minimum thermometers in screen at 4 ft. registered $7^{\circ}\cdot 5$, and one of Casella's forked minimum thermometers on the snow— 5° . On Pen-hill (1800 ft.) the minimum was $12^{\circ}\cdot 5$, and the maximum in March $50^{\circ}\cdot 5$. Here the maximum was $56^{\circ}\cdot 2$ on the 24th.

I am, Sir, &c.,

F. W. STOW.

Aysgarth, Bedale.

THE LAW OF STORMS.

To the Editor of the Meteorological Magazine.

SIR,—At the majority of stations, both in Europe and in North America, an increase of wind-force, accompanied by a brisk diminution of pressure, is of by no means uncommon occurrence with a wind from due west. The phenomenon is ordinarily the result either of the rapid expansion of a depression in the north, or of its progress in a direction considerably to the south of east. Not only those who, like your correspondent, regard the distinction between "circular" and "incurving" cyclones as imaginary, but others also may well ask, On what grounds would Mr. Birt refuse to attribute a similar phenomenon, when occurring on the surface of the North Atlantic, to a similar cause?

Homeward-bound vessels in the North Atlantic not unfrequently experience a decreasing pressure with an increasing westerly wind, especially, as would appear, between the parallels of 25° and 40° west. What reasons are there for the supposition that in such instances a cyclone of abnormal character is being encountered?

There is a further query I should like to make. In the present state of cyclonology, will not a new code of rules, such as it is proposed to frame, be likely to be regarded by most practical sailors as superfluous and perplexing? They are aware that a cyclone (although its probable course can be readily conjectured) does not travel like a locomotive along an absolutely fixed line. A captain possessed of ordinary intelligence, on experiencing an increase of storm, with a rapid fall of the mercury, does in any case conclude that he is likely to be getting nearer to the centre of depression, and is able to shape his course accordingly, without having to decide the hypothetical species or sub-species of cyclone which he has encountered.

And, supposing the new rules likely to be generally accepted by naval men, will not *too much haste* in framing them be quite as likely as delay to "mean destruction?"—Yours truly,

W. CLEMENT LEY.

Ashby Parva Rectory, Lutterworth.

To the Editor of the Meteorological Magazine.

SIR,—As an outsider, I beg to thank Mr. Birt and Mr. Clement Ley for their letters in the Magazine. The idea of a perfectly circular wind was new to me, and I had no notion that it was generally

accepted or had ever been proved exactly correct. May I ask in what cases? The first diagram strikes me as unique, because I cannot at this moment think of any other instance in nature of a body moving in a circle if free to move in any other path. I can understand a vortex, because then the barometrical depression in the centre is connected with it either as cause or effect,—either the rotation is caused by the rush of air from all sides towards the centre, just as the removal of a plug from the bottom of a basin produces a whirlpool, or the depression is caused by the upward motion of the air in the centre of a whirlwind generated by opposing currents, as in the case of the little dust-eddies which one often sees. But if Buys Ballot's law is to be held to mean that the wind blows exactly along the isobars, and that a cyclone is a body of air revolving and progressing, like a humming top on an inclined plane, I cannot understand how it can take as high a scientific rank as the "cycles" of ancient astronomers. Those *were* modified by "epicycles" into an accurate expression of the facts, but here it seems we have been content with a law that is not only unscientific, but inaccurate. I am glad that Mr. Clement Ley has observed the "incurving" of ordinary winds. I should have guessed it at 15° on an average, from cursory inspection of the daily weather charts, but have not paid the attention to the subject which would warrant my expressing an opinion. It is certainly different with different winds.

If somebody who has studied the subject would give us a real induction, showing cause and effect, instead of a mere hand to mouth generalisation, we should have something worth calling a law.

I am, Sir, your obedient servant,

F. W. STOW.

THE METEOROLOGICAL SOCIETY.

The ordinary meeting of this society was held on the 18th ult. at the Institution of Civil Engineers, Dr. R. J. Mann, president, in the chair. The first paper was read by Mr. R. H. Scott, F.R.S., on "An attempt to establish a relation between the Velocity of the Wind and its Force (Beaufort Scale), with some Remarks on Anemometrical Observations in general." The author stated that he considered the existing scales of wind force were unsatisfactory. The highest pressure corresponding to Force 6 of the Land Scale was 36lb. per square foot, whereas pressures of above 40lb. had frequently been registered. He further brought forward proofs of the irregularity in the distribution of such high pressures. He then spoke of the Beaufort Scale, and pointed out some of its defects, but stated that, speaking generally, it might be considered to be a rough classification of the wind force, exact enough for practical purposes, and proceeding by nearly equal degrees. He had recently had comparisons made at Holyhead and at Yarmouth to test the velocity recorded by the anemometer at each station at the hours when the several figures of the Beaufort Scale were reported. The result was a scale which agreed very closely with that given by Schott, as a deduc-

tion from theory, in his discussion of the observations made by Sir F. Leopold M'Clintock in the *Fox*, and published by the Smithsonian Institution. Inasmuch as the accordance of practice with theory was very great, he proposed this scale for general adoption :—

Force.			Miles per Hour.		Force.			Miles per Hour.
0	...	...	2.5		7	...	...	40.5
1	...	...	8		8	...	...	48.5
2	...	...	13		9	...	...	56.5
3	...	...	18		10	...	...	65
4	...	...	23		11	...	...	75
5	...	...	28		12	...	...	90
6	...	...	33.5					

The paper then went on to point out, from experience gained at Holyhead, Yarmouth, and Falmouth, the very serious discrepancies which had been proved to exist in the records of velocity for the various points of the compass, especially at Yarmouth, and which showed that the influence of local situation, not only as to the contour of the country, but even the very shape and height of the observatory and adjacent buildings, exercised a most serious influence on the correctness of the data afforded by the instruments. It therefore seemed very dangerous to reason as to the mean motion of the air over the British Isles from the anemometrical records of one or two stations, as has been done by Dove. The next paper was by Mr. G. J. Symons, "On the Sensitiveness of Thermometers," in which he gave the results of a series of comparisons of the speed with which thermometers with bulbs of various sizes took up the true temperature to which they were exposed. Three series of thermometers were used :—A set with spherical bulbs filled with mercury, and varying in diameter from a quarter to three-quarters of an inch ; the result was that the small bulb took up the true temperature in about three minutes, while the large bulb took three times as long. A second set were similar in form, but filled with spirit ; they were more sluggish, but the small spirit ones were more prompt than large mercurial ones. Lastly, the new patterns of spirit *minimum* thermometers introduced by Mr. Casella and Mr. Hicks were tested, and found as sensitive as ordinary mercurial thermometers. The instruments were all examined by the Fellows at the close of the meeting. The last paper read was by Mr. Strachan, "On the Weather of 13 Autumns."

MARCH, 1874.

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 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.			Deg.	Date.	Deg.	Date.		
												inches	inches.	in.
I.	Camden Town	·39	— 1·69	·08	12	12	65·4	23†	21·9	11	7	12	
II.	Maidstone (Linton Park).....	·83	— 1·66	·26	9	10	67·0	23	18·0	11	11	...	
III.	Selborne (The Wakes).....	·77	— 1·83	·14	31	9	59·0	23†	21·5	11	10	11	
IV.	Hitchen	·72	— 1·45	·35	9	14	60·0	27	18·0	10	15	...	
V.	Banbury	·85	— 1·35	·16	29	13	61·2	23	21·5	11	11	...	
VI.	Bury St. Edmunds (Culford).....	1·07	— 1·13	·26	9	10	65·0	23†	13·0	10	13	17	
VII.	Bridport	·54	— 2·33	·20	27	8	61·0	24	19·0	11	7	...	
VIII.	Barnstaple	2·07	— 1·08	·38	8	14	60·0	27	31·5	7	...	...
IX.	Bodmin	2·08	— 1·67	·40	9	16	58·0	29	31·0	7	1	6	
X.	Cirencester	1·08	— 1·52	·24	29	13	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall)	·88	— 1·06	·17	9	15	65·0	31	18·0	11	7	10	
XII.	Tenbury (Orleton)	1·04	— 1·38	·23	8	13	67·5	23	21·8	11	9	11	
XIII.	Leicester (Wigston)	1·00	— 1·11	·20	11*	12	67·0	23	17·0	10	9	...	
XIV.	Boston	·70	— 1·09	·20	9	9	66·0	27	20·0	11	7	...	
XV.	Grimsby (Killingholme)	1·07	...	·16	29	14	60·0	23	19·0	12	8	...	
XVI.	Derby	1·22	— 1·02	·20	17	13	67·0	23	21·0	11	5	...	
XVII.	Manchester	3·37	+ ·68	·71	17†	18	62·0	23	11·0	11	5	12	
XVIII.	York	1·36	— ·36	·25	29	14	62·0	22	21·0	11	8	...	
XIX.	Skipton (Arncliffe)	6·61	+ 1·80	1·89	29	19	...	...	...	...	...	...
XX.	North Shields	1·04	— 1·31	·13	9	18	58·5	23	20·6	11	5	7	
XXI.	Borrowdale (Seathwaite).....	14·24	+ ·84	3·44	28	20	...	...	...	...	...	...
XXII.	Cardiff (Ely).....	2·49	— ·46	·49	17	14	...	...	...	...	...	...
XXIII.	Haverfordwest	3·48	+ ·03	·50	17†	17	55·5	22	20·0	11	6	12	
XXIV.	Rhayader (Cefnfaes).....	2·89	— ·95	·68	16	11	62·0	...	19·0	...	...	...
XXV.	Llandudno	2·12	— ·14	·45	8	17	59·4	25	27·5	11	3	...	
XXVI.	Dumfries	2·01	— ·97	·33	28	19	58·0	29	23·0	10†	6	11	
XXVII.	Hawick (Silverbut Hall).....	1·88	...	·35	29	15	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill).....	3·32	...	·79	15	21	57·5	26	22·0	11	5	7	
XXIX.	Castle Toward	4·37	— ·22	·58	16	22	53·0	7§	...	...	6	...
XXX.	Leven (Nookton)	2·10	+ ·03	·52	29	15	59·0	24	23·0	11	8	18	
XXXI.	Stirling (Deanston) .....	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Logierait	2·63	...	·55	31	14	60·0	17**	16·0	9	6	...	
XXXIII.	Braemar	2·32	+ ·11	·55	29	15	55·1	22	20·6	10	8	21	
XXXIV.	Aberdeen	1·86	...	·22	1	23	63·5	23	24·6	10	6	15	
XXXV.	Portree	12·13	+ 3·09	1·87	16	27	...	...	...	...	...	...
XXXVI.	Loch Broom	6·88	...	·84	27	27	...	...	...	...	...	...
XXXVII.	Inverness (Culloden)	1·71	— ·25	·50	30	8	61·0	25	25·0	11	6	17	
XXXVIII.	Helmsdale	3·42	...	·62	11	22	...	...	...	...	...	...
XXXIX.	Sandwick	3·46	+ ·13	·46	19	23	55·5	4	24·8	10	4	5	
XL.	Caherciveen Darrynane Abbey	3·20	...	·63	16	23	...	...	...	...	...	...
XLI.	Cork	1·05	...	·30	27	13	...	...	...	...	...	...
XLII.	Waterford	2·31	— ·58	·98	26	17	59·0	5||	25·0	11	4	...	
XLIII.	Killaloe	3·25	— 1·07	·75	28	18	62·0	23	26·0	11	6	10	
XLIV.	Portarlinton	1·36	— 1·95	·47	29	22	58·0	22	22·5	10	6	...	
XLV.	Monkstown, Dublin	·78	— 1·80	·38	28	11	68·0	24	23·0	11	5	...	
XLVI.	Galway	4·34	...	1·28	28	21	61·0	25	24·0	10	4	...	
XLVII.	Ballyshannon	3·43	...	·47	31	26	50·0	27	29·0	9	1	...	
XLVIII.	Waringstown	1·63	...	·27	9	14	62·0	9	18·0	11	5	9	
XLIX.	Edenfell (Omagh).....	2·81	...	·48	28	19	56·0	23†	16·0	10	7	...	

* And 17. † 19. ‡ 27. § 17, 22, 23. || 22, 23, 24. ¶ 11. ** 23.
 +Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON MARCH.

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

E N G L A N D.

CAMDEN TOWN.—The difference from the average of the first three months of the year is greater than the fall. January having been '78, February '31, and March 1'69 below the mean.

LINTON.—The second week very wintry, with more S than at any other time during the season; but the rest of the month fine and dry, the last week especially so. Fogs frequent; winds often brisk, but not remarkably high. Frost very severe on the 11th, while the 23rd was an unusually warm summer-like day; taken as a whole it has been a fine month, but as only 5'60 in. of R. has fallen during the last five months, (instead of 11'08 which is the average for that period), fears are entertained as to the water supply in the coming summer.

SELBORNE.—On the whole a damp, foggy, cheerless month, but with little R. No high winds until the close.

CULFORD.—Heavy fog on 1st and 2nd, and S fell more or less on the 9th, and the three following days. High wind on 28th, 29th, and 30th. On the 10th the temp. fell to 13°, or 19° below the freezing point, doing much damage to the fruit; while on the 23rd and 27th, the temp. (in the shade) rose to 65°; the average temp. of the month was 42'2. Easterly wind on nine days, and westerly during twenty-two.

BODMIN.—The only signs of winter during the whole season, were on the 9th, 10th, and 11th, when much S fell.

SHIFNAL.—March has come true to its character, for although the first six days were mild and pleasant, it changed to frost on the 7th, with thick fog on the 8th, and S from the N.W. the three days following; the night of the 10th was the coldest this winter, (ther. at 18°), and did much damage to the apricots then beginning to blossom. The Equinoctial gales came true to their time, from S.W., lasting from 18th to 22nd, and after an interval returned with increased violence on the 28th, continuing to the close. Average day temp. 50'2, that of night 37'5. Bar. unusually high (30'37) on the 6th. Large humble bee seen on the 6th; ringdove first heard, and rooks began to build on 7th. Fine Lent seed time.

ORLETON.—Warm and dry, but generally cloudy, to the 6th, when the bar. rose to 30'54, which is higher than it has been registered for many years. Frost then set in, with a fall of S on the 8th, and the weather continued cold till the 13th, with S showers on the 9th, 10th, and 11th, covering the ground, the remainder of the month was generally very warm and dry. On the 23rd the ther. rose to 67'5. A steady rough wind prevailed after the 26th. Mean temp. about 34° above the average of the month.

WIGSTON.—A dry month as regards rainfall, but a moist atmosphere for March; but little March dust. The 9th, 10th, and 11th, stormy, with a heavy fall of S on the 10th, which rapidly melted. Vegetation backward compared with many seasons.

BOSTON.—After passing through all the winter months with scarcely a vestige of snow, in the middle of this month after a period of fine dry weather, the ther. suddenly fell to 12° below the freezing point, and the ground was covered with S. On Sunday the 8th, the mean temp. was 41°, and the weather fine and sunshiny. On Wednesday the temp. was only 26°; the weather bitterly cold, with snowstorms and driving winds. On Saturday the temp. had risen to 44°, and the weather was fine and mild. On the 18th and 20th, very high tides, the water rising, on the latter day, to 16 ft. 4 in. above Ordnance datum, or 3 ft. 4 in. above an ordinary high spring tide; the water flowed up to the church door, and within 3 ft. of the top of the Sea banks; the highest known tide was in 1810, when the tide rose 18 in. higher; in 1854 it was 10 in. higher, and in 1868 8 in. higher than this of 1874.

GRIMBSY.—10th, ground covered with S; frogs spawning on the 18th; larch leaves opening on the 25th; hedges tinged with green on the 29th. Gale began at noon on the 28th, lasting, with short intervals, till the close of the month. 23rd, quite a summer's day. The dry state of the soil was favorable for sowing, but the stores of water are very low. Vegetation forward.

DERBY.—The constant high reading of the bar. and ther., the paucity of E, and the almost total absence of E. winds, have made March a very remarkable and enjoyable month. Vegetation is not in a forward state, owing, no doubt, to the absence of those warm showers so conducive to the propagation of vegetable life. Temp. $4^{\circ}4$ above the average.

NORTH SHIELDS.—7th, auroral arch from N.W. to N.E., near the horizon. S on the 9th, 10th, 11th, and 12th. Lunar halo on 24th.

SEATHWAITE.—T and L on 30th. $3\cdot44$ in. of R fell on the 28th, and more than 14 in. during the month.

WALES.

HAVERFORDWEST.—Very severe weather from 6th to 11th. S 5 in. deep on the level on the 11th; the S when melted produced $\cdot85$ in. Remarkably high bar. during the first six days; a very stormy wet period from the 26th to the end. Except the six severe days, the weather of this month was milder than usual. Measles of a mild type extremely prevalent.

CERNFAES.—Vegetation forward; prevailing winds S.E. and N.W.

LLANDUDNO.—A wave of sea fog passed over the town about noon, and again at 5.30 p.m. on the 2nd; aurora on the night of the 6th. S and H with T S on the 8th; last six days very stormy.

SCOTLAND.

DUMFRIES.—During the first half of the month very little rain fell; on several nights there was frost which was beneficial in checking vegetation, which was too advanced for the season. In the latter part of the month more rain fell, with frequent storms. On the whole, the weather mild; the mean temp. $3^{\circ}2$ above that of last year. The close of the month stormy and wet; on the 1st of April the Nithesdale and Annandale Hills were covered with S.

SILVERBUT HALL, HAWICK.—Frost on 6th, 10th, 11th, 12th, and 13th, and again on 23rd, 24th and 25th. Beautiful aurora on the night of the 8th. High winds on 11th, 17th and 19th, and from the 27th to the end of the month. Hills white with S on the 10th, 11th, 12th and 31st.

ANNAN HILL, KILMARNOCK.—Bar. pressure much higher than during last month. Prevailing winds S. Westerly, moderate to strong. The close of the month rough and stormy. The evenings were generally fine up to the middle of the month. Slight T heard on the evening of the 15th; snow and hail showers on the 9th, 18th, and 30th. Foliage bursting into leaf, and garden blossoms good; young grass and pastures also looking well. Ozone well developed; mean temp. $44^{\circ}5$. Small-pox nearly gone.

CASTLE TOWARD.—A very wet month throughout, with but few bright days from 9th to 12th; very hard frosts; min. on 11th, $20^{\circ}0$. Winds very variable, in the fore part of the month very piercing, preventing any growth being made. Little progress has been made in farming operations, and but a few oats are sown and potatoes planted. Fruit trees, such as plums, pears and apples, look well and blossom plentifully. On the morning of the 30th, a storm of T L and R.

NOOKTON.—Snowstorm from 1 to 4 p.m. on 9th. Stormy from 27th to the end of the month.

BRAEMAR.—A very fine month, and most favourable for farming operations.

ABERDEEN.—A month of mild but stormy weather; severe snowstorm with high winds in the second week. Bar. pressure and mean temp. above the average.

PORTREE.—A cold, wet, stormy month. Snow fell on the 8th and 9th to the depth of 13 in.; no such heavy fall has occurred here since 1868. Frequent gales in the latter part of the month. T and L from 10 to 11 p.m. on 17th, at 6 p.m. on 29th, and on the 31st nearly all day, with heavy H showers. The wettest

March since 1868 ; agricultural operations never so far behind at the close of this month as they were this season ; no seeds have been sown, the land is soaked with wet. Provender for cattle is getting scarce ; garden shrubs injured by the cold winds ; and fears are entertained, unless the weather improves, for the lambing time, which is near at hand.

CULLODEN.—Aurora bright to N. up towards zenith on the 8th, and a faint aurora over N. horizon on 9th. Snow on 10th, 11th, and 12th. Gale on 20th. Solar halo on the same day. Gales on 28th and 31st.

SANDWICK.—March has been warmer and wetter than the mean ; from the 8th to the 12th we had the most wintry weather of the whole season, the roads being blocked up with snow drifts ; there was a thaw on the 12th and 13th, so that the plains were freed from snow. Aurora on 7th and 18th. Gales of 50 miles an hour on 18th and 28th, and one of 40 miles an hour on 31st, from 9 p.m. till 1 a.m. on the following morning.

IRELAND.

DARRYNANE.—First week fine but foggy, with variable wind. Snow on night of 8th, 9th, and showers of snow all day on 9th ; frost on 10th and 11th, thence to 24th, moderate to fresh. W. and N. Westerly winds ; last week constant gales from S. to W. and heavy sea. Heavy rain on morning of 29th, and great floods.

MONKSTOWN.—A very dry month, with the exception of the last week, which was very wild, strong westerly winds prevailing ; severe frost on the nights of the 9th and 10th.

GALWAY.—Aurora on night of 7th.

BALLYSHANNON.—The month on the whole has been a severe one, and remarkable for its sudden changes of temp. The frost did not continue long enough for ice of sufficient strength to be stored for the preservation of salmon, but instead a large quantity of snow has been accumulated, which, when kept from the air, is found a good substitute for ice. Aurora visible from 9.45 to 10 p.m. on 7th. S on 9th, 10th, and 11th ; all disappearing next day. Gale from S.W. on 19th. Storm from S.W. with T L on 29th, wind continuing to the end of the month.

WARINGSTOWN.—There were S showers on seven days this month ; but, generally speaking, it was mild.

EDENFELL, OMAGH.—Weather of the month notable for its sudden vicissitudes, remarkably fine and mild from 1st to 8th, 12th to 18th, and 22nd to 27th ; the remaining periods, viz., from 8th to 12th, 19th to 22nd, and 27th to end being equally remarkable for heavy S and keen frost, sudden and heavy gales, and R squalls respectively. Sowing of grain, &c., backward, owing to the almost entire absence of the usual spring easterly winds to dry the soil.

SYMONS'S

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CONCERNING ANEMOMETERS AND THE REAL FORCE OF THE WIND.

WE do not aim in this article at any higher object than that of stringing together sundry thoughts which have doubtless occurred to others as well as to ourselves, and indicating certain points which we think ought to be ascertained without further delay. While we have no desire that anyone who has an anemometer at work should neglect to record it, we hold that of the many thousands of pounds expended in the purchase and erection of anemometers, a very large proportion has been absolutely wasted. This is a strong statement; let us give a few reasons in its support.

What is a proper position for an anemometer? Can anyone answer that question? Shall we take the positions in which they have been placed by eminent meteorologists as our guide and answer? If so, we fear the answers are so contradictory as to amount to little more than a general rule that they should be up among, and slightly above, the chimney-pots, on a building of any shape, and at any height above the ground.

We think that these points are all wrong. Chimney-pots imply three objectionable features—(1) their presence, even below the level of the cups, must disturb the regular flow of the air, like “snags” in a river; (2) chimneys usually imply smoke, and anemometers, under the most favourable conditions, require very frequent cleansing and oiling; soot and oil jointly make a glutinous compound, with which we have seen an anemometer coated half-an-inch thick; (3) chimneys imply usually the discharge of currents of heated air, scarcely likely to seriously affect the readings, but not conducive to their accuracy.

The shape of a building on which an anemometer is placed cannot be unimportant, although we are not aware that anyone has attempted to ascertain what effect it produces; yet we hold that if anemometers are to be placed upon house and observatory roofs, it is beginning at the wrong end to compare the results of different stations one with another until we know the “personal error,” if it may be so termed, of the position of each instrument.

Then as to height above ground, the variety is nearly as great as in the positions of the instruments, and the shape of the buildings; and yet there cannot be a shadow of doubt that the velocity of the wind increases with every foot of elevation above the ground. The friction of the air against the surface of the earth is very great. We have heard of two anemometers, one with its cups 2 ft. above a grass field, and the other mounted on an isolated pole 20 ft. high, and that the upper one recorded something like seven times the wind that the lower one did. Again, was anyone ever in the golden gallery of St. Paul's when there was a calm at that elevation? or we may quote the many miles which a balloon will be carried while the anemometers are scarcely turning.

Before proceeding to other branches of the subject, we may perhaps answer in anticipation the possible remark, "It would be quite as well if in addition to pointing out the defects of what has been done, you would state how you would avoid these difficulties." We have no desire to shirk this perfectly legitimate criticism. We believe that no anemometer should ever be placed on or near any house or observatory, but that some definite height (not less than 20 ft.) should be agreed upon for the elevation of the cups (if a cup anemometer be used) above the ground; and that they should be raised to that height by some framing which should be arranged to give the greatest rigidity at the same time that it presents the least possible surface to disturb the even flow of the wind, and this erection should be in a level open field, at least a hundred yards from any trees.

Previous to deciding upon the height to be adopted, and really the sooner the better, if our observations are to be of practical utility, a series of instruments must be erected on isolated poles in some very open place, at heights ranging from 1 or 2 ft. to the greatest which may be found practicable, perhaps somewhat as follows:—2, 10, 20, 40, 60 ft. Five anemometers thus mounted would, we believe, be of more real use than any dozen now at work.

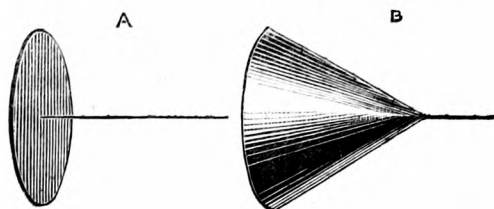
There is another point of which no observations are made, and none worth recording could be made on any existing observatory. We refer to the inclination of the wind. We suppose no one who ever thought much about it believes that the wind always, or even generally, blows exactly level; and if it does not, what becomes of pressure anemometers whose plates are always so set as to act against an absolutely horizontal wind? Evidently, whenever the wind has an upward or downward tendency, these plates must indicate less than the truth. We believe that one instrument intended for the determination of this element is still in existence at Nottingham, but we are not aware that any results have been published. Some ten years since the British Association granted to Prof. Hennessey two sums of £13 and £20 respectively for the construction of apparatus to test this question, but we cannot find that even "progress" was ever reported.

We are extremely glad to hear that the experiments made many years since by Mr. Glaisher have lately been repeated in a modified

form under the direction, we believe, of the Meteorological Committee. We expect our opticians to do much for us, and are not disappointed, but there are some things which it is not reasonable to expect, and one of them is, that they should test all the anemometers they sell. There are two reasons against it, but as one is fatal, the other need not be mentioned. The fatal one is, that the testing could not possibly be carried out properly in the heart of a busy city. Indeed, it is not easy to test anemometers even in the open country, for if they are near enough to be in the same current they will mutually influence their readings. Mr. Glaisher's experiments were, we believe, made by attaching an anemometer to the end of a long arm, rotated horizontally by manual power; those recently conducted consisted in attaching outriggers to a very large "merry-go-round," driven by steam, so that the anemometers were on radii of a circle of about 50 ft. in diameter. This could be rotated at such a velocity that the cups were driven at we should think thirty miles an hour, and as the distance travelled was of course known accurately, the results when published will be of considerable importance.

There are several other points to which we desire to call attention, but they must be dismissed more briefly. We do not think that the indications of the barometer have been sufficiently attended to, when attempts have been made to compare the records of pressure and velocity of anemometers. It is probably true that the effect of different barometric pressures is not sufficient to account for the apparently hopeless irreconcilability of the two classes of instruments. Still, it must not be forgotten that with an ordinary English cyclone the barometer will not infrequently be at 28 inches with a S.S.E. wind, and considerably above 30 with one from N.E. Evidently with the barometer at 28 inches, the density of the air is one-fifteenth less than when it is at 30 inches, and, therefore, the pressure exerted by a wind of any velocity will be one-fifteenth (say 7 per cent.) less than with the higher barometer.

Mr. Cator in his anemometer has avoided one great evil of pressure instruments—viz., the deterioration of springs, for he has done away with them entirely. But he has introduced a new principle, which either he or some of our authorities should first have tested. Hitherto all the surfaces exposed for the purpose of receiving the pressure have been plane metal surfaces, like Fig A. Mr. Cator, however, has backed



his plate with a cone, as in Fig. B. We think that these two forms should be strictly compared.

The best proportion for cups was, we believe, approximately determined by Mr. Stow, but the best size for pressure plates is unknown.

Again, there is the very important question of the relative merits of vanes and fans for keeping the plates at right angles to the direction of the wind. We need hardly remind our readers that it is absolutely essential to the accurate measurement of pressure that the surface acted upon should be exactly perpendicular to the direction of the wind acting upon it. We have already stated that this is not provided for with reference to a vertical plane, and that the force of all except absolutely horizontal winds is understated. At least equal inaccuracy prevails with reference to direction, for it is obvious that, except when a high pressure occurs from exactly the point of the compass to which the vane is pointing, it is improbable that the vane will bring the pressure plate exactly to the right azimuth at the instant of greatest pressure, and if it does not, then again the wind acts obliquely upon the pressure plate. This evil may be produced quite as much by excessive facility of motion in the vane as by its sluggishness, for it will be as likely to produce error if the vane carry the plate too far as if it do not carry it far enough. For this reason an attempt was made to substitute a fan, or "windmill-governor," but we believe it was not regarded as satisfactory. We should like to see a simultaneous comparison of plates governed by the two methods.

In concluding these unconnected notes, we desire to express the hope that for the future the directors of leading observatories will not make attempts to improve the instruments under their care, but that somewhere, and by some body of experienced men (probably Kew is in all respects most suitable), all experiments should be tried. The former will render the records of our observatories available for comparison as regards secular questions. At present, with few exceptions, it is as useless to compare the records of one set of years with another as it is to compare those of different positions.

The latter proposal we think of extreme importance—far more than that of erecting instruments in fresh localities, for we should not only obtain the means of having all anemometers *properly* tested before erection, but we should also have a centre where all rational ideas upon the subject might be impartially examined, and where a store both of instruments and experience would soon be gathered, whence might finally be evolved an instrument which should be sound in principle and suitable for universal use. When this has been done, we trust it would be unanimously accepted, that very stringent rules would be framed for its mounting and management, descending even to the minutæ of cleaning and the kind of oil to be used, and then we should have that which at present seems so distant—comparable anemometric observations.

INDIAN METEOROLOGY IN PARLIAMENT.

We are very glad to see that this extremely important subject has been taken up by Mr. Egerton Hubbard, who brought it forward on

May 8th, in a short speech which commanded the attention of the House, and in response to which Lord G. Hamilton agreed to produce all the despatches moved for, and added that Lord Northbrook intended to give full consideration to it, and to organize a complete system of meteorological registration.

We believe that the following may be regarded as an accurate report of the remarks upon the subject.

Mr. E. Hubbard rose to call the attention of the House to page 30 of the "Abstract of Report of Surveys in India," in which it was stated that "the question of the organization of a Meteorological department in India is still under consideration—the despatch from the Secretary of State on the subject, dated the 18th May, 1871, and enclosing the report of the committee of the Royal Society, not having yet been answered." The hon. member asked the Under Secretary of State for India, whether he would have any objection to laying upon the table all despatches which had passed to and from the Government of India upon the subject during the last five years. He stated that his own attention was first directed to the matter by a letter which appeared on November 3rd, 1873, in the *Daily News*—a paper to which the country was indebted for most talented criticisms in relation to the famine in India (hear, hear). The hon. member referred to the present state of meteorology in India, and to the advantages which would result from a knowledge of the rainfall, and of the temperature of different parts of the country; pointed out how much the officials in India were indebted to Meteorology for indications as to the present famine, and how important it was that India should have a good meteorological department. He expressed the hope that the Under Secretary of State would cause additional Blue books on this subject to be printed, seeing that the only information which the public could obtain was from the works of Mr. Clements Markham, the distinguished secretary of the Royal Geographical Society. The hon. member concluded by moving for all the despatches on this subject to and from the Indian Government during the last five years.

Lord G. Hamilton said that he had no objection to laying upon the table the despatches for which the hon. member had moved. Lord Northbrook had stated recently that he intended to give full consideration to the question of organizing a complete system of meteorological registration, and there was reason to believe that provision had been made for the necessary expenditure, in the Indian estimates for 1874-5 (hear, hear).

Those of our readers who are acquainted with the state of Indian meteorology will agree with us that nothing could have been more felicitous than the above brief remarks. We trust that few, if any, more years will elapse before this great subject is finally decided; and several remarks in the recent papers prepared for the Indian office by Mr. Markham, gives us every reason to confidently expect such an issue. We refer to such paragraphs as the two following:—

"Indian administrators are beginning to be impressed with the great impor-

tance of meteorological observations to agriculture ; and a general system of inter-comparable registration is being introduced."

"The Lieutenant-Governor of Bengal is impressed with the connection between meteorological registration and agriculture, and considers that there is much scope for enquiry as to the effect of peculiar climatic conditions on health, and on the crops. Little is known of the course of the monsoons, of the circumstances under which the summer rainfall is thrown sometimes on the East, sometimes on the West of the Bay of Bengal, is sometimes abundant in Bengal and scanty in the North-west provinces, and sometimes, as in 1872, almost deserts Bengal and falls in Northern India. The questions whether the rainfall of Northern India is more connected with rain-bearing winds coming from Bengal and deflected by the Himalayas, or with those coming up from Western India, and whether the S.E. winds in Bengal, towards the end of the rainy season, and in October, have any connection with the currents which cause the N.E. monsoon falling on the S.W. coast of the Bay of Bengal, will be solved by the efforts of Meteorologists, with data carefully registered over a series of years. Mr. Blandford is already able to give a tolerably complete notion of the general barometric pressure over Northern India, throughout the year, as well as of the distribution of the mean temperature, deduced from observations extending over four years. The annual changes in temperature appear to correspond in general with the distribution and changes of mean pressure ; the areas of low temperature coinciding with those of high pressure. As these investigations advance, light will also be thrown on the normal law of the monsoons and of their anomalies, with respect to the distribution of rainfall, and its variation in different years ; and eventually a very much more complete knowledge will be acquired of laws, which, in their influence on the crops, have a direct bearing on the well-being of the people."

Any one who doubts the necessity of the prompt adoption of some well-considered scheme for the utilization of present and past work, for avoiding superfluous observations in the future, need only carefully read Mr. Markham's capital article on "Meteorological and Tidal Observations," which we may, *en passant*, quote as a very exhaustive, and to meteorologists, indispensable summary of the bibliography and history of meteorology for nearly a hundred years, as well as an accurate record of matters as they stood in 1870. While we estimate highly what has been done, and is still continued by Messrs. Blandford, Chambers, Pogson, and others, and trust that every encouragement will be extended to them, we certainly do think it most desirable that all the systems of meteorological registration in India should be brought into absolute uniformity under some one individual or body. At the same time, it is equally necessary not to bury the individuality of such men as those above-mentioned.

The observations must be made with absolute identity, and the results must be uniformly worked out and printed, but at the same time it is most desirable that the country should still have the advantage of the individual and personal views of the gentlemen in local charge of the various systems. The public require (1) absolutely comparable data from all parts of India ; (2) results deduced from these data by the most able men whose services it is possible to enlist ; (3) that these publications be not under any circumstances allowed to fall in arrear.

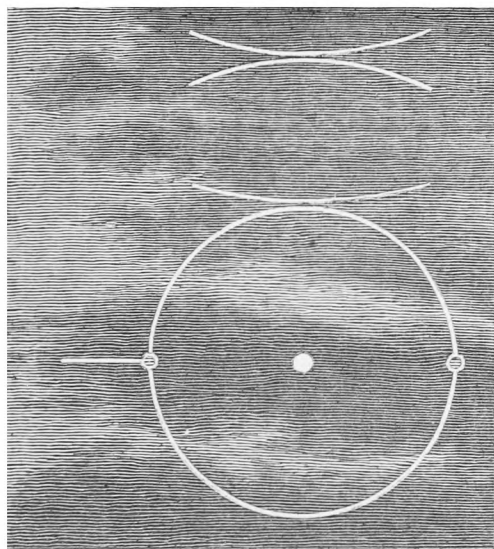
From Mr. Hubbard's question it appears that the Meteorological Committee have been consulted as to the organization suitable for India, and it would seem that their report will be among the papers which Lord G. Hamilton has promised. We shall look for it with considerable interest, and return to the subject after its perusal.

CLOUDS, PARHELIA, &c., ON MAY 1st.

To the Editor of the Meteorological Magazine.

SIR,—I jot down the following notes in the hope that they will prove of interest to some of your readers. I do not think that many meteorological observers have often seen fine examples of parhelia, or mock suns. Certainly, although I have been in the habit of watching the sky with some care for ten years, I have never been fortunate enough to see such phenomena before this month.

About 5 p.m. I was sitting near a west window watching the operations of a queen wasp in my garden, when I chanced to look skyward. A bright prismatic fringe lay on a cloud in the S.W. at an altitude of some 30° . On going outside I readily made out the complete solar halo of about 22° radius, the lower portion being extremely faint. At each of the opposite points where the horizontal diameter cut the halo there was a mock sun: they were much less bright than the real sun, smaller, and very ill-defined. About 60° above the sun's centre there was a coloured arc (the red towards the sun), perhaps 40° degrees in length, its centre being near the zenith. In contact with the lowest point of this there was another coloured arc, having the sun for its centre. Lower down, and in contact with the first-named halo, there



was also a coloured arc, with its centre above, and this arc also was about 40° in length. The southern mock sun was much brighter than that towards the north, and in no part of the halo was the colour so fine as near these suns. A bright white beam shot out some 10° beyond the southern mock sun. The thin clouds which prevailed in the west were hidden about 5.45 p.m. by dense white clouds at a lower level brought over by the N.E. wind.

At 8 a.m. to-day the clouds nearest the earth's surface were moving

from the N.E. ; higher there was a stratum of cloud moving from the N.W.

At 7 p.m. long lines of beautiful white fibrous clouds lay across the sky from N.W. to S.E., diverging from both points to the zenith. The fibres of which they were composed lay at right angles to the length of the clouds. The fibrous structure soon gave way to small closely-packed cirro-cumuli. These clouds were all moving slowly from N.W. to S.E. Traces of similarly disposed clouds could be seen in the full moonlight about 11.30 p.m.

Yours very truly,

JOSEPH GLEDHILL, F.G.S., &c.

P.S.—Halos were seen on twelve days in April last.

MEASUREMENT OF SNOW.

To the Editor of the Meteorological Magazine.

SIR,—Having had some experience in the management of rain gauges, and knowing that snow measurements are interesting to you and your readers, I thought it worth my while to make, as far as I was able, a note of the fall of rain and snow during the winter months at this place. I have taken much trouble with it, and the measurements are strictly accurate.

In my letter last month on the climate of this place, I mentioned that I had two gauges at work ; one (termed in Table, rain gauge), an ordinary rain gauge, a copper cylinder ; the other (termed snow gauge), an iron japanned cylinder. Both have funnels 5 in. diameter, 4 in. deep, but the copper one has only a rim half-inch deep, the iron one has a perpendicular rim 6 in. deep before the funnel commences. For the glass bottles sent with them as receivers I substituted tin ones, as glass would not have stood the frost here for a moment. The rims of the gauges were perfectly level with each other, 18 in. from the ground, and 9 in. apart from each other.

I do not give the exact dates of fall, as I measured at all times, when possible, the moment the snow ceased for the time, to avoid chance of evaporation. I have endeavoured to give the direction of the wind as far as, in this still air, I could ascertain it, from the movement of the clouds during the fall, but, unless otherwise specified in the remarks, the fall was in fact in a calm.

The snow *usually* falls here in the finest and most minute crystals. This led me to make further experiments, viz., 1st, with the light crystal snow, No. 1, in Table III. ; 2ndly, denser snow, falling in large flakes, No. 2; and 3rdly, snow which had lain upon the ground a day or two with a hot sun upon it, No. 3. The average yield of water from a depth of 3 in. of snow in each case (taking the mean of the ten measurements) was, in the 1st case, .224; 2nd, .299; 3rd, .742. This last is, probably, of no value, but as I made the observation I insert it. These measurements were made by inverting snow gauge funnel in the snow, slipping a piece of zinc underneath, placing the snow in so many covered cups, melting in a warm room, and then

measuring. I may add that all measurements in the tables were made with the same measuring glass.

TABLE III.—10 *Measurements with inverted funnel of 3 inches of Snow.*

1	2	3
Snow in fine Crystals.	Snow in large Flakes.	Old Snow.
in.	in.	in.
·220	·310	·770
·225	·260	·750
·220	·280	·730
·223	·320	·720
·227	·310	·780
·228	·305	·750
·220	·297	·735
·229	·298	·725
·233	·300	·740
·225	·310	·720
Means	·224	·299
		·742

The measurements, however, in Table II., were made by bringing the funnels into a warm room, covering the funnel, and placing the pipe in the measuring glass. Measuring by inverting the funnel is not satisfactory, because, unless the weather be very cold, the snow invariably melts for a short time before it begins to lie.

TABLE II.—*Total of Measured Snow.*

Snow Gauge.	Rain Gauge.	Measure.	Depth.
in.	in.	in.	in.
·100	·100	·080	1
1·130	·900	·600	6
·610	·420	·420	5
·570	·310	·500	7
·500	·200	·500	6
·450	·300	·430	5
·230	·120	·225	3
·250	·230	·230	3
·310	·200	·310	5
·130	·130	·130	2 $\frac{1}{4}$
·200	·150	·180	3
·210	·200	·210	3
·440	·440	·430	5
·722	·722	·652	7
5·852	4·422	4·897	61 $\frac{1}{4}$

I think it may fairly be inferred from the tables that a deep rim of 6 or even 8 in. would be an advantage to all gauges, and save the trouble I frequently have experienced of going out after dark to put down the snow gauge when snow has unexpectedly come on. In calm rainy weather, and when snow is not too deep for the rain gauge, both

TABLE I.

Date.	Snow Gauge. 5 in.	Rain Gauge. 5 in.	Measurement with Funnel inverted.	Depth in Inches.	Direction of Wind.	Force. 0-10	REMARKS.
	in.	in.	in.				
Oct. ...	0.430	0.430	...	...	S.W.	1	Steady R.
	.635	.635	...	...	„	1	do.
	.010	.010	...	...	N.E.	2	A shower.
	.320	.320	...	...	W.	1	S and R.
	.610	.600	...	...	„	1	S and sleet.
	.020	.020	...	...	„	1	do.
	.070	.060	...	...	S.W.	1	S and R turning to S.
Nov ..	.420	.420	...	...	W.	1	R.
	.400	.400	...	...	„	2	R.
	.700	.630	...	...	„	7	High wind, S and R.
	.180	.180	...	...	„	1	R.
	1.720	1.720	...	...	N.W.	2	R, S, sleet.
	.100	.100	.080	1	W.	1	S.
	1.130	.900	.600	6	N.W.	8	TS 4 a.m., with gale and heavy R turning to S.
Dec....	.110	.090	...	...	„	4	High wind, sleet.
	.390	.390	...	...	N.E.	1	R, freezing as it fell.
	.610	.420	.420	5	„	9	Violent gale, S.
Jan. ...	±.570	.310	.500	7	„	7	High wind, R turning to S.
	.015	.010	...	...	„	3	Slight S, melting in sun as it fell.
	.500	*.200	.500	6	„	2	4 hours' S.
	.015	.015	...	...	„	1	R.
	.010	.010	...	...	Calm	0	Slight S, melting as it fell.
Feb....	.050	.050	...	...	„	0	do. do.
	.450	*.300	.430	5	„	0	S in fine crystals.
Mar....	.050	.050	...	...	S.W.	1	R.
	.070	.070	...	...	Calm	0	S and R.
	.230	.120	.225	3	S.W.	6	High wind, 3 hours' S in fine crystals.
	.250	.230	.230	3	„	3	3 hours' S in fine crystals.
	.310	*.200	.310	5	W.	1	S during night.
	.130	.130	.130	2½	N.E.	1	Steady fine crystal S.
	.200	.150	.180	3	„	1	do. Strong wind for 1 hour.
	.210	.200	.210	3	„	1	S in night.
	.070	.070	...	...	N.	4	R.
	.145	.145	...	...	„	3	Showers of S and R.
	.040	.040	...	...	N.W.	4	do.
	.035	.035	...	...	N.	1	R.
	.270	.270	...	...	N.	2	R.
	.230	.230	...	...	N.W.	1	R.
April..	.020	.020	...	...	S.W.	6	3 hours' S and sleet.
	.440	.440	.430	5	Calm	0	8 hours' heavy S in enormous flakes, melting in gauges as it fell, but lying on old S and grass.
	.070	.070	...	...	„	0	3 hours' S and sleet.
	.040	.040	...	...	„	0	3 hours' small S.
April 5	.722	.722	.652	7	„	0	23 hours' S, melting in gauges as it fell, and lying after a time on grass.
	12.997	11.452	4.897	61¼			

* Gauge unable to hold the depth.

have worked together, but when snow falls *with wind*, and when it is a deep fall, the rain gauge does not catch what it ought. On the 4th January (marked in Table I. with a †), when the snow fell during a violent gale, I watched the two gauges for a very long time, and it was long before the rain gauge caught anything, the snow whirling round the funnel and out again—not so the gauge with the 6 in. rim. I do not think a single flake fairly in ever came out again. The fall began with heavy rain, and the result was as seen in table:—snow gauge, 0·570; rain gauge, 0·310; measurement of 7 in. depth, 0·500.

I cannot close this without mentioning an extraordinary change of temperature within the last few days. Friday, 3rd, there was a brilliant sun, heat intense, 74° in shade; the fields covered with flowers, snowdrops, crocus, gentian, soldanella, and numberless others. At 10 p.m. thermometer stood at 63°; at 4 a.m.; 4th, thermometer at 32°, with heavy snow, which has continued almost without interruption till 5 a.m. this morning. From 6 a.m. on Easter Sunday it never ceased for twenty-three hours; at the time I am writing, noon, the thermometer is 58°, and snow, nearly a foot deep at 9 a.m., is gone.

I am, Sir, truly yours, MICHAEL FOSTER WARD, F.M.S.
Rossinière, Canton Vaud, Switzerland, 6th April, 1874.

Meteorological Register taken at Mentone (Western Bay), Alpes Maritimes, France.

	January		February.		March.		April.	
Barometer—								
Highest reading	30·362e	22nd	30·432m	13th	30·365m	5th	30·190e	22nd
Lowest „	29·637m	18th	29·623e	17th	29·505m	11th	29·113m	14th
Hygrometer—								
Mean of degrees of dryness	2·38	..	4·30	..	4·70	...	4·21	...
Thermometer—								
Mean max. 4ft..	61·7	...	61·7	...	67·3	...	72·2	..
Absolute max...	68·8	31st	72·6	1st	74·8	1st	85·8	25th
Mean min.....	36·0	...	36·9	...	38·4	...	47·7	...
Absolute min...	27·6	7th	23·6	11th	29·6	13th	42·1	11th
Mean min. 6in. above ground.	34·9	...	35·9	...	37·5	...	46·9	...
Absolute min. „	25·8	7th	22·2	11th	27·5	13th	41·0	13th 16th
Rainfall—								
Total amount...	1·714	...	1·662	...	·570	...	6·270	...
Greatest in 24 hours	1·245	16th	·852	15th	·302	9th	2·350	4th
No. of days on which ·001 fell	4 days	...	4 days	...	3 days	...	7 days	...
Cloud—								
Mean amount...	3·8	...	4·9	...	3·6	...	5·4	...
No. of cloudless days.....	8 days	...	7 days	...	5 days	...	5 days	...

PHILIP WRIGHT. F.C.S.

APRIL, 1874.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 401 or more fell.	TEMPERATURE.						No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1860-5	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.	Camden Town	1.26	+ .13	.33	9	11	79.2	23	32.7	11	0	4			
II.	Maidstone (Linton Park).....	1.91	+ .69	.68	10	10	80.0	21*	30.0	1	7	...			
III.	Selborne (The Wakes).....	2.93	+ 1.43	1.23	4	10	73.0	27	27.5	30	2	7			
IV.	Hitchen	1.84	+ .84	.80	4	12	68.0	21	31.0	10†	4	...			
V.	Banbury	1.43	+ .27	.50	9	12	73.5	21	29.0	13	3	...			
VI.	Bury St. Edmunds (Culford).....	.69	— .06	.27	8	9	74.0	21	24.0	29	5	11			
VII.	Bridport	1.82	+ .34	.47	4	12	73.0	26	29.0	6	4	...			
VIII.	Barnstaple	1.89	— .12	.46	3	11	79.0	28	35.0	11	...	...	
IX.	Bodmin	2.56	+ .86	.47	8	17	72.0	25	34.0	11	0	0			
X.	Cirencester	1.59	+ .30	.48	9	12	...	...	...	...	...	...
XI.	Shiffnal (Houghton Hall)	1.17	+ .02	.44	2	13	71.0	26	30.0	11§	6	11			
XII.	Tenbury (Orleton)	1.59	+ .05	.42	2	13	76.0	21	29.2	11	7	8			
XIII.	Leicester (Wigston)	1.22	— .08	.46	9	10	80.0	21*	31.0	10†	4	...			
XIV.	Boston .....	.46	— .51	.15	13	8	76.0	21**	33.0	11	...	...	
XV.	Grimsby (Killingholme).....	.91	...	.32	9	8	72.0	21	34.0	6,11	0	...		
XVI.	Derby	1.26	— .17	.45	9	11	75.0	21	31.0	11	1	...			
XVII.	Manchester	1.00	— .76	.27	2	15	80.5	26	29.0	13	2	7			
XVIII.	York	1.28	+ .18	.33	13	8	72.5	21	33.0	9||	0	...			
XIX.	Skipton (Arneliffe)	2.95	— .09	1.30	2	14	...	...	...	...	...	...
XX.	North Shields .....	.72	— .59	.29	13	11	71.5	21	33.4	12	0	0		
XXI.	Borrowdale (Seathwaite).....	4.72	— 2.18	1.08	8	19	...	...	...	...	...	...
XXII.	Cardiff (Ely)	1.80	— .13	.25	13	12	...	...	...	...	...	...
XXIII.	Haverfordwest	2.34	+ .48	.40	8	14	74.1	27	32.2	26	...	9			
XXIV.	Rhayader (Cefnfaes).....	2.06	+ .17	.56	17	16	75.0	...	29.0	...	...	...
XXV.	Llandudno	1.41	— .09	.47	2	12	81.0	27	35.3	11	...	...	
XXVI.	Dumfries	2.12	+ .45	.67	2	15	74.0	27	30.5	13	3	9			
XXVII.	Hawick (Silverbut Hall).....	1.95	...	1.08	2	11	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill).....	1.29	...	.42	2	15	72.5	27	32.5	12	0	5		
XXIX.	Castle Toward	2.94	+ .44	.62	11	16	71.0	26	...	...	0	0		
XXX.	Leven (Nookton)	1.46	+ .21	.47	2	15	69.0	21	27.0	11	5	19			
XXXI.	Stirling (Deanston) .....	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Logierait	1.25	...	.26	1	12	74.0	29	31.0	1¶	...	...	
XXXIII.	Braemar	2.42	+ 1.02	.80	1	16	68.0	29	25.0	23	5	23			
XXXIV.	Aberdeen .....	.98	...	.21	15	12	66.6	22	32.5	12	0	12		
XXXV.	Portree	5.88	+ .61	.93	4	24	...	...	...	...	...	...
XXXVI.	Loch Broom	4.69	...	1.21	4	21	...	...	...	...	...	...
XXXVII.	Inverness (Culloden)	1.60	+ .13	.25	3	14	62.2	28	31.5	23	1	10			
XXXVIII.	Helmsdale	2.91	...	.58	20	20	...	...	...	...	...	...
XXXIX.	Sandwick	2.10	+ .36	.42	2	19	56.5	29	35.4	4	0	2			
XL.	Caherciveen Darrynane Abbey	3.26	...	.47	12	18	...	...	...	...	...	...
XLI.	Cork	1.28	...	.43	12	9	...	...	...	...	...	...
XLII.	Waterford	2.61	+ .38	.54	7	17	64.0	19*	32.0	11	1	...			
XLIII.	Killaloe	3.46	+ 1.33	.50	2,12	18	75.0	27	28.0	11	5	12			
XLIV.	Portarlinton	1.61	— .41	.28	3	20	70.0	28	29.5	10	2	...			
XLV.	Monkstown, Dublin	1.11	— .53	.25	12	12	74.0	27†	28.0	11	3	...			
XLVI.	Galway	3.07	...	.53	1	19	77.0	29	31.0	12	2	...		
XLVII.	Ballyshannon	3.03	...	.65	2	23	58.0	26*	32.0	4	1	...		
XLVIII.	Waringstown	1.41	...	.26	12	13	76.0	27	28.0	11	7	10		
XLIX.	Edenfell (Omagh).....	2.45	...	.33	2,7	21	69.0	26*	27.0	11	7	...		

* And 27. † 28. ‡ 12. § 13. || 11, 13. ¶ 6, 11. ** And 23.

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

METEOROLOGICAL NOTES ON APRIL.

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 or Snow.

ENGLAND.

CAMDEN TOWN.—Very heavy H for a short time, commencing noon, on the 11th.

LINTON PARK.—The beginning of the month not remarkable; heavy rain on 10th and 12th, but none after the 14th, the last 16 days being very dry and fine, in fact, often as hot as June, so that vegetation made great progress, the hawthorn being in bloom on the 27th, which is earlier than I have any record of, except in 1857 and 1868. Nightingale heard on 19th, and the cuckoo on the 20th, which is later than the average for both. High wind on 2nd and 3rd, and slight frosts on 1st, 4th, 6th, 7th, 9th, 11th and 30th. Bar. generally high and steady; altogether a fine month.

SELBORNE.—T and L at 7 p.m. on 2nd; H at 1 p.m. on 3rd; T and L and high wind at 7 p.m. on 4th. A fine summer's day on 27th; ther. in shade 73°. The ther. max. during the nine days from the 20th to the 28th averaged 66°·5; a sudden fall in the temperature took place from the highest, on the 27th—73°, to the lowest, on the 30th—27°·5. Wind very high the beginning of the month, chiefly from S.W.; the last week mostly N.E. Blossoms on fruit trees most abundant, and spring flowers unusually early. (As a general rule I find that there is frost on the grass whenever the temperature 4 feet above it falls to 34°·5.)

BANBURY.—Singular yellow gloom on 12th. Apples in bloom on 15th; hawthorn first in bloom on 19th. Last twelve days of the month very warm and dry, with S.E. winds.

CULFORD.—An exceedingly dry month; high wind on 2nd. On the 19th the weather became suddenly warm, with wind from S.W.; the max. temperature, 74°, occurring on 21st; on the 25th the wind became easterly, and the weather became again cold, the min. temperature, 24°, occurring on the 29th. Westerly winds prevailed during twenty days, and easterly during ten days, the latter occurring at the end of the month. The average temperature of the month was 49°·4. The nightingale was heard here as early as the 5th, swallows were seen on the 21st, and the cuckoo was first heard here on the 27th.

BRIDPORT.—The first half of the month was remarkable for heavy gales, and the variations in the bar. On the 2nd, heavy gale all day, and from 10 p.m. to 3 a.m. furious gale, with T and L. 3rd and 4th, gales. Swallows seen on the 1st, cuckoo heard on 16th; oak in leaf on 22nd, lilac and chesnut in bloom on 23rd, May on 27th, laburnum on 30th.

BODMIN.—Mean temperature of the month 54°·1, being 3°·4 above the average.

SHIFNAL.—The stormy weather with which March closed lasted till the 4th inclusive. R fell (excepting the 1st and 3rd) on the first twelve days, from which day, with the exception of the 17th and 18th, it continued dry to the end. The nights were cold, with frequent frosts, and the day temp. scarcely ever exceeded 55° till the 21st, when a sudden rise to 70° took place, the difference between the night and day temp. being 30°; this lasted to the 29th, when cold easterly winds set in, W. and N.W. having previously prevailed. Damson in blossom on 3rd, wild cherry on 9th and pear tree in blossom on 17th; sand martins seen on 10th, chaff chaff heard on 11th, cuckoo heard on 24th, and landrail on 26th; white butterfly seen on 14th; first queen wasp seen on 20th.

ORLETON.—The first half of the month cold and rainy, with frequent frosts; from the 15th to the end of the month generally very bright, warm, and pleasant. Violent wind on the 2nd; distant T heard on 10th and 13th, and L seen on the latter day. A solar halo at 5 p.m. on the 28th. The mean temp. about 2°·4 above the average of the month. Cuckoo generally heard on 22nd, chaff chaff first seen on 16th, swallows and white throat on 21st; damson trees in full blossom on 7th, and early cherry trees about the 12th.

WIGSTON.—Wind stronger than usual for April during the first ten days or fortnight, since which the temperature has ranged high, with great calm.

ness. Vegetation was more forward at the end of the month than I ever remember it; more leaf on the oak than has frequently been on the 29th May; corn looking well.

GRIMSBY.—Very dry month. The rainfall of the last six months only 5·61, nevertheless the thorough pulverization of the soil by frost in winter has in a wonderful degree retained its moisture. Pastures and corn crops looking very well. High wind on 1st, 2nd, and 3rd; distant T heard on 12th; first swallow seen on 21st; max. temperature of month, 72°, on the same day; apple trees began to blossom on 23rd; willow warbler arrived on 24th; cuckoo heard on 26th.

MANCHESTER.—The month of April had a rainfall greatly below the average, and the latter half of the month was marked by very excessive temperature for the season.

NORTH SHIELDS.—Apple, pear, and currant trees in blossom on 29th.

WALES.

HAVERFORDWEST.—Very heavy weather during the first four days, terrible gale on 2nd and 3rd, with sad casualties round the west coast. One vessel, 2000 tons burthen, totally wrecked near the Smalls lighthouse twenty miles off St. David's Head; all souls lost; the vessel drifted in keel uppermost. The force in this gale between 11 and 12. Heavy weather again about the 14th; after this date the wind shifted easterly, and no rain of importance fell. A remarkable period of heat like Midsummer from 24th to 29th; less frost than usual.

CEFNFAES.—The month fine; no R after the 18th; slight frosts at night; wind S.E. and N.W. Cuckoo heard on the 20th.

LLANDUDNO.—After the first two days a remarkably dry month. A swallow seen on Good Friday, and Cuckoo heard on 24th. S on distant hills from 3rd to 17th. Monthly rose and lilac in flower on 16th; hawthorn on 19th; horse chesnut on 25th, and laburnum on 27th.

SCOTLAND.

DUMFRIES.—The month opened stormy, with S on the hills, and the first half of the month showery and cold, but the latter half very fine; and after the 18th vegetation made great progress; fruit trees in blossom, and a great display of bloom. T on 23rd and 26th; S on 1st and 4th. Rainfall above the average; temp. also above the average. Cuckoo heard on 23rd; swallow very rare.

SILVERBUT HALL.—Very stormy winds on 1st, 2nd and 3rd, and hills covered with S till the 5th. The rainfall on the 2nd was 1·08 in., which brought out the Teviot in full flood. T in the E. in the afternoon of 11th; sharp frosts on the nights of the 22nd, 26th and 29th. There has not been such an appearance for fruit seen here for many years—every tree and bush is literally covered with blossom.

ANNANHILL.—Principal winds W. and S.W., usually light and moderate. On 2nd S.W. gale, 56 miles an hour with heavy squalls of R and wind; rest of month calm. Ozone scarce; a few frosty mornings during the month, but on the whole fine, and favourable for out-door work; usually dry, and land in good condition for sowing and planting, the high temp. having brought fruit blossoms and foliage of all kinds very forward; pastures abundant. Health statistics much more favourable.

CASTLE TOWARD.—The first half of the month dull and wet; but from the 17th it was in every way favourable for out-door work; the clearing of ground for green crops well advanced; potato planting uninterrupted. The grasses and wheat look well; every appearance of an abundant supply of fruit.

NOOKTON.—2nd and 3rd, stormy, on the latter day TS.

BRAEMAR.—A genial month; vegetation and agricultural work in a very forward state—two weeks more forward than usual.

ABERDEEN.—Mean bar. and rainfall below the average; mean temp. 2°·9 above it. A month of very fine, mild, dry weather. S.W. and N.W. winds more prevalent than usual.

PORTREE.—The early part of the month cold and stormy, the latter part fine. Seed sowing and potato planting nearly finished. Cattle and sheep healthy and thriving well.

LOCHBROOM.—The first portion of the month stormy, but from the middle the weather became as mild and genial as could be wished. A finer lambing season we never remember, the consequence is that very few losses have occurred, even in these highland wilds.

SANDWICK.—April has been rather warmer than the average; the first three days were very stormy and rather wet, but the latter part was dry and favourable for agricultural operations. The red flowering currant and gooseberry were in flower on the 4th. Hills white with snow on the 17th; aurora on three nights.

IRELAND.

DARRYNANE ABBEY.—Heavy gale on night of 2nd; 6th to 12th moderate westerly winds. Hurricane on the 13th, commencing at S.W., and veering by N.W. to N.; squalls terrific, and awful sea; such a storm has not been known here for years; those who remember the storm of January, 1839 say this was quite as bad. Remainder of the month light variable winds; 26th to the end very fine. H on 3rd 4th, and 5th; frost on 11th and 12th.

MONKSTOWN.—An unusually warm, genial month, especially the latter half.

BALLYSHANNON.—The month on the whole has been a fine one, and favourable for agricultural pursuits, vegetation has made considerable advances, and the summer promises to be a fine one. Easterly winds prevailed during the greater part of the month. At 6.30 p.m. on 21st a gale of unusual violence swept across the bay from S.S.W., duration about two hours.

WARINGSTOWN.—A remarkably dry and warm month.

OMAGH.—First fortnight extremely raw, cold, and unsettled; farming operations almost at a standstill; third week finer, fourth week remarkably fine and warm, causing great vegetation.

BOOKS RECEIVED.

AUSTRIA.

Bericht uber die Verhandlungendes internationalen Meteorologen.—Congreses zu Wien. Vienna, 1873; 8vo.

Jelinek, Dr. C. Jahrbucher der K.K. Centralanstalt fur Meteorologie und Erdmagnetismus. Jahrgang, 1871. 4to, Vienna, 1873.

BARBADOES.

Rawson, The Hon. R. W., Rainfall Returns and Diagrams. Oct., 1873—Mar., 1874.

DENMARK.

Bulletin Météorologique du Nord, publié par les Insituts météorologiques de Norvège, de Danemark et de Suède. Oblong 4to. Jan.—March, 1874.

Hoffmeyer N., Vejledning til Benyttelsen af det Meteorologiotre Instituts daglige Vejrmæddeløser. Copenhagen: George Chr. Ursins Efterfølger, 1873; 4to.

Hoffmeyer Capt., L'Institut Météorologique Danois. Daily observations November and December, 1873; oblong 4to.

FRANCE.

Annuaire de la Société Météorologique de France, 1872. 8vo.

Annuaire Météorologique et Agricole de l'Observatoire de Montsouris. Pour l'an 1874.

Belgrand M. E., et Lemoine M. G. Observations sur les cours d'eau et la pluie.

Lemoine M. G. and Belgrand M. E. Résumé des Observations centralisées par le service Hydrométrique du bassin de la Seine, 1871—2.

Poey A., sur les rapports entre les taches solaires et les ouragans des Antilles, &c.; 4to.

GREAT BRITAIN.

- Aldridge E. G., Temperature and Rainfall at Ventnor, 1852-1873; single sheet, 4to.
- Airy Sir G. B., Greenwich Observatory Magnetical and Meteorological Observations, 1871; 4to.
- Buchan, A., F.R.S.E., On the Destruction of Seedling Ash Trees by Frost near Edinburgh in April, 1873.
- Croll, James. On Ocean Currents. Part III. On the Physical Cause of Ocean Currents. [Excerpt from Phil. Mag. 8vo.]
- Dines, G. Diagram of the Rainfall in the London District during 60 years, 1813-72.
- Everett, Prof. J. D., M.A., D.C.L. On Mirage. [From Proceedings of the Belfast Nat. Hist. Society.] 8vo., 1874.
- Fenland Meteorological Circular. Edited by S. H. Miller, F.R.A.S., F.M.S. Nos. I. and II. Feb. and March. 4to.
- Glaisher J. W. L.. Report of Committee on Mathematical Tables [British Association Report]; 8vo.
- Kew Committee, Report of, for the year ending October 31st. 1873 [Proc. Roy. Soc.]; 8 vo.
- Mackenzie J. Ingleby, Meteorology of Sidmouth in 1872 [Transactions Devonshire Association, 1873]; 8 vo.
- Marlborough College. Report of the Nat. Hist. Society, 1874. 8vo.
- Meteorological Committee Quarterly Weather Report, Oct. to Dec., 1872; 4to.
- Ditto ditto ditto Jan. to March, 1873; 4to.
- Morgan, T. M. On a Source of Error in Mercurial Thermometers. [From Proc. Lit. and Phil. Soc., Manchester] Vol. XIII. No. 7. Session 1873—4.
- Report of the Proceedings of the Meteorological Congress at Vienna. Translated by order of the Met. Com. London, Stanford, 1874. 8vo.
- Rugby School. Report of the Nat. Hist. Soc., 1873, 8vo. 1874.
- Silver, S. W., & Co. Australia and New Zealand. Small 8vo. 1874.
- Stevenson, R. L., Thermal Influence of Forests [Proceedings Royal Society Edinburgh]; 8 vo.
- Sykes, E. J., Report of the Devonshire Hospital for the year 1873; 8 vo.
- Wheeler Rev. R. F., and Hoppell Rev. R., Tyneside Naturalists' Field Club Report for 1872 [Natural History Trans., Northumberland]; 8 vo.

HOLLAND.

- Ballot, Dr. B. Nederlandsch Meteorologisch jaarboek voor 1873. Oblong 4to. Utrecht, 1873.

ITALY.

- Ragona, Prof. D. Sulle variazioni non periodiche della Pressione atmosferica. Folio. Roma, 1874.

MAURITIUS.

- The Overland Commercial Gazette, April 4th, 1874.

NEW ZEALAND.

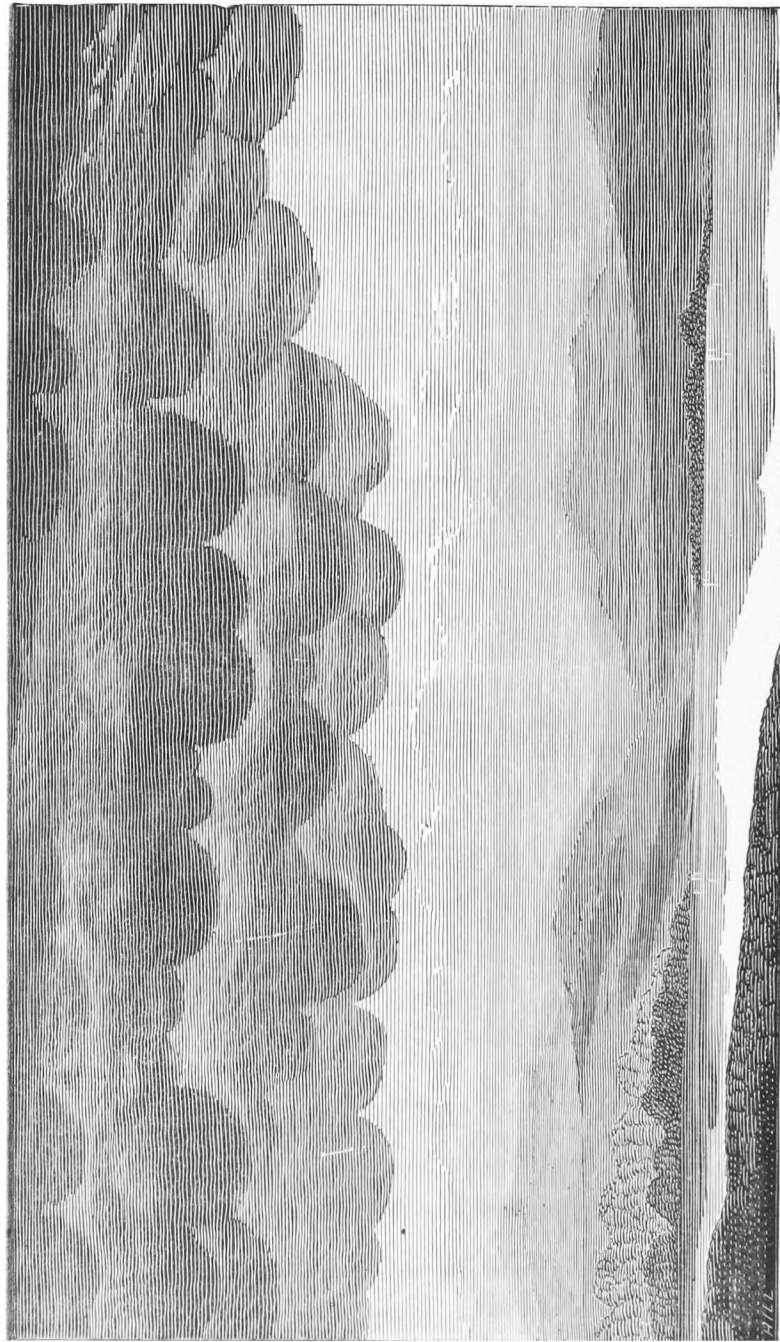
- Abstract of Meteorological Observations, New Zealand. Jan.—Nov., 1873.

PRUSSIA.

- Karsten, G. Ueber die wissenschaftliche der Ostsee und Nordsee. [Excerpt Poggendorff's Annals].
- Karsten, G. Tafeln zur Berechnung der Beobachtungen an den Küsten-Stationen und zur Verwandlung der angewendeten Maasse in Metrisches Maass. Small 8vo. Kiel, 1874.
- Karsten, G. Ergebnisse der Beobachtungs stationen an den deutschen Küsten über die physikalischen Eigenschaften der Ostsee und Nordsee und die Fischerei, Jan. and Feb., 1873. Oblong 4to. Berlin, 1874.

UNITED STATES.

- Journal of the Telegraph. No. 146 and 150—155.



THE POCKY CLOUD, AS SEEN FROM ELTERWATER, MAY 7, 1874.

[See page 75.]

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CL.]

JUNE, 1874.

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

METEOROLOGICAL OBSERVATIONS AT ROSSINIÈRE.

[Col. Ward, who has been passing the winter at Rossinière, having obtained a copy of Prof. Dufour's memoir, has translated it, converted all the values into English measures, and kindly placed it at our disposal; we have no doubt that our readers will agree with us that it is an interesting paper, worthy of translation and of the space which it occupies.—Ed.].

Summary of Meteorological Observations made at Rossinière, Canton Vaud, Switzerland, by MESSRS. HENCHOZ, between the years 1799 and 1850.

BY PROFESSOR CH. DUFOUR, of Morges.

If there be a Pastor who has left behind him a revered memory it is surely Mons. Henchoz, who was for more than half-a-century Pastor of Rossinière, in the "Oberland" of the Canton Vaud.

During this long space of time Mons. Henchoz occupied himself, not only in the care of his flock, but also in certain scientific studies, for which a solid education well fitted him. Amongst his labours we must notice his Meteorological Observations, made from March 1st, 1799, to December 31st, 1834, and continued by his nephew from that time till the end of 1850, that is to say nearly to the time of his death. There are only wanting the records of a few months of 1828, and of the year 1829; either the observations were not made, or the records are lost.

The registers of Mons. Henchoz, kept with great regularity, show the temperature three times daily, viz: sunrise, 1 or 2 p.m., and 10 p.m. They show also the height of the barometer (but without temperature of mercury), the state of the sky, and the direction of the wind. At the end of each month are several observations of periodical phenomena, such as the state of the crops, budding of trees, the appearance of certain birds, &c. These manuscripts contain more than two hundred thousand indications of various kinds.

With regard to the temperature, it is to be regretted that Mons. Henchoz's thermometer has not been preserved, for one knows that the graduation of these instruments is not so exact as not to require certain corrections to ascertain the true temperature. The observations, therefore, lose much of their value. At the same time they are useful for comparison between themselves, the whole having been made with one instrument. We can tell, for example, the moment of extreme heat and cold in the first half of the 19th century; they serve also to compare the temperature of one year with another, &c. Besides, before Meteorology made the progress it has of late, such care was not taken in the position and comparison of thermometers. Mons. Henchoz made his observations as De Luc made his at

Geneva, and as they were, doubtless, made in many other places. They are, too, not the less valuable as being, probably, the only ones made in Switzerland at that time. After all it is better to have the daily temperature of the air to within a few tenths of a degree than not to have it at all.

Rossinière is situated on the valley of the Sarine*, which there runs E. to W. in latitude $46^{\circ}28'$ N., longitude $4^{\circ}45'$ E. of Paris, or $7^{\circ}5'$ E. of Greenwich. Its height is 1886 feet above the Lake of Geneva, or 3117 feet above the sea.

TEMPERATURE.—The thermometer was placed outside a window on the N. side of the Parsonage, about 16 feet from the ground. I know well that *now* such a position would be criticised, but it must be remembered that at that time thermometers were generally so placed, and thus Mons. Henchoz's thermometer was under the same conditions as others of the period.

For want of time I have not been able to calculate the mean temp. of every day and every year from 1799 to 1850. I am compelled to limit myself to the means of five years, viz: 1814 to 1818. Taking as the mean temp. of the day the mean of the three temperatures before named, I have composed the following table :

Years.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.Mean.
1814.....	29.7	22.5	34.9	48.4	51.3	57.2	62.6	61.2	54.0	46.4	41.4	35.8	45.43
1815.	20.7	37.8	41.0	48.2	53.8	57.9	60.1	59.4	57.6	50.0	33.3	27.5	45.59
1816.....	28.6	29.1	37.2	44.1	51.6	54.9	57.0	57.2	55.2	51.8	35.4	28.8	44.24
1817.....	34.0	37.2	37.6	38.7	50.9	62.8	60.3	60.3	61.2	42.6	41.2	29.5	46.17
1818.....	33.3	35.4	39.4	48.9	54.7	60.2	65.5	62.1	56.7	48.9	44.1	30.6	48.30
Gen. Mean.	29.2	32.4	38.0	45.6	52.5	58.6	61.1	60.0	56.9	48.0	39.1	30.4	45.96 (say 46°)

The mean temperature, therefore, of Rossinière, from 5 years' observations, is $46^{\circ}\frac{1}{2}$. That of Geneva, according to Mons. Gauthier, in a memoir published in the "*Cahier de la Bibliothèque Universelle*," of January, 1843, is 49° ; and only 48° according to a memoir published in 1851, by Mons. Plantamour, and entitled, "*Résumé des Observations Thermométriques et Barométriques faites à Genève et au Grand-St.-Bernard*."

Taking even the higher figure, namely, that of Mons. Gauthier, it results that the mean temp. of Rossinière is 3° less than that of Geneva, a difference which one would have expected to be greater considering the difference of altitude between the two localities. According to the above quoted memoir of Mons. Plantamour the temperature diminishes between Geneva and St. Bernard $1^{\circ}.8$ for each 623 feet of elevation. Adopting this law, the temperature of Geneva ought to be $5^{\circ}.4$ above that of Rossinière, or, in other words, the mean temp. of Rossinière ought to be 43° or 44° instead of 46° .

I admit that 46° cannot be considered perfectly exact as the mean temperature of Rossinière, in consequence of the uncertainty as to what correction should be applied to Mons. Henchoz's thermometer; and also that 5 years is too short a time to be able to ascertain correctly a mean temperature. It could well happen also that there is a difference between the *theoretical* and *real* temperature of Rossinière, and that it has a higher mean than could be supposed, judging from the observations at Geneva. In fact, situated in a valley opening E. and W., it is protected from the N. wind, which can only blow, as it were, *indirectly*, a circumstance which might contribute to make the climate milder. Again, the figures

* N.B.—The valley is from half to three quarters of a mile broad, the mountains on the N. being from 3 to 4000 feet high and those on the S. from 1 to 3000 feet. It is shut in at either end by a gorge, that on the E. being about 1 mile, that on the W. about 2 miles distant. The parsonage stands about 260 feet above the level of the Sarine, on its northern bank.—M. F. W.

† There is another point, which Prof. Dufour has overlooked, viz., the fact that a series of observations made at sunrise, 1 or 2 p.m., and 10 p.m., if averaged without correction for diurnal range give too low a temperature by about half a degree Fahrenheit. This brings the mean up to $46^{\circ}.6$, which is certainly high for so elevated a locality.—Ed.

given for Geneva are, perhaps, exceptionally low, for Mons. Plantamour found that, from observations made at Bâle and Turin, the temperature of Geneva should be 2° greater than that observed; and he does not hesitate to attribute this depression to the proximity of the lake, which raises by 2° the winter temperature and depresses that of the summer by 4° , causing a mean diminution of 2° .

At Rossinière, no such cause existing, that locality may in reality be warmer, notwithstanding its height above the Lake of Geneva.

According to Mons. Quetelet, the temperature of Brussels is $50^{\circ}36$, making, therefore, allowance for difference of altitude and latitude, the mean temperature of Rossinière should be $45^{\circ}68$, a figure coming very near to that obtained from the records of Mons. Henchoz.

From the foregoing remarks I think we may conclude that, notwithstanding its elevation, the mean temp. of Rossinière is hardly $2^{\circ}7$ or $3^{\circ}6$ lower than that of Geneva.

Whatever may be the opinion as to the exactitude of Mons. Henchoz's thermometer, it must be allowed that from his observations there can be ascertained the hottest and coldest days of each year, as well as the moment of extreme heat and cold during a period of half-a-century.

Between 1799 and 1850 the thermometer once reached $91^{\circ}0$, July 14th, 1824, a day on which, however, no extraordinary heat was experienced in other places. At Geneva in that year the maximum was 86° , on July 25th. After that of July 14th, 1824, the highest temperatures are $90^{\circ}0$, August 3rd, 1827; $88^{\circ}7$, July 6th, 1819; and $88^{\circ}2$, July 2nd, 1804, July 13th and August 27th, 1807, and July 20th, 1825.

The moment of extreme cold happened February 2nd, 1830 — $9^{\circ}6$, showing a range between the two extremes of $100^{\circ}6$.

After that of February 2nd, 1830, the lowest temperatures are — $7^{\circ}4$, January 21st, 1815; — $6^{\circ}9$, February 22nd, 1810; — $6^{\circ}7$, January 1st, 1812; — $6^{\circ}3$, February 23rd, 1814, and January 31st, 1831; — $4^{\circ}5$, January 2nd, 1811, and December 29th, 1836. On the 15th January, 1838, the minimum at Geneva was — $13^{\circ}5$, the lowest registered in that town since regular observations have been made. The same day at Rossinière the minimum was — 4° .

With regard to the time of year when these extremes have been noticed, I find that the hottest day has never occurred after August 28th, viz., in 1815, with a maximum of $77^{\circ}9$; whilst in 1811, May 31st, and July 19th, were the hottest days of the year, the maximum in each case being $85^{\circ}6$. With the exception of 1811, the hottest day never took place in the month of May. It occurred 15 times in August, 18 times in July, 7 times in June.

In 1807 the moment of greatest cold was on December 10th, $1^{\circ}4$; in 1828 it was on March 8th, $5^{\circ}7$. In the other years it ranged between these extreme limits.

The coldest days occurred 11 times in December, 27 times in January, 10 times in February, and *once* in March.

The coolest summers were 1815 (max. $77^{\circ}9$, August 27th and 28th), 1816 (max. $77^{\circ}9$, August 13th), and 1843 (max. $78^{\circ}8$, July 5th).

The least cold winters were 1818 (min. $15^{\circ}3$, December 30th), 1822 (min. 14° , January 8th), and 1831 (min. $10^{\circ}9$, December 28th, 29th and 31st).

An element interesting to know, to enable us to determine the climate of a locality, is the number of days on which it freezes, and the number of days on which it "freezes all day" in the course of a year. In this respect there is a remarkable approximation between Rossinière and Geneva.

At Rossinière from March 1st, 1799, to December 31st, 1850, (leaving out the months of October, November, and December, 1828, and the whole year 1829, for which the registers are wanting), I find a total of 4834 days during which the thermometer of Mons. Henchoz *has been seen* below 32° , giving a mean of 97 days per year. At Geneva the corresponding figure is 93, but one may be sure this difference of 4 days is too small, Mons. Henchoz's thermometer not being a minimum, and the days taken as days of frost are only those when *at sunrise* the thermometer was below 32° . It is true that, as a general rule, this is the coldest time in the 24 hours, but it happens often when the sky is clear during the night and overcast towards morning that the moment of greatest cold does not take place at sunrise; consequently all the minima which have occurred in this way,

between 10 p.m. and sunrise, could not be ascertained from Mons. Henchoz's thermometer, and 97 cannot be taken as the true number of days of frost at Rossinière. M. Henchoz has ascertained the greatest number of frosty days to have been

128	in the winter of 1837-38,
127	" " 1834-35,
124	" " 1836-37,
121	" " 1816-17,

and the least number to have been

67	in the winter of 1845-46,
68	" " 1839-40,
72	" " 1825-26,
77	" " 1804-05.

The winter of 1845-46 is also that in which at Geneva the number of frosty days was the smallest.

If it be not a matter of wonder that at Rossinière it should freeze oftener than at Geneva, one would, perhaps, be surprised to learn that the number of days on which it "freezes all day" there is small.

At Geneva there is a mean of 23 days per year when the temperature remains all day below 32° . At Rossinière the mean of 50 years gives only 17.6 as the corresponding mean, and had there been a maximum thermometer this mean would probably have been diminished. In short, when Mons. Henchoz saw his thermometer above 32° it is a proof that during that day it thawed; and even if during other days the mercury has risen above 32° between the hours of observation and again fallen below 32° towards one or two o'clock—this fact could not be ascertained by Mons. Henchoz, and the day would be wrongly entered as a day when it "froze all day." Consequently it may be assumed that at Rossinière there are at the utmost 17 days during which the thermometer does not go above 32° *

The anomaly which appears to exist between these observations and those at Geneva is easily explained. On the border of the lake the days on which it does not thaw are ordinarily those when the sky is overcast with clouds. These clouds, however, do not extend to any great height, and while in the plain there exists a great cold under a leaden sky, there is, on the contrary, above the clouds a brilliant sun, and during the day a temperature which reminds you of spring.†

I remember amongst others a winter during which I lived at Orbe. There had been a thick fall of snow when the fog covered the plain. During 10 or 12 days we never saw the sun, and it did not thaw, while at a little higher elevation, such as Romainmôtier and Vallorbes they had magnificent days, and the snow disappeared rapidly. When the fog cleared we saw snow still on the summits of the of the Jura while the intermediate country had none, and presented a zone of curious aspect between two banks of snow. One can comprehend thus that the number of days on which the thermometer does not reach 32° may be less at Rossinière than at Geneva.

To complete my remarks on the temperature it only remains for me to say a few words on the extreme limits of frosty days. Mons. Henchoz never saw his thermometer reach 32° before Sept. 26th,—this occurred in 1812 and 1837; nor after May 28th—this occurred in 1821. The other dates of late frosts were May 17th, 1802 ($25^{\circ}2$)—May 17th, 1803 ($31^{\circ}5$)—May 1st, 1814 ($27^{\circ}5$), and May 12th, 1837 ($25^{\circ}2$).

The frost of May 17th, 1802, is likely to be long remembered by agriculturists. That day nearly all the vines were frozen on the borders of the lake, where so late a frost had not occurred in the memory of man. Some days later the vines budded again, and still gave a sufficiently abundant crop, but of a bad quality. The frost of May 1st, 1826, which was so grievous for the vines of Montreux, was accompanied at Rossinière by a fall of snow. In the morning the sky was overcast, and at sunrise the thermometer stood at $34^{\circ}2$.

* My observations this winter, which was considered here less cold than usual, showed 40 days on which it did not reach 32° between 1st of November and 1st of March.—M. F. W.

† This is certainly the case, having seen here, between 1st November and 31st March, 99 absolutely cloudless days against 49 on the lake.—M. F. W.

I have designedly pointed out the preceding dates as those on which the thermometer was seen below 32°, for it often happens that the temperature on the ground is many degrees lower than that 3 or 6 feet above the ground. It frequently happens, also, that plants are frozen near the earth, although a thermometer suspended at a certain height does not reach 32°.

In the journal of Mons. Henchoz I find notices of many frosts in June, and one on August, 22nd, 1839. The month of July is the only month in which a frost has not occurred during the space of 50 years.

	Days on which it froze during 24 hours.	Days on which it froze all day.
January	23·4	8·4
February	19·1	2·2
March	15·3	0·4
April	5·6 .....	...
May	0·2 .....	...
September	0·1 .....	...
October	2·2 .....	...
November	10·5	0·7
December	20·3	5·9
Annual total	96·7	17·6

It must be observed also that during 50 years observation the number of days when it "froze all day" varied enormously one winter with another, although the number of frosty mornings deviated much less from the general mean.

BAROMETER.—I do not mention the barometric observations of Mons. Henchoz because his instrument, in addition to not indicating the temperature of the mercury, was otherwise not sufficiently perfect to enable conclusive results to be drawn.

WIND.—As would be expected, the prevailing winds at Rossinière are those which blow in the direction of the valley—viz., N.E. and S.W. The duration of these winds have, however, surprised me. Often during an entire month the same wind is constantly noted at all the hours of observation.

RAIN.—The number of rainy days is not clearly indicated, except from 1834 to 1850. During this period of 16 years there were 2,560 days on which rain or snow fell. These days were distributed as follows:—

Year.	Days.	Year.	Days.
1835	150	1843	158
1836	157	1844	157
1837	146	1845	182
1838	156	1846	170
1839	164	1847	150
1840	153	1848	156
1841	165	1849	157
1842	158	1850	181

Mean of 16 years = 160 days per year.*

At Geneva the corresponding figure is only 117·7 days, and at the Gt. St. Bernard 128·9.

The following table shows how the days of rain are distributed in the different months at Geneva, Rossinière, and the Great St. Bernard:—

	Rossinière.	Geneva.	Gt St. Bernard		Rossinière.	Geneva.	Gt St. Bernard
January...	11·8	9·9	14·4	July ..	14·6	8·9	7·7
February	10·4	8·1	9·9	August...	15·9	9·8	8·0
March...	12·4	9·3	12·5	Sept. ..	13·3	11·6	10·1
April ...	14·8	9·3	11·2	Oct. ...	12·8	10·3	12·7
May ...	16·7	11·2	12·0	Nov. ...	11·4	10·8	12·5
June ...	16·8	9·5	7·9	Dec. ...	9·1	9·0	10·0
Yearly total ..	160·0	117·7	128·9				

* In the half-year beginning 1st October, 1873, and ending March 31st, 1874, there were 38 days on which rain or snow fell.—M. F. W.

The difference between the number of wet days at Rossinière and Geneva does not surprise me, considering the number of times during the year one sees (from the lake) rain or snow falling on the mountains, although in the plain the sky is overcast without rain falling. It appears that the relative number of rainy days at St. Bernard would be in contradiction of the fact I have just quoted; but it must be observed that I have only spoken of places in the vicinity of the lake, and that St. Bernard, situated on a high pass, exposed to other winds than those of the plains, finds itself under very different meteorological circumstances, and, therefore, one cannot make a comparison. It is much to be regretted that Mons. Henchoz had not a rain gauge, so as to have indicated the amount of rainfall as well as the number of days.

THUNDER.—During the same period, 1834 to 1850, there were 354 days on which thunder was heard.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total,
1835	2	9	8	9	.	.	.	.	28
1836	1	6	1	6	2	1	.	.	17
1837	1	2	6	4	9	1	.	.	.	23
1838	9	8	2	2	1	.	.	.	22
1839	6	3	4	3	.	.	.	.	16
1840	2	1	7	4	6	1	.	.	.	21
1841	1	5	3	4	5	1	1	.	.	20
1842	4	6	5	7	9	1	.	.	.	32
1843	2	2	.	2	5	2	.	.	.	13
1844	2	2	4	1	7	2	1	.	.	19
1845	1	3	6	2	3	1	.	.	16
1846	2	.	1	18	6	6	6	.	.	.	39
1847	2	.	5	4	8	9	.	.	.	.	28
1848	1	.	.	5	2	3	4	3	.	.	.	18
1849	3	6	4	4	5	2	.	.	24
1850	1	.	.	2	2	7	5	.	.	.	1?	18
Total	2	4	12	53	86	71	91	28	6	.	1?	354
Mean	0.1	0.25	0.75	3.3	5.4	4.4	5.7	1.75	0.4	.	0.1	22.1

From this table it results—

1st. That from 1834 to 1850 thunder has never been heard in January or November. In December there was only Dec. 17th, 1850, when Mons. Henchoz remarked "They say thunder was heard in the night."

2ndly, June, 1846, shows a really extraordinary number of days on which it thundered.

3rdly, From 1834 to 1850, May, June, July, and August never passed without thunder, June, 1843, being the sole exception.

From 1799 to 1850 lightning has only struck 3 times in or near Rossinière, and then it did little damage.

Hailstorms were tolerably frequent.

VARIOUS OBSERVATIONS.—As I have already said, at the end of each month Mons. Henchoz made notes of the principal meteorological phenomena, which he had remarked, and which did not come in his ordinary list of observations.

It is here that one finds the budding and fruiting of plants, the appearance and disappearance of certain animals, etc. If, instead of giving only *many* observations of this kind Mons. Henchoz had given *all*, he would have left a magnificent and valuable series of periodical observations, such as Mons. Quetelet has urged for many years, and which would probably have given important results for the natural philosophy of the earth.

In the manuscripts of Mons. Henchoz I have found from 1799 to 1850 records of five earthquakes, viz.:—

Marth 11th, 1817	..... ..	9.30 p.m.
Dec. 22nd, 1817	..... ..	5.0 p.m.
Feb. 19th, 1822	..... ..	9.0 a.m.
Oct. 24th, 1824	... ..	7.45 p.m.
July 12th, 1847	..... ..	during the night

Under date August 24th, 1802 Mons. Henchoz writes.—

“All the Oberland of Vaud, Gruyère, and part of the Bernese Oberland, were enveloped in a species of fog of a peculiar nature, and which was generally attributed to the burning of a large forest near Sierre, in Canton Valais—a forest which was consumed during the night of 22—23rd August.”

I attach importance to this entry because, during the dry fogs which covered a great part of Europe in 1831, and particularly in 1783, many people thought the earth was passing through the tail of a comet. It was soon discovered, however, that this theory was inadmissible, and it is thought that these fogs were caused by the gases proceeding from the earth's centre, and by the smoke of volcanoes during earthquakes, as well as volcanic eruptions which took place at these two periods. However, it seemed difficult to admit that the smoke of a few volcanoes could cover a whole continent. Nevertheless, we see here, that the burning of a forest which only lasted one night was sufficient to cover with smoke a considerable district, comprising perhaps an area of 1,550 square miles. Much more then would the smoke of a volcano cause fogs equally extensive as those of 1783 and 1831.

Finally Mons. Henchoz remarks that during the autumn of 1811 all root crops were ravaged by myriads of black caterpillars of a species hitherto unknown.

A similar pest appeared in 1853, and the larvæ were made the subject of a communication by Mons. Alexis Forel in June, 1854.

In 1812, as in 1854, there was no trace of the creatures which had done so much mischief the preceding year. I draw no conclusion from this fact. I merely wish to call the attention of those who took up and interested themselves in the question of the black caterpillars of 1853, to their appearance also in 1811.

OBSERVATIONS OF THE AURORA BOREALIS AND THE ZODIACAL LIGHT MADE AT BIRR CASTLE IN THE YEARS 1873 and 1874, by MR. RALPH COPELAND, Assistant Astronomer.

(Communicated by the Right Hon. the EARL OF ROSSE, F.R.S., &c.)

THE observations were made in the following manner: if the sky was tolerably clear and the moon below the horizon, the 6 ft. telescope was used for examining the nebulae, and the observer had a good opportunity of detecting any aurora from the galleries of that instrument. Under other circumstances the sky was casually looked at during the course of the evening, a thorough examination being made at midnight (Greenwich time)* a record being made then, or on finally closing the observatory for the night. If any aurora was seen it is recorded by the insertion of the letter (A) in the following table at the correspond-

* The observations are, however, referred to Dublin time.

ing date, the brightness of the aurora being occasionally modified by an appended (f) faint, and this again by (v) very, or (e) excessively. If the sky had been, at least occasionally, sufficiently free from cloud to permit of a fair examination, and no aurora was seen, the fact is shown by an (n) in the table; the letters (cl) denoting, on the other hand, that the sky was completely obscured by clouds or dense haze. The disturbing presence of the moon is indicated by a (☾). On three occasions no observation was made. Particulars of some of the auroræ and occasionally of the zodiacal light are given in the notes below, which are referred to by the small figures. It will be seen from the summary that more or less aurora was detected on thirty out of one hundred and fifty one nights on which observation was possible, or on one night in every five.

Table of Auroræ.

1873.						1874.				
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April	May.
1	...	n	n	(n	cl	cl	(cl	(cl	(cl	(n
2	...	n	cl	(A ¹⁴	cl	cl	(n	(cl	(n	(n
3	..	(n	cl	(n	cl	(n	n ²²	(cl	(n	A ³⁵
4	...	(n	(n	cl	cl	(n	A ²³	(cl	(n	cl
5	...	(n	(n	cl	cl	(n	A ²⁴	(cl	n	cl
6	..	cl	(n	cl	cl	(n	cl	n ²⁷	n	A ³⁶
7	...	cl	(n	cl	(n	cl	n	A ²⁸	A ³²	n
8	...	cl	cl	(n	cl	n	n	n	cl	n
9	...	n	cl	n	(f A ¹⁵	n	n	A ²⁹	A ³³	n ³⁷
10	...	n	n	cl	n	n	cl	n ³⁰	n	n
11	...	n	A ¹⁰	n	n	cl	cl	cl	n	n
12	...	n	A ¹¹	cl	cl	A ¹⁷	n	n	cl	n
13	...	cl	n	cl	cl	n	n	n	cl	n
14	...	cl	n	cl	cl	cl	n	cl	e f A ³⁴	cl
15	A ¹	A ⁶	cl	n	cl	cl	n	cl	cl	cl
16	n	cl	cl	n	cl	A ¹⁸	cl	cl	n	cl
17	cl	n	cl	cl	cl	cl ¹⁹	A ²⁵	n	cl	n
18	n	n	f A ¹²	cl	n	cl	f A ²⁶ ?	A ³¹	cl	...
19	cl	cl	cl	cl	n	cl	cl	no obs	cl	...
20	n	A ⁷	n	cl	n	n	cl	no obs	cl	...
21	v f A ²	A ⁸	cl	cl	cl	cl	n	no obs	(n	...
22	f A ³	n	n	cl	n	cl	n	n	(n	..
23	e f A ⁴	n	n bef ⁸	cl	n	cl	(n	cl	(n	...
24	cl	n	n	n	cl	cl ²⁰	(cl	n	(cl	...
25	cl	cl	n	cl	n	cl ²¹	(cl	n	cl	...
26	cl	n	cl	n	A ¹⁶	cl	(n	cl	n	...
27	n	cl	n	n	n	cl	(n	n	(cl	...
28	n	n	n	cl	(n	cl	(n	cl	(cl	...
29	n	A ⁹	cl	(n	(n	(cl	..	(cl	(n	...
30	cl	cl	A ¹³	(n	(n	(cl	...	cl	(n	...
31	A ⁵	...	cl	...	(n	(cl	...	(n	...	...

Summary.

	1873.					1874.					Totals.
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May.	
	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.
cl	6	10	12	17	15	20	9	14	13	5	121
A	5	4	4	1	2	2	4	3	3	2	30
n	6	16	15	12	14	9	15	11	14	10	122
No obs	...	...	...	..	...	...	...	3	...	...	3
Days..	17	30	31	30	31	31	28	31	30	17	276

NOTES.

- Aug. 15th. (1.) Shortly after midnight a bright aurora was seen through a gap in the clouds near the horizon in the N.N.W.
- Aug. 21st. (2.) Very faint aurora in N.N.W.
- Aug. 22nd. (3.) Faint aurora in N.N.W.
- Aug. 23rd. (4.) Excessively faint aurora in N.N.W., N., and N.N.E. about midnight. A streamer under δ Ursæ majoris at 13h. Dublin time.
- Aug. 31st. (5.) Strong auroral gleam through a gap in the clouds in the N.W.
- Sept. 15th. (6.) A few auroral rays about 11 p.m. in N.N.W.
- Sept. 20th. (7.) At 12h. much auroral light in N.W. b. N. ; a dark segment some 4° high in azimuth N. 34° W. Ill-defined streamers nearly vertical from horizon towards η and ζ Ursæ majoris. Aurora almost entirely gone by 12 $\frac{1}{2}$ h.
- Sept. 21st. (8.) 9 $\frac{1}{2}$ h., bright aurora ; low dark segment 3° to 4° high ; a few streamers 14° to 15° long in N.W. The aurora disappeared and came on again about midnight. At 15 $\frac{1}{2}$ h. the zodiacal light was very bright.
- Sept. 29th. (9.) Moderately bright aurora low down in N.W.
- Oct. 11th. (10.) Faint aurora ; a faint vertical ray at 8 p.m.
- Oct. 12th. (11.) Faint aurora.
- Oct. 18th. (12.) Aurora low down in N.W.
- Oct. 30th. (13.) Bright aurora low in N.N.E. at midnight.
- Nov. 2nd. (14.) Moonlight ; there seemed to be a considerable amount of aurora low down in N.W.
- Dec. 9th. (15.) Some faint aurora low in N.N.W.
- Dec. 26th. (16.) Faint but decided aurora at 12h. in N.N.W.
- Jan. 12th, 1874. (17.) Bright auroral light, very low down in N.N.W. from 9 $\frac{1}{2}$ h. to 11 $\frac{1}{2}$ h.
- Jan. 16th. (18.) Aurora in N.W., low down over a permanent, irregular-outlined, very dark cloud ; very bright at 13h., but without rays.
- Jan. 17th. (19.) Sky clear for a short time after sunset. The zodiacal light extended nearly to α Arietis (long. 36° , lat. $+10^\circ$) between Mars and ζ Aquarii. The sun's long. was $297\frac{1}{2}^\circ$, whence the zodiacal light extended nearly $98\frac{1}{2}^\circ$ from the sun.
- Jan. 24th. (20.) Clear evening, followed by dense clouds ; no aurora seen.
- Jan. 25th. (21.) Ditto, ditto.
- Feb. 3rd. (22.) Diffused zodiacal light seen.
- Feb. 4th. (23.) Aurora seen in twilight as diffused cloudy masses. 6h. 26m. Dublin time. Aurora extends from east to west, a little south of the zenith, through Pegasus, the head of Aries, the Pleiades and the middle of Gemini in diffused masses. 6h. 30m. Straight streamers in N.E. and N.W. 6h. 36m. Formed a very symmetrical figure like a cusped gothic arch ; the segment east of Procyon rose immediately, and at 6h. 39m. the same figure was repeated, with the central segment rising up to Auriga. 6h. 49m. Intense streamers. 7h. 16m. 20s. A brilliant corona was formed to the north of a convergence point, which was 1°

west of ι Aurigæ. Hence altitude of convergence-point, $68^{\circ} 55'$; azimuth S. $20^{\circ} 40' E.$ Aurora of an intense red. 7h. 17m. 20s. Convergence point 1° north of ι Aurigæ or altitude $69^{\circ} 40'$; azimuth S. $23^{\circ} 34' E.$ 7h. 27m. 9s. Intense dancing rays, making about five pulsations per second, with one quiet patch near the convergence point, through which ι Aurigæ shone with intense brilliancy, reminding one of Arcturus seen through the tail of Donati's comet. The aurora remained more or less visible until between 9 and 10 o'clock.

Feb. 5th. (24.) Faint aurora in N.N.W. at $11\frac{1}{2}h.$

Feb. 17th. (25.) Auroral light about midnight—low.

Feb. 18th. (26.) Brilliant zodiacal light, Mars, lat. 0° , in the axis. The point was beyond α Arietis, but about 8° to the south, say lat. $+2^{\circ}$, long. 37° . The sun's long. $=330^{\circ}$, whence the zodiacal light extended about 67° from the sun. No very decided aurora; perhaps a gleam of light on the horizon in N.

Mar. 6th. (27.) Very bright zodiacal light extending to half-way between A Tauri and the Pleiades, lat, $+3^{\circ}$, long. 59° . The sun's long. being 346° , the light reached 73° from the sun.

Mar. 7th. (28.) Very bright aurora from about 8h. until 13h. Time fully occupied in observing nebulae.

Mar. 9th. (29.) An aurora, consisting of a low segment and arch, seen at $14\frac{1}{2}h.$ Zodiacal light seen in the evening.

Mar. 10th. (30.) Bright zodiacal light seen.

Mar. 18th. (31.) Very faint aurora at midnight.

Apr. 7th. (32.) Aurora; dark segment. At 12h. 35m. the azimuth of the centre of the arch was N. $24^{\circ} 2' W.$, while its altitude was $2\frac{3}{4}^{\circ}$. The aurora was seen as early as half-past 9 to 10, by the amanuensis Mitchell, with rays shooting upwards, one of which moved round in the direction of increasing right ascension.

Apr. 9th. (33.) Faint aurora at 9h. 20m. p.m.

Apr. 14th. (34.) Scarcely perceptible aurora.

May 3rd. (35.) Equable auroral light in N.N.W.

May 6th. (36.) Much light in the north at midnight; it was thought at the time to be twilight, but as the sun was $20^{\circ} 12'$ below the horizon it must have been aurora.

May 9th. (37.) Sky clear; no twilight or aurora at midnight; see preceding note.

ATMOSPHERIC ELECTRICITY.

To the Editor of the Meteorological Magazine.

SIR,—Allow me to offer to your readers a remark or two on *one* point in Mr. Stow's admirable essay on "Scotch Mist," in *British Rainfall* for 1873. In describing the Polar rains the author speaks of the two bodies of air, the Equatorial and Polar currents, rapidly mixing and producing violent precipitation, "while the opposite electrical states of the contending bodies of air frequently give rise to thunder and lightning." I am not quite clear as to whether the two portions of *air*, arriving from different parts of the atmosphere warmer and colder, are in differently electrified states. Both streams contain aqueous vapour, that in the equatorial current approaching the state of maximum density at its then temperature; and that in the polar being most probably considerably below this point. The [dry] air in both streams being a non-conductor and a most perfect insulator, the particles of vapour are ready to receive a positive electric charge immediately on their passing from the gaseous state into that of condensed vapour as dew, cloud, rain, or snow. It is at this moment that the earth in a superlative degree, or the neighbouring clouds by induction, exhibit the

opposite charge, and when the process is greatly exalted thunder and lightning occur. To me it appears that so soon as the cold heavy polar current streams down and mixes with the intensely heated and moist equatorial current, condensation is rapidly induced, and an exalted electric tension of the condensed particles is the result, the dry air of the polar current completely insulating them and preventing the escape of the electricity to the earth. This view restricts the production of electrical phenomena in the atmosphere to the condensation of aqueous vapour irrespective of the distinction of the aerial currents containing it. Polar currents almost invariably exhibit high electrical tension, the annual maximum occurring in January. It is, however, in the summer, about the time of minimum tension, that thunderstorms are most frequent, when, as stated by Mr. Stow, the cold dry air of the polar current streams down, insulating the charged particles and preventing a restoration of the equilibrium until a discharge takes place.

I cannot conclude without expressing my great admiration of Mr. Stow's most valuable essay. There can be no question that the subject of rainfall is daily increasing in interest, and papers such as Mr. Stow's cannot fail of enlarging our knowledge of so important a branch of meteorology.

Yours truly,

W. R. BIRT.

Walthamstow, May 19th.

THE POCKY CLOUD.

To the Editor of the Meteorological Magazine.

SIR,—I have the pleasure of enclosing to you a slight sketch of a most remarkable form of clouds which I saw here on the 7th of May. The view is taken as seen from Woodlands, looking over Elterwater Tarn, with Oxenfell in the distance. The time was 5 p.m., and the engraving [See frontispiece] represents the south-eastern sky, in which direction the clouds proceeded from the north-west. A small quantity of rain fell, and there was a muttering of thunder. The following are the instrumental readings for the 6th, 7th, and 8th of May, and remarks :—

Wednesday, 6th.—A cloudy day with few slight showers of R. Wind, W. and veering to W.N.W.

Bar.	Att. Ther.	Dry Bulb.	Wet Bulb.	Air Min.	Grass Min.	8 a.m. in shade.	Max. in shade.	Rain.
29.60	54°	48°	44°	38°	34°	48°	57°	—

Thursday, 7th.—A shower of H at 10 a.m., and T in the afternoon at 5 p.m. with R. Wind, N.W.

Bar.	Att. Ther.	Dry Bulb.	Wet Bulb.	Air Min.	Grass Min.	8 a.m. in shade.	Max. in shade.	Rain.
29.46	53°	47°	44°	39°	34°	47°	54°	.02

Friday, 8th.—Snowballs, showers and a little sleet and R. Wind, North-West.

Bar.	Att. Ther.	Dry Bulb.	Wet Bulb.	Air Min.	Grass Min.	8 a.m. in shade.	Max. in shade.	Rain.
29.47	53°	45°	40°	30°	27°	45°	52°	.02

The clouds presented to my eye very much the appearance of so

many balloons inflated to the fullest extent. I quite expected to see something like a water-spout every moment, but all the clouds passed over without anything of the kind occurring that I am aware of.

Yours truly,

E. TUCKER, JUNR.

Woodlands, Elterwater, Ambleside, June 2nd.

[We regard this letter and sketch with considerable interest as an entirely independent description and illustration of the cloud to which the name given by Dr. Clouston (who was the first to observe and describe it) will, we presume, always be attached. The present sketch should be compared by all our readers with that given in Dr. Clouston's *Explanation of the Popular Weather Prognostics of Scotland*, (Longman's), and if they will also refer to Vol. III., p. 81, of this Magazine, they will find some further particulars.—Ed.]

SOLAR HALOS AND PARHELIA.

To the Editor of the Meteorological Magazine.

SIR,—On Sunday evening, 17th May, 1874, at six o'clock, I noticed a very distinct circular ring of light round the sun, having a diameter of about 40° ; the sky within the ring seemed somewhat darker than that beyond it; the sky was cloudless, but on the circle due right and left of the sun, on either side, was a parhelion, and the prismatic colours were very distinct in the arcs of the circle which crossed the two parhelia. These were at times well defined, but occasionally appeared elongated into elliptical white images of the sun.

The circle was very well defined all round the sun, except near the horizon, which was somewhat hazy.

It continued more or less defined till sunset.

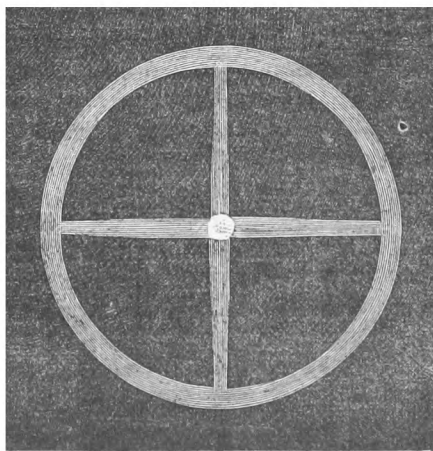
B. STREET.

Barnetby Vicarage.

LUNAR HALO.

To the Editor of the Meteorological Magazine.

SIR,—On the evening of May 1st, about nine o'clock, George Harrap, pupil of Mr. J. H. Beale, of this town, while standing on the lawn in front of the latter's house, noticed a faint haze spread over



the moon, in which an ill-defined luminous circle, about 4° in diameter soon became visible, connected with the moon by vertical and horizontal radii. Soon afterwards a brilliant *mock moon* made its appearance about 12° to the N.E. of the true moon, and at an elevation of 30° above the horizon. At first it was somewhat elongated in a horizontal, afterwards in a vertical, direction, and finally became circular; and it showed bright prismatic colours—the violet towards the moon. Mr. Beale, and his son, Mr. Harold Beale, coming out, also saw the halo and the mock moon, and were particularly struck by the brilliancy of the whole phenomenon, which was visible for ten minutes.

Yours, &c.

T. BEESLEY, F.C.S.

Analytical Laboratory, 5, High-street, Banbury.

RAIN GAUGES AND THE VIENNA CONFERENCE.

We are very glad to find that the views enunciated in *British Rainfall*, 1873, have independently the support of our excellent contemporary *Nature*, in which the following paragraph appeared after the writing, but before the publication, of the note in *British Rainfall*.

We may also mention that a very high continental authority has expressed in strong terms his conviction that the decision must be rescinded. The following is the able paragraph in *Nature* :—

“As regards rain-gauges, the Congress adopted as the best form for the receiver of the rain-gauge the circular one, with a diameter of 14 in., and at a height of 3 ft., or better $4\frac{1}{2}$ ft., above the ground, a decision which was agreed to by all the delegates except Mr. Buchan, who lodged his protest against it. We have taken the trouble of looking over Mr. Symons' *British Rainfall*, 1872, and observe that there are not more than half a dozen gauges in the British Isles of this dimension. The readers of *Nature* are no doubt aware of the extensive experiments and observations made on this subject in England for some years past, and published annually in the *British Rainfall*, from which it has been experimentally proved that gauges of all sizes from 3 in. to 24 in. inclusive collect amounts not differing more than two per cent. from each other. We have had a communication from Mr. Scott, by which we are glad to learn that the Meteorological Office has resolved to retain at its stations the 8 in. gauges hitherto in use. This decision as to the size of the gauge a future Congress will no doubt rescind. Equally in error is the decision as regards height of gauge above the ground, especially large gauges. It is certain from numerous observations made on the subject, that gauges placed at from 3 ft. to $4\frac{1}{2}$ ft. above the ground will not indicate with sufficient correctness the amount of the rain which falls at the place of observation in cases where wind accompanies the rain, owing to the disturbance caused by the obstruction offered by the gauge itself, and by the eddies generated within the funnel. Now owing to the enormous dragging influence of the earth's surface of the wind, these disturbing effects are reduced several fold at the surface and at one foot above it as compared with 3 to $4\frac{1}{2}$ ft. high. On these grounds we cannot recommend British Meteorologists to follow the decision of the Congress. Owing to the extreme variableness of the rainfall, particularly in such countries as Great Britain, where the surface is so uneven, the proper observation of the rainfall requires twenty times more observers than are required to observe any of the other meteorological elements. It is, therefore, well that a cheap gauge is also a good one, since it facilitates an adequate observation, through numerous observers, of the rainfall, which from its practical and scientific bearings it is so important to know.”

MAY, 1874.

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 Bright days.
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Dpth.		Max.		Min.		
				inches.	in.			Deg.	Date.	Deg.	Date.	
I.	Camden Town	1.14	- 1.26	.66	25	7	73.9	27	33.3	9	0	
II.	Maidstone (Linton Park)	1.21	- 1.03	.25	8	11	82.0	22	28.0	10	10	
III.	Selborne (The Wakes) .....	.42	- 2.06	.14	22	5	69.2	28	27.5	10	10
	Hitchin .....	.62	- 1.31	.14	25	10	68.0	22*	29.0	1,10	10
IV.	Banbury	1.76	- .46	.43	25	10	70.5	27	29.0	9	4	
V.	Bury St. Edmunds (Culford) .....	.49	- 1.67	.15	14	10	74.0	31	24.0	16	15
" ENGLAND.	Bridport .....	.65	- 1.38	.24	3	9	73.0	25	28.5	9	6
	Barnstaple .....	.70	- 1.74	.19	21	8	71.0	31	34.0	10	0
" ENGLAND.	Bodmin	1.06	- 1.40	.50	21	12	69.0	31	34.0	11	0	
	Cirencester	1.01	- 1.27	.26	3	10	...	...	...	...	...
" ENGLAND.	Shifnal (Haughton Hall)	1.98	- .28	1.01	23	13	68.0	27+	32.0	2,16	2	
	Tenbury (Orleton)	2.05	- .83	.83	22	10	70.2	27	28.5	10	7	
" ENGLAND.	Leicester (Wigston)	1.24	- .88	.39	23	15	73.0	31	29.0	1,8	5	
	Boston .....	.85	- 1.09	.20	3	12	73.0	26	32.0	10	1
" ENGLAND.	Grimsby (Killingholme)	1.41	...	.31	8	16	68.0	31	34.0	2,4+	0
	Derby	1.33	- .83	.35	8	12	70.0	27	31.0	8	1	
VIII.	Manchester	1.40	- 1.26	.43	24	17	70.3	26	29.0	9	2	
IX.	York	1.96	+ .01	.43	23	15	65.0	27	32.0	17	1	
	Skipton (Arnccliffe)	2.52	- .83	.39	7	20	66.0	31	28.0	16	...	
" WALES.	North Shields	2.30	- .34	.73	23	15	...	...	...	...	...
	Borrowdale (Seathwaite)	2.82	- 6.72	.53	29	13	...	...	...	...	...
" WALES.	Cardiff (Ely)	1.35	- 1.25	.72	26	6	...	...	...	...	...
	Haverfordwest .....	.97	- 1.75	.30	14	9	67.1	30	30.0	10	4
" WALES.	Rhayader (Cefnfaes) .....	.90	- 1.95	.26	23	6	69.0	...	31.0	...	...
	Llandudno	2.68	+ .30	1.03	28	11	65.8	31	36.6	2	0	
" WALES.	Dumfries	1.35	- 1.04	.42	14	15	69.0	18	30.5	16	1	
	Hawick (Silverbut Hall)	1.72	...	.32	24	15	...	...	...	...	...
XIV.	Kilmarnock (Annanhill)	2.17	...	.24	14	10	62.4	19	30.0	16	4
XV.	Castle Toward	2.63	- .76	.47	28*	8	...	...	...	...	...
	Leven (Nookton)	1.74	- .26	.55	24	14	66.0	31	30.0	16	3	
" SCOTLAND.	Stirling (Deanston) .....	...	...	...	...	...	...	...	...	...	...
	Logierait	1.02	...	.24	29	10	78.0	17	29.0	15	8
XVII.	Braemar	1.20	- .60	.31	14	12	62.3	17	28.1	11	5	
	Aberdeen	1.56	...	.33	24	15	66.3	30	31.7	16	1
XVIII.	Portree	5.04	- .61	1.21	30	19	...	...	...	...	...
	Loch Broom	1.45	...	.22	10	15	...	...	...	...	...
" SCOTLAND.	Inverness (Culloden)	1.59	+ .03	.41	15	14	62.6	17	30.5	16	1	
	Helmsdale	2.03	...	...	...	...	...	...	...	...	...
" SCOTLAND.	Sandwick	1.41	- .85	.35	26	14	58.8	31	35.3	15	0	
	Caherciveen Darrynane Abbey	1.20	...	.21	10	17	...	...	...	...	...
" SCOTLAND.	Cork .....	.18	...	.10	30	5	...	...	...	...	...
	Waterford .....	.52	- 1.73	.17	22	13	69.0	19	26.0	9	1
" IRELAND.	Killaloe	1.60	- 1.58	.55	28	15	75.0	23	30.0	10	2	
	Portarlington	1.48	- 1.72	.40	29	18	67.5	18	30.0	2	4	
XXI.	Monkstown, Dublin	1.38	- .53	.60	28	10	71.0	16	29.0	3	8	
	Galway	3.09	...	.58	17	14	72.0	20	32.0	11	1
XXII.	Ballyshannon	1.50	...	.36	29	19	...	...	...	...	...
	Waringstown .....	.75	...	.19	28	11	75.0	19	28.0	3,9	2
XXIII.	Edenfell (Omagh)	1.93	...	.83	29	16	67.0	23	28.0	9	4

* And 30.

† 28 & 30.

‡ 9 & 18.

§ And 16.

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

METEOROLOGICAL NOTES ON MAY.

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.

LINTON PARK.—First 21 days very cold, with frequent frosts, after that it was more mild. T on 8th, 23rd, and 25th, the last-named day very severe, killing two men and injuring several others in a cricket field four miles from here; R at the time very moderate. Only 0·16 frosts on 8 nights, that on the 10th so severe that a basin of water standing on the grass near the house was frozen sufficiently hard to be turned upside down without the water coming out. Winds (never high) mostly N. and N.E., except during the last ten days. May has been a dry, ungenial month, with a greater number of frosty nights than any previous one at this place for upwards of 20 years. There were indications of frosts on 4 other nights besides the 8 above mentioned.

CULFORD.—An exceedingly dry and cold month, the min. temp. falling under 32 deg. during every night for the first 11 days. The mean temp. of the month below that of April. Slight H storms on 3rd, 5th, 7th, 8th, and 9th. T heard on 23rd and 24th, but no rain fell. Easterly winds on 8 days and Westerly on 23 days.

BRIDPORT.—This month has been noticeable for the high temp. and fine weather almost the entire month; small amount of R; the frosts were severe, and cut most of the potatoes; ice on the 9th.

SHIFNAL.—An unusually cold May till the 25th, when the temp. rose 7 deg., from 60 deg. to 67 deg., and continued high to the close. Occasional showers till the 15th, when distant T was heard, and cumuli clouds denoted it for many days more. Copious R set in on the 21st, followed by a great fall (1·01 in.) next day, which greatly relieved the dried up ground; frequent frosts at night till the 18th, and on the 16th so sharp that in the lower grounds potatoes were cut down, and the young leaves of ash and walnut quite killed. Prevailing winds from N.W. to N.E.; bar. very equable throughout. Cuckoos and white butterflies numerous, queen wasps few, swallows first seen here on the 2nd, orange-tipped black fly on 25th, grey flycatcher (very late) on 27th; oak in full leaf on 12th, ash in leaf on 30th (very late).

BOSTON.—Early potatoes cut off by the frosts; fruit not much injured, the weather being very dry. Grass being very scarce and backward, wheat and other crops looking well. Chesnuts in flower on 8th, may on the 10th, oak in leaf on 20th, ash not in leaf at the end of the month.

GRIMSBY.—The month was cold up to the 27th; the corn crops looking well, and a prospect of a good crop of apples; springs, streams, and ponds very low. One clap of T on the 6th at 1 p.m. Horse chesnut began to flower on 1st; monthly rose began to flower on 24th; purple beech leafing on 2nd; potatoe crop cut by frost on 17th; lesser white throat heard on 8th; spotted flycatcher seen on the 30th.

MANCHESTER.—H on 7th and 8th; S on 8th.

ARNCLIFFE.—A forward season; rainfall below the average of May; an unusual prevalence of N. and N.E. winds till the last week.

SEATHWAITE.—The greatest fall was considerably under an inch, and the total fall nearly 6½ in. below the average.

WALES.

CEFNFAES.—The month unusually cold and dry, with frosts at night; wind generally N.E. or N.W.

LLANDUDNO.—Mountain ash in flower on 8th, hedge rose gathered on 11th, landrail heard on 12th; S on the distant hills from 9th to 13th inclusive; H on 8th, 9th, 10th, and 11th; TS on 9th.

SCOTLAND.

DUMFRIES.—Although north-easterly and easterly winds have prevailed during the month, the weather has not been quite so dry as the May of last year; but little R during first two weeks; heavy E on 14th, then dry for a week, and last week refreshing showers. S on the 9th; frost on several nights, but except on morning of 16th did no injury. Night temp. nearly 3 deg. higher than May, 1873, but during the day very little difference, mean of the month being only 1°·5 higher. Rainfall 0·71 in. under the average of five years. Great display of fruit blossom, and also of hawthorn and wild fruits. Little injury done by frost; pastures luxuriant, and crops looking well.

HAWICK.—Frost on 1st, 3rd, 4th, 6th, 10th, and 15th; S on the hills on the 3rd and 4th. The month has been remarkable for cold east winds and heavy H showers. The hay crop will not bulk heavily in this quarter this season.

CASTLE TOWARD.—This month in general being a favourable one for the employment of all classes, having little or no R, and beautiful sunshiny weather; the latter part of the month chilly Easterly winds, but well adapted for clearing and preparing the soil for the reception of turnip seed, &c., many fields of swedes and others being sown. A copious R having fallen the last few days has moistened the earth, and caused everything to look fresh and healthy. The appearance of fruit scanty for the amount of blossom. Cuckoo first heard, and swallow first seen on the 5th.

BRAEMAR.—A fine month; but, towards the end, rather dry. Grub-worm causing considerable damage to young braird.

ABERDEEN.—Bar. pressure and prevalence of N.E. winds above the average of the last 17 years; the temp., rainfall, and estimated pressure below the average. A month of cold, dry weather, with much easterly wind.

PORTREE.—The month was very cold, with S showers during the day, and frosts at night up to the 23rd, when the wind from N.E. to S. and S.W.; the 30th and 31st were two fearfully wet days, upwards of an inch of rain falling on each of these days.

SANDWICK.—May is generally our driest month, and this year it has been about the average. It has been remarkably free from meteorological phenomena and none were noted. During the first 12 days northerly winds prevailed with a low temperature, never exceeding 49°·1 in the shade; during the last 11 days southerly winds prevailed, and the temperature in the shade rose to 59°.

IRELAND.

DARRYNANE.—The driest May since I have kept a gauge; in fact, the rainfall was less than in any month since I began in 1870. First week, moderate northerly winds and cold; from 10th to 26th, light variable winds and fine weather; last four days, S.W. wind and broken changeable weather. H on 3rd, 4th, and 7th.

WATERFORD.—Prevalence of N. and N.E. winds during great part of the month, the change to the S. during the last few days being attended with but little rain, but almost continuous strong winds.

BALLYSHANNON.—The month has been a fine one, and free from storms. The potatoe crop has progressed favourably, and vegetation in general has made good growth.

RAINFALL IN NORTH-WESTERN EUROPE, NOVEMBER, 1873, TO JUNE, 1874, AND ITS RELATION TO THE AVERAGE.

	FRANCE.																		BELGIUM.						HOLLAND.					
	Carcassonne (Aude). Lat. 43°12' Lon. 2°20' E.			Marcenx (Landes). Lat. 44°0' Lon. 0°50' W.			Vals (Ardèche). Lat. 44°25' Lon. 4°27' E.			Jardin Botanique, Bordeaux. Lat. 44°50' Lon. 0°34' W.			Les Settons, Morvan. Lat. 47°15' Lon. 4°5' E.			St. Martin, Sens. Lat. 48°12' Lon. 3°17' E.			La Villette, Paris. Lat. 48°50' Lon. 2°20' E.			Brussels. Lat. 50°51' Lon. 0°17' E.			Ostend. Lat. 51°13' Lon. 2°55' E.			Utrecht. Lat. 52°6' Lon. 5°5' E.		
	Average for 22 yrs 1849-70.	Actual 1873-74.	Ratio average = 100.	Average for 6 yrs. 1865-73.	Actual 1873-74.	Ratio average = 100.	Average for 7 yrs. 1867-73.	Actual 1873-74.	Ratio average = 100.	Average for 9 yrs. 1865-73.	Actual 1873-74.	Ratio average = 100.	Average for 10 yrs. 1859-68.	Actual 1873-74.	Ratio average = 100.	Average for 10 yrs. 1859-68.	Actual 1873-74.	Ratio average = 100.	Average for 10 yrs. 1859-68.	Actual 1873-74.	Ratio average = 100.	Average for 10 yrs. 1861-70.	Actual 1873-74.	Ratio average = 100.	Average for 5 yrs. 1862-66.	Actual 1873-74.	Ratio average = 100.	Average for 26 yrs 1873-74.	Actual 1873-74.	Ratio average = 100.
November	2·61	5·55	213	5·68	5·29	93	5·72	8·27	144	2·81	5·44	193	6·77	6·85	101	1·65	1·26	76	1·61	1·65	103	2·27	1·22	54	2·24	1·13	50	2·15	1·06	49
December	2·37	·39	16	3·16	·59	19	5·02	1·38	27	2·49	·38	15	7·05	2·60	37	1·73	·35	20	1·65	·35	21	2·16	·90	42	1·31	·65	50	2·35	·56	24
January	2·57	·28	11	6·93	1·74	25	3·21	3·35	109	4·11	·91	22	7·91	2·52	32	1·81	·87	48	1·61	1·30	81	2·13	2·25	106	2·13	2·08	98	1·93	1·96	101
February	2·35	1·18	50	3·10	1·96	63	2·47	3·11	126	2·52	1·60	63	5·32	2·44	46	1·30	·95	73	1·22	·75	61	1·70	1·35	79	1·50	·58	39	1·72	1·36	79
March	2·99	·63	21	3·39	1·32	39	2·77	·75	27	2·28	·83	36	5·87	2·48	42	2·13	·35	16	1·81	·47	26	2·04	1·87	92	1·87	2·00	107	1·63	2·48	152
April	2·55	3·35	131	2·44	2·56	105	2·15	1·54	71	2·13	2·10	99	4·29	2·95	69	1·30	·47	36	1·50	·87	58	1·32	·93	71	1·05	·60	57	1·62	·35	22
May	3·57	1·89	53	3·92	1·96	50	3·28	2·40	73	2·50	1·69	68	4·33	3·70	85	2·01	1·02	51	2·24	·87	39	2·67	1·65	62	1·34	1·75	131	1·93	3·17	163
June	2·34	...	...	3·06	...	...	1·14	...	...	2·32	5·75	247	7·05	5·16	73	2·28	1·26	55	2·21	2·05	93	1·94	1·53	79	1·96	1·09	56	2·09	1·65	79

	HOLLAND—con.						BRITISH ISLES.																							
	Helder. Lat. 52°57' Lon. 4°45' E.			Groningen. Lat. 51°37' Lon. 5°57' E.			London. Lat. 51°32' Lon. 0°8' W.			Bodmin. Lat. 50°28' Lon. 4°45' W.			Orleton. Lat. 52°18' Lon. 2°45' W.			N. Shields. Lat. 55°0' Lon. 1°25' W.			Braemar. Lat. 57°0' Lon. 3°25' W.			Sandwick. Lat. 59°6' Lon. 3°22' W.			Killaloe. Lat. 52°48' Lon. 8°25' W.			Dublin. Lat. 53°23' Lon. 6°20' W.		
	Average for 30 yrs 1873-74.	Actual 1873-74.	Ratio average = 100.	Average for 30 yrs 1873-74.	Actual 1873-74.	Ratio average = 100.	Average for 6 yrs 1860-65.	Actual 1873-74.	Ratio average = 100.	Average for 6 yrs. 1860-65.	Actual 1873-74.	Ratio average = 100.	Average for 6 yrs 1860-65.	Actual 1873-74.	Ratio average = 100.	Average for 6 yrs 1860-65.	Actual 1873-74.	Ratio average = 100.	Average for 6 yrs 1860-65.	Actual 1873-74.	Ratio average = 100.	Average for 6 yrs 1860-65.	Actual 1873-74.	Ratio average = 100.	Average for 6 yrs 1860-65.	Actual 1873-74.	Ratio average = 100.	Average for 6 yrs. 1860-65.	Actual 1873-74.	Ratio average = 100.
November	2·43	1·28	52	2·26	·89	39	2·41	1·87	78	4·98	6·06	122	2·47	1·59	64	2·70	1·30	48	2·82	4·82	171	4·00	4·69	117	4·89	3·19	65	2·89	1·85	64
December	2·33	·83	36	2·05	1·10	54	1·50	·48	32	5·24	1·32	25	2·46	·62	25	2·20	·29	13	3·77	3·16	84	3·97	4·29	108	3·49	2·52	72	2·62	·71	27
January	1·87	2·13	114	1·85	1·39	75	1·95	1·18	65	5·19	6·12	118	2·53	2·51	99	2·11	1·50	71	3·13	2·91	93	3·29	3·98	121	4·86	4·35	89	3·39	2·19	65
February	1·48	·94	63	1·70	·91	53	1·22	·91	75	2·79	5·40	193	1·57	3·06	190	1·53	·96	63	1·98	2·54	128	2·48	1·39	56	2·90	2·43	84	1·64	3·22	196
March	1·49	2·46	165	1·59	2·14	135	2·08	·39	19	3·75	2·08	55	2·42	1·04	43	2·35	1·04	44	2·21	2·32	105	3·33	3·46	104	4·32	3·25	75	2·58	·78	30
April	1·47	·54	37	1·63	·59	36	1·13	1·26	111	1·70	2·56	151	1·54	1·59	103	1·31	·72	55	1·40	2·42	173	1·74	2·10	121	2·13	3·46	162	1·64	1·11	68
May	1·41	1·41	100	1·89	1·75	92	2·40	1·14	48	2·46	1·06	43	2·88	2·05	71	2·64	2·30	87	1·80	1·20	67	2·26	1·41	62	3·18	1·60	50	1·91	1·38	72
June	1·41	·97	69	2·35	1·81	77	3·05	2·05	67	4·04	2·15	53	3·52	1·15	33	2·74	1·00	37	3·44	2·45	71	1·54	1·67	109	3·63	1·48	41	2·61	·82	31

SYMONS'S

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CII.]

JULY, 1874.

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THE WATER SUPPLY OF NORTH WESTERN EUROPE DURING THE SUMMER OF 1874.

[Two papers have been published in rapid succession by the most able men in France upon the supply of water which the springs and streams of their country will yield during the present summer. These papers are of such importance that we give them *in extenso*, and having, by the kindness of the authors, and of MM. Buys Ballot of Utrecht, Cavalier of Ostend, and others, been favoured with certain details, we shall, at the end of the translations, add a few words on the question as it affects the North-West of Europe generally.—Ed.]

Probable diminution of the yield of Spring Water in the basin of the Seine, in the Summer and Autumn of 1874. By MM. E. BELGRAND and G. LEMOINE.

[Extrait des *Comptes rendus des séances de l'Académie des Sciences*, t. lxxviii. séance du 1er Juin 1874.]

THE object of this note is to announce that the streams and springs of the basin of the Seine will continue to decrease from now to the middle of next October, when their discharge will be very low.

By this warning, which applies to more than four months, we do not wish to imply that there will be no rain during the summer, but that, however rainy the summer months may be, the yield of the springs will not be affected to any extent. The slight river floods, which might even result from summer rains, would very rapidly disappear, and the springs will nevertheless yield a very greatly diminished supply.

M. Dausse has proved that the rain of the summer months scarcely at all increases the volume of streams, as most of it is carried into the air by evaporation. The result of our own observations in the Seine basin has been that when at the end of May the yield of the springs is low, it does not increase during the hot months, and we know that the minimum yield usually occurs in October.

Hence it will be understood that from the rainfall of the cold months one can foresee within certain limits what will be the state of the streams during the ensuing summer. If the cold season has been a wet one, we may rest assured that the springs and water courses will yield well, up to the ensuing autumn. If, on the contrary, the cold

season has been very dry, the springs and water-courses will be, throughout the hot season, at a very low point.

Resting upon these principles, we, on June 4th, 1870, gave warning of the great dryness of the streams which prevailed even to the winter of 1870-71 (*Annales des Ponts et Chaussées*, t. xix. 1870.) We now attempt, for 1874, similar forewarnings.

A division of the year into two halves commencing and ending on the 1st May is very convenient for many hydrological questions. In the basin of the Seine the six months, May 1st to October 31st, form the hot season; and the six months Nov. 1st to April 30th, the cold one. What have been the characteristics of the past cold season?

I. The rainfall from Nov. 1st, 1873, to April 30th, 1874, has been, throughout the basin of the Seine, exceptionally small. In many parts it hardly reached half its usual amount, as is shown by the following abstract of the observations collected by the hydrometric service of the basin of the Seine. The table not only brings into juxtaposition the average rainfall and that of the past season, but it also includes that preceding the great droughts of 1858 and 1870. These two cold seasons were very remarkable for their small rainfall; but in that of 1873-74 it has been still less.

Rainfall in France in the Cold Season (Nov. 1st to April 30th).

STATIONS.	Mean 1859-68. Depth.	1873-4.		1869-70.		1857-8.	
		Depth.	Relation to Mean	Depth.	Relation to Mean	Depth.	Relation to Mean
	in.	in.		in.		in.	
LesSettons(Source of theCure)	37·21	19·84	0·53	33·11	0·89	17·17	0·46
Pannetière, Morvan	16·34	9·88	0·60	14·45	0·89	11·46	0·70
La Colancelle „	11·76	8·43	0·57	11·14	0·75	8·86	0·60
Pouilly, Cote d'Or	13·15	7·87	0·60	8·62	0·66	10·32	0·78
Grosbois „	13·07	9·57	0·73	9·65	0·74	10·43	0·80
Montbard „	13·70	7·60	0·57	8·50	0·64	9·17	0·69
Grignon, near Montbard .....	...	8·66	...	...	...	...	...
Chanceaux(Source of theSeine)	17·95	9·21	0·51	15·16	0·84	13·58	0·76
Chatillon-sur-Seine .....	...	7·60	...	9·69	...	...	...
Bar-sur-Seine .....	...	10·83	...	9·84	...	...	...
Vassy .....	...	9·88	...	11·85	...	...	...
Vitry-le-Français	11·38	4·80	0·43	6·81	0·60	5·95	0·52
Snippes, Chalons .....	...	6·85	...	7·64	...	...	...
Sommesous .....	...	5·79	...	5·91	...	...	...
Saint-Martin, Sens	9·92	4·25	0·42	7·01	0·71	5·00	0·50
Paris (La Villette)	9·37	5·55	0·59	7·21	0·77	...	...
„ (Observatoire, cour) ...	10·04*	5·59	0·56	...	..	6·54	0·65

* Mean of 45 years, 1818-62.

After a cold season with slight rainfall, it may sometimes happen that partial compensation is afforded by rain at the commencement of the hot season, when May is very rainy. It was in this hope that we have delayed, until the present date, the warning which is the purport of this note, but nothing of this kind has occurred. We have at

Paris (La Villette) in May only had 0.87 in. instead of 2.24 in. which is the mean amount for this month. This will, therefore, not lessen the deficiency.

II. The streams have, in every respect, faithfully agreed with the rainfall of the cold season 1873-74. It would be difficult, throughout the entire extent of the observations made upon the Seine and its tributaries, to find a winter and a spring when the waters have remained at a lower level. There was a slight flood on the Seine at the end of October, 1873, but it only gave a maximum of 4 ft. on the scale on the *pont d'Austerlitz* at Paris. Since then the highest points have been 3 ft. 3 in. from December 1st to 5th, 1873, and 3 ft. 7 in. on January 4th, 1874. On May 31st the river had fallen to 4 in. From 1854 to 1870 the Seine had every year reached a higher point than 6 ft. 7 in. on the *pont d'Austerlitz*. In the cold season of 1866-67, it exceeded 13 ft. 2 in. during 62 days, and in the cold season of 1872-73, on 34 days.

The mean height of the Seine deduced from daily observations at the *pont d'Austerlitz*, from November 1st, 1873, to April 30th, 1874, has been exactly 2 ft. Now, from 1732 to 1854, that is to say, in 122 years (1776 being lost) the mean of the same months has once been less; and there are only seven instances of its being less than 3 ft. 3 in. on the scale on the *pont de la Tournelle*, Paris.

Cold Season.	Mean Scale reading	Highest point.
1749-50 ..	1 ft. 6½ in. ...	3 ft. 6 in., Feb. 25, 3 ft. 3 in., April 3
62-63 ...	2 ft. 10½ in. ...	4 ft. 5 in., Nov. 19, 7 ft. Mar. 6
66-67 ...	2 ft. 7½ in. ...	7 ft. 3 in., Feb. 16, 7 ft. 9 in., Mar. 7
1799-1800 ...	3 ft. ...	7 ft. 6 in., Nov. 18, 8 ft. 2 in., Feb. 1
1802-03 ...	3 ft. 1 in. ...	11 ft. 5 in., Feb. 19,
18-19 ...	2 ft. 6 in. ...	8 ft. 6 in., Feb. 26,
1834-35 ...	3 ft. 1 in. ...	8 ft. 4 in., Feb. 25, 8 ft. 7 in., Mar. 21

Before the construction of the weir near the Pont-Neuf, the indications on the scale of the *pont de la Tournelle* agreed with those on that of the *pont d'Austerlitz*.

III. The springs have, during the cold season just ended, presented characteristics analogous to those of the Seine, the height of which faithfully epitomize the meteorological phenomena of its whole basin. Usually, the yield of the springs gradually increases during the cold months, and is at its maximum at the end of March. This year, on the contrary, it has not increased throughout the winter. These facts are very clearly proved by the observations of the springs of the Vanne, which are intended to be brought to Paris. The gaugings calculated in litres, per second, have been as follows:—

Years.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1870 .	1015	1112	970	927	801	859	829	784	738	717	760	...
1 .	...	...	...	...	1036	1029	1051	1023	911	825	799	749
2 .	726	818	938	1046	1055	965	908	936	825	767	898	1714
3 .	1788	2080	1868	1973	1800	1476	1337	1309	1159	1049	1018	965
4 .	909	966	886	851	...	...	...	...	...	...	...	...

This table shows very clearly the contrast of the cold seasons of 1872-73 and 1873-74, the one very wet, the other very dry. It shows

that in March and April, when the yield is usually greatest, there is this year less than at the same period in 1870. The streams during the hot season of 1870 were exceptionally low, and this year the same causes will produce the same effects.

Even in the middle of spring the want of water was felt in the country. For instance, at certain farms near Noyers (Yonne) they were obliged, at the end of April, to send carts to the river for water. This is the beginning of a scarcity from which we shall suffer much during the next three or four months, and nothing now can prevent it.

IV. The springs, though *principally* regulated by the rainfall of the cold season, are, nevertheless, like all natural and physical phenomena, influenced by precedent conditions. A dry winter will produce a much smaller summer discharge, if, during the previous summer, the springs have been lower than usual. We may consider that, under these circumstances, the subterranean waters continue to diminish. It was thus that the dryness of 1870 was increased by that of 1869 and 1868; and that of 1858 by that of 1857.

In what condition was the ground at the beginning of the cold season of 1873-74? During the hot season of 1873, the yield of the springs was in no respect unusual, there was no deficiency. We may easily perceive why that was the case, for the cold months of 1872-73 had been, starting from October, 1872, exceptionally rainy, so that the soil had regained its normal condition. From this time the yield increased sufficiently until the spring of 1873, and kept the rivers adequately supplied. This is corroborated by the following table of the minima of the Seine at Mantes during each hot season from 1857 to 1873, the minimum height of 1ft. 7in in 1873 notably exceeds that of the driest years; it should, however, be regarded as very low, since the *étiage* adopted for the Seine at Mantes corresponds to 2ft. 7½in.

1857, 1 ft. 2 in. ...	1863, 7 in. ...	1869, 7 in.
8, 4 in. ...	4, 10 in. ...	70, zero.
9, 7 in. ...	5, 5 in. ...	71, 10 in.
1860, 3 ft. 2 in. ...	6, 2 ft. 2 in. ...	72, 4 in.
1, 10 in. ...	7, 1 ft. 8 in. ..	73, 1 ft. 7 in.
2, 1 ft. 8 in. ...	8, 4 in.	

This storage of moisture in the lowest beds of the soil might have been sufficient to diminish the intensity of the scarcity of spring water which is now beginning; but the past cold season has been so dry, that this natural store from the season 1872-73 has completely disappeared. This is the result of the actual discharge of the springs up to the present time.

To sum up—the principles upon which we rest do not permit us to foresee the weather of the summer and autumn of 1874. It may be that they will be very dry, or very wet—we are, in this respect, in absolute ignorance.

But, whatever may be the meteorological characteristics of the hot season now beginning, its hydrological character is now fixed. We may say that, in all probability, *the water-courses and springs of the basin of the Seine will fall between now and the middle of next October to almost the lowest point yet observed.* After the middle of October the streams may further diminish, but we cannot speak positively on the subject. To prevent the perfect fulfilment of our forewarning, altogether exceptional rains (like those of Sept. 1866) must occur; but at this period of the year they have not occurred more than once in a century.

We know how numerous are the material necessities of mankind which depend upon our streams; it may be very necessary for agriculture, for the supply of canals, and of towns, not to be unprovided against the dearth of water, which has already commenced, and can only increase from now until October next.

After the reading of this note, M. Belgrand, in accordance with a remark of M. Elie de Beaumont, undertook that the actual discharge of the great Artesian wells of Paris should be determined with the greatest care, at least once a fortnight, throughout 1874 and the first six months of 1875.

Probable Decrease of discharge of Spring Water in the South-West of France, in the Summer and Autumn of 1874, by PROF. V. RAULIN.

(Bulletin de l'Association Scientifique de France, 5 Juillet, 1874, t. xiv. p. 223-4.)

THAT which Messrs. Belgrand and Lemoine have announced for the North of France, and especially for the basin of the Seine, is perfectly applicable to the South-West, and in particular to the basins of the Garonne and the Adour.

In fact, since the months of October and November, which were very rainy, the six months December to May have been, three of them extraordinarily dry, and three of them very dry, whence it results that the whole six months have only furnished a very small quantity of water; relatively less indeed than has fallen in the North of France.

In the basin of the Seine they have not registered more than half of the usual rainfall. In the South-West of France, the quantity fallen during these six months hardly reaches two-fifths of its mean amount. This is the result of the observations made at the Botanical School of Bordeaux by myself, and at Marcenx by M. Claverie.

This dearth of water during the last six months, appears to have extended over the whole plain of South-West France, and to the Pyrenees, for M. Schroder, junr., tells me that on the mountains, snow during the last fortnight was very rare; that the snow line was 500 or 600 metres (1,600 to 2,000 feet) above its usual level, in the neighbourhood of the Cauterets, and that it has already almost entirely disappeared from the summits of Marboré. Similar drought is not

altogether without precedent at Bordeaux. During the 160 years, which have elapsed since rainfall observations were commenced in 1714, it has occurred six times, viz., in 1750, 1768, 1779, 1781, and in 1864, and 1874.

It is superfluous for us to express our agreement with the views and remarks in the foregoing papers; we therefore proceed at once to compare the deficiency in France with that elsewhere. In order that our readers may have the opportunity of doing this as well as ourselves, we have prepared the following small table for the British Isles in exactly the same manner as that for France, given by MM. Belgrand & Lemoine,

Rainfall in the British Isles in the Cold Season (Nov. 1st to April 30th).

STATIONS.	Mean 1859-68. Depth.	1873-4.		1869-70.		1857-8.	
		Depth.	Relation to Mean	Depth	Relation to Mean	Depth	Relation to Mean
Camden	10.29	6.09	59	10.69	104	...	...
Linton	12.30	7.51	61	10.80	88	6.93	56
Selborne	15.37	12.66	82	16.24	106	...	...
Hitchen	10.02	7.96	80	10.37	103	8.54	85
Banbury	10.75	8.31	77	12.55	117	...	...
Culford	10.12	6.44	64	11.64	115	...	...
Bridport	16.13	11.72	73	12.89	80	8.54	53
Barnstaple	18.02	14.42	80	16.60	92	12.05	67
Bodmin	23.65	23.54	100	23.12	98	18.01	76
Orleton	12.99	10.41	80	14.30	110	10.93	84
Boston	9.31	5.32	57	10.16	110	5.39	58
Derby	10.12	8.17	81	10.69	106	5.80	57
York	9.83	6.91	70	11.32	115	4.88	50
Arnccliffe	28.16	29.11	103	33.69	120	12.92	46
N. Shields ...	12.28	5.81	48	11.70	96	...	...
Rhayader	21.10	20.25	96	24.65	117	...	...
Llandudno ..	13.01	10.99	85	15.28	117	...	...
Dumfries	18.48	12.45	67	17.46	94	16.55	89
Nookton	13.71	10.53	77	8.20	60	8.72	64
Culloden	12.11	11.97	99	8.73	72	10.90	90
Sandwich	18.81	19.91	106	19.71	105	13.57	72
Waterford	20.38	14.87	73	19.46	95	...	...
Killaloe	22.59	19.20	85	25.57	113	19.66	87

and also the accompanying rather elaborate, but extremely interesting folding table from data supplied to us by the friends mentioned above. A very few words are required to explain certain omissions, purposely made in the table, in order to render it compact. The N. for North Latitude is omitted, as unnecessary in a table referring only to Europe. All measurements are converted into, and given in, English inches; all ratios are printed in Egyptian type, to distinguish them from measurements of rainfall. In case this may fall into the hands

of any persons not accustomed to this mode of discussing rainfall observations, it may be well to state (1) that they may be regarded as the answer to the following rule of three sum, *e.g.*, if at Carcassonne the average rainfall in November is 2·61 in., and the actual fall in November, 1873, was 5·55 in., what was the ratio of that fall to the average, if the latter be taken as 100? then

$$\text{As } 2\cdot61 : 5\cdot55 :: 100 : 212\cdot6.$$

Of course the short cut to this is

$$\begin{array}{r} 2\cdot61 \overline{) 5\cdot5500} (212\cdot6 \\ \underline{522} \\ 330 \\ \underline{261} \\ 690 \\ \underline{522} \\ 1680 \\ \underline{1566} \\ 114 \end{array}$$

and as this is nearer 213 than 212, the former is entered in the table. It will be obvious to all who are familiar with computations that there is a much easier way even than this, but we need not enter into further details.

(2) The advantage of reducing observations to this form is, that it facilitates enormously comparisons between the fluctuation of rainfall at various stations, no matter how widely different may be the total amount.

(3) From these few remarks it will be evident to every one that the real meaning of the following entries is:—

200	150	100	50	25
Rainfall twice the average.	Rainfall half as much again as the average.	Rainfall just the average.	Rainfall half the average.	Rainfall one quarter the average.

With these few words for the benefit of those not used to the subject, all will be able to examine the table with profit. The results appear to us to be for the several months as follows:—

November, 1873.—Rainfall small in Belgium, Holland, and across the middle of England and Ireland; near the average, in central France; and above it, in the south of France, the south-west of England and in Scotland.

December, 1873.—Extremely dry throughout France and England, not a quarter of the average. In Holland and Belgium it was about one-third; in Ireland, half; and in Scotland, nearly the average.

January, 1874.—Another extremely dry month in France, especially in the south (except Ardèche), rather more rain in the east and north of that country, and nearly the average in other parts of western Europe.

February, 1874.—Ardèche again excepted, the fall in France may be taken as half the average. In Belgium, Holland, and the outer portion of the British Isles the fall was about three-quarters the average; but in Cornwall, Worcester, and Dublin it was nearly double the average—193, 196, and 190 respectively.

March, 1874.—There were scarcely any French stations where the fall exceeded one-third of the average, and in London there was not one-fifth. In Scotland the fall was about the average, and in Holland and Belgium it was nearly 40 per cent. in excess.

April, 1874.—This month was almost the opposite of March; it was very dry in Belgium, Holland and the east of France; and above the average in most other districts, except the east of England.

May, 1874.—Rainfall above the average in Belgium and Holland, below it elsewhere, especially in the south of England and north of France.

June, 1874.—Rather dry generally, especially in England; above the average at Bordeaux and in Orkney.

Taking now each country separately we find the following:—

France.—The dry period may be considered to have extended from the beginning of December to the end of May, and the average ratios are—

	Dec.-May	Nov.-April		Dec.-May	Nov.-April
Carcassonne ...	47	74	Les Settons ...	52	55
Marcenx ...	50	57	St. Martin ...	41	45
Vals ...	72	84	Paris ...	48	58
Bordeaux ...	51	71			

The first column shows the six months of greatest deficiency, the second gives the values for the period chiefly affecting the yield of springs. The small differences between these last values and those in M. Belgrand's paper arise from his values being worked from the totals for the period, ours from the sums of the ratios. It is clear, however, by either method, and in whatever way the subject is treated, that one of the driest parts of France, that near Paris and Fontainebleau, has had for six successive months less than half its usual rainfall.

Belgium and Holland may be taken together, the rainfall being very similar, and at all stations the drought began with November, but was much less severe than in France; in fact, January had an average rainfall, and March considerably above it. The following are the mean ratios, worked out in the same manner as those for France:—

Station.	Dec.-May.	Nov.-April.
Ostend ...	80	67
Utrecht ...	90	71
Helder ...	86	78
Groningen ...	74	65
Brussels ...	75	74

The British Isles.—In some parts of these islands there has been no drought whatever, in others it has been almost as severe as in any part of the area under consideration. The mean ratios are—

Station.	Dec.-May	Nov.-April.	Station	Dec.-May.	Nov.-April.
London ...	63	58	Braemar ...	126	108
Bodmin ...	111	97	Sandwick ...	105	95
Orleton ...	87	88	Killaloe ...	91	89
N. Shields ...	49	56	Dublin ...	75	76

From which it will be seen that in the south-west of England, and in Scotland (in fact, in wet places) the rainfall has been equal to, or greater than, the average; but at dry stations, like London and North Shields (just as at Paris and St. Martin), the fall has been little more than half the average.

There is, therefore, reason to believe that in the eastern part of England the supply of water in wells, ponds and streams will be very deficient, although not quite to the same extent as in north-eastern France.

PROPOSED ISSUE OF DAILY WEATHER CHARTS OF EUROPE AND THE NORTH ATLANTIC.

To the Editor of the Meteorological Magazine.

SIR,—I have the honour to inform you that Capt. Hoffmeyer, Director of the Royal Meteorological Institute of Copenhagen, has sent me a circular announcing his intention to publish daily charts of the weather for the district from 60° E. to 60° W. long. and from 30° to 75° N. lat. The charts for the three months—Dec. 1873-Feb. 1874—will be published as an experiment.

The cost will be four francs per month, exclusive of postal charges.

Capt. Hoffmeyer states that he can only deal with central offices, and has requested me to undertake these islands as regards the distribution of the charts. I have therefore to announce that I have been instructed by the committee to subscribe for twenty-five copies of these charts, and I shall be happy to supply copies for the three months to any gentleman, at the cost of 11s., to cover carriage from Copenhagen, and postage from London to his address.

ROBERT H. SCOTT, *Director.*

Meteorological Office, June 22nd.

A METEOROLOGICAL BREAKFAST AT BELFAST.

THE following paragraph appeared in our notice of the Bradford meeting of the British Association :—

“On looking over this list [of 39 Meteorologists present at Bradford] one cannot but regret that amid the one, two, or three thousand members and associates it is very difficult to pick up individual persons whom one wishes to meet. It also seems a pity that, as a rule, meteorologists do not hold more together than they have done. At the Edinburgh meeting Mr. Milne Home, as Convener of the Council of the Scottish Meteorological Society, gave a breakfast to the principal meteorologists at the meeting. We cannot expect to find a Mr. Milne Home at every town the Association visits, but surely it only requires *the will*, to arrange for a friendly breakfast limited to meteorologists, and to take place on the morning of the day (the Monday) appropriated by long established custom to the discussion of Meteorological papers in section A.”

We are very glad to say that Mr. Smyth, of Milltown, one of the best observers in the north of Ireland, has entered warmly into the scheme, and that arrangements will be made for carrying out this

suggestion at Belfast, on August 24th. The proposal having been originated by ourselves, it is almost superfluous for us to express our wish for its success ; but it is by no means certain that the result will be such as to ensure its becoming a permanent institution, unless each reader of these lines does his utmost to advance the proposal, and to make it known to his friends. This early notice of the date will prevent anyone having a previous engagement for that morning, and if the gathering is half as pleasant as that at Mr. Milne Home's, we are sure that those who are absent will have cause to regret it.

A word or two as to details, the room will be open at 8.30 a.m. for conversation, breakfast will be served at 9 a.m. *precisely* (as many will require to be at Sectional Committees at 10). Seats can only be guaranteed to those who send in their names previously ; the cost will be very small, not exceeding five shillings, and being probably less ; until August 15th all communications should be addressed to Mr. G. J. Symons, 62, Camden Square ; after that date, Reception Room, Belfast.

SUPPLEMENTARY TABLE OF MONTHLY RAINFALL.

WE have been requested by several of our readers to print the total fall of rain at a few stations in addition to those given in our present table. We always desire to receive suggestions for improvement, and act upon them whenever we can. Admitting that there are in the present table considerable interstices, we accept the suggestion, and will insert in future a table similar to the following, and will enlarge it by the addition of such other records as may be promised to be sent to us, by the 4th of each month, from stations 15 miles distant from any of our regular stations, or from any of those quoted below (all of which fulfil this condition). Of course we shall only be able to accept one offer for each vacant district.

Div.	County.	Station.	Total Fall.
			in.
II.	Kent	Margate, Acol	1.43
"	Sussex	Hailsham	1.61
"	Hampshire	Strathfield Turgiss	0.90
IV.	Suffolk	Ipswich, Bishop's Hill	1.10
"	Norfolk	Swaffham	2.13
V.	Devon	Teignmouth	1.48
"	Somerset	Taunton, The Castle	1.07
IX.	York	Wakefield, Stanley Vicarage	0.74
X.	Westmoreland	Shap	1.86
XI.	Pembroke	Castle Malgwyn	1.25
XVII.	Banff	Keith	1.49
XVIII.	West Ross	Strathconan	4.02
XX.	Cork	Fermoy, Glenville	1.48
XXI.	Westmeath	Athlone, Twyford	1.50
XXII.	Galway	Ballinasloe	1.95

REVIEWS.

Report of the Rugby School Natural History Society for the Year 1873.

8vo. 76 pp. 3 plates. W. Billington : Rugby.

THE principal feature in this report is a paper by Mr. R. H. Scott, F.R.S. (Old Rugbeian), upon the Weather, giving a popular account of the general principles upon which the warnings of the Meteorological Office are based. We should be glad to see, that the boys themselves take an increasing interest in the work of the Society, the Meteorological register fuller, so re-arranged that the months are not divided, and supplemented by an abstract for the year. The right to prepare this abstract might perhaps be awarded to those who supplied most notices of halos, auroræ, thunderstorms, &c., the addition of which to the present list of instrumental readings would be a great improvement.

S. W. Silver and Co.'s Handbook for Australia and New Zealand.

Royal 8vo., 413 pp., 1 plate. Silver & Co., London.

ALTHOUGH there is no statement or advertisement to that effect, we believe that this work is the first of a series, which is to embrace the whole colonial empire of Great Britain—if so, we pity the compilers of the future issues, because they will naturally be expected to equal, if they do not surpass, the first of the series, which will be a very difficult task for several reasons. With future issues we have, however, nothing to do, and therefore we turn again to the work before us. It is, to the best of our judgment, very impartial, as well as very comprehensive, and well arranged. Each colony is treated separately, so that we have New South Wales, Victoria, South Australia, Queensland, Western Australia, Tasmania, and New Zealand; and respecting each colony the following subjects are treated—"Discovery, History, Geography, Climate, Geology, Natural History, Botany, Government, Population, Statistics, Education, Religion, Pastoral, Agricultural, Mining, Trade, Manufactures, Land Laws, Immigration, Rates of Wages, Prices of Provisions, Hints to Intending Emigrants." When our readers have recovered their breath after reading this long list, they may wish to know whether these numerous and various heads are properly treated; we have no hesitation in saying that all those branches of which of we are competent to judge are very well done, a remarkably large amount of information being given in a very condensed manner. The articles on climate are extremely good, and if they were all cut out of this work, and published with a separate title as a "Climate of Australia and New Zealand," we should be obliged to acknowledge it the most complete work of which we are aware. A practised meteorologist will see by two or three entirely unessential "trips" that the compiler is not familiar with the science, and will, therefore, probably share our high appreciation of one who could treat so well a subject with the technicalities of which he is evidently not familiar. It would be absurd for

us to attempt to epitomize the climate of our Antipodean empire in a single page, and we shall therefore not attempt it, but refer those of our readers who require information to this pleasantly written Australasian Encyclopædia.

We should not greatly regret the loss of the frontispiece, and we think that a series of maps of the colonies giving every place named in the text would be very valuable. It would also be better to abolish the head-line "Handbook to Australia and New Zealand," which is repeated on every left hand page (*i.e.* 194 times) and to give instead the name of the colony treated upon each opening of the book.

The Fenland Meteorological Circular and Weather Report. Edited by S. H. MILLER, F.R.A.S., F.M.S. No. I.-VI., Feb.-July, 1874. 4to. Leach & Son, Wisbech.

THE title of this new serial is so expressive, that it is unnecessary for us to say much respecting its contents, which (as those who know the editor would assume), are uniformly good. The circular aims at being a storehouse of meteorological records for the Fen district, and at bringing the medical and agricultural uses of meteorology forward in such a way as to prevent the present generation remaining, or the next growing up, incompetent to understand how much the atmosphere influences almost every sphere of human action. The observations at Wisbech are printed in great detail, and supplemented by a barometer diagram; there are also abstracts of those at about a dozen stations between Cambridge and Louth, with remarks upon the weather and crops. Considerable attention is given to tidal records, and we are glad to see in later numbers an increasing tendency towards giving them in relation to Ordnance datum; as many of the notes on this subject bear the signature of W. H. Wheeler, their trustworthy character may be taken for granted.

The editor should, however, not attempt more than is within his power; his June table bears the date of July 9th, which is remarkably early to issue tables based on returns from any staff of observers, earlier than any of the county associations with which we are acquainted, and implies an undue pressure on the editor's time, of which there is proof in half a dozen misprints on page 40. True they are mostly obvious, and printer's errors, but their presence shows that the proofs have been read too hastily. Few know better than we do the difficulty of maintaining a high standard of accuracy, especially when work is hurried, but there can be no question that Meteorological printing must be either very accurate, or—worthless. When the Editor reads this he will doubtless think that we are (as we are so often said to be) too severe. Probably he knows nothing of a storm (upon this subject) now gathering, but when it has burst he will feel that the unkind cut in the *Meteorological Magazine* was one of the most serviceable reviews which he had.

We think that this publication merits support even beyond the area to which it specially appeals, and we wish it a long and successful career.

JUNE, 1874.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables which each station belongs.]	RAINFALL.				Days on which "01 or more fell.	TEMPERATURE.				No. of Nights below 32°		
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.			Max.		Min.				
				Dpth	Date.		Deg.	Date.	Deg.	Date.			
I.	ENGLAND.	Camden Town	inches 2.05	inches. — 1.00	in. .72	23	12	81.7	2	39.5	13	0	0
II.		Maidstone (Linton Park)	2.63	— .11	.73	17	11	83.0	5	32.0	13	1	...
III.		Selborne (The Wakes)	2.63	— .60	.47	26	10	75.0	5	34.0	13	...	1
IV.		Hitchin	1.35	— 1.29	.36	23	14	74.0	9	35.0	12	0	...
V.		Banbury	.50	— 2.78	.27	29	8	78.0	9	38.5	13	0	...
VI.		Bury St. Edmunds (Culford)	1.64	— .94	.42	23	10	80.0	9	...	...	...	...
VII.		Bridport	2.46	— .78	1.19	26	10	80.0	9	36.0	13	0	...
VIII.		Barnstaple	1.48	— 2.64	.47	2	7	79.0	9	43.0	14	...	...
IX.		Bodmin	2.15	— 1.89	.80	26	10	70.0	10	36.0	13	0	2
X.		Cirencester	1.84	— 1.54	1.05	28	7	...	...	...	...	...	...
XI.	WALES. <td>Shifnal (Haughton Hall)</td> <td>.77</td> <td>— 2.34</td> <td>.46</td> <td>24</td> <td>10</td> <td>74.0</td> <td>9,30</td> <td>39.0</td> <td>15</td> <td>0</td> <td>0</td>	Shifnal (Haughton Hall)	.77	— 2.34	.46	24	10	74.0	9,30	39.0	15	0	0
XII.		Tenbury (Orleton)	1.15	— 2.37	.48	26	6	81.3	9	36.5	13	0	0
XIII.		Leicester (Wigston)	.58	— 2.18	.23	29	9	80.0	2,*	34.0	12	0	...
XIV.		Boston	.72	— 1.47	.33	2	7	81.0	5	38.0	15	0	0
XV.		Grimsby (Killingholme)	.86	...	.20	29	9	76.0	9	40.0	12§	0	...
XVI.		Derby	1.07	— 1.82	.37	24	10	80.0	9	41.0	12||	0	...
XVII.		Manchester	2.00	— 2.34	...	...	...	...	...	...	...	...	...
XVIII.		York	...	...	...	...	...	...	...	...	...	...	...
XIX.		Skipton (Arnccliffe)	1.53	— 2.57	.56	30	12	79.0	19	34.0	10	0	...
XX.		North Shields	1.00	— 1.74	.59	24	8	72.0	4	37.0	12	0	0
XXI.	SCOTLAND. <td>Borrowdale (Seathwaite)</td> <td>3.02</td> <td>— 7.49</td> <td>1.69</td> <td>30</td> <td>9</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td>	Borrowdale (Seathwaite)	3.02	— 7.49	1.69	30	9
XXII.		Cardiff (Ely)	1.58	— 3.06	.54	24	5	...	...	...	...	...	...
XXIII.		Haverfordwest	1.31	— 2.34	.69	23	5	77.0	18	38.0	11	0	...
XXIV.		Rhayader (Cefnfaes)	.66	— 3.32	.35	24	...	76.0	...	35.0	...	0	...
XXV.		Llandudno	.35	— 1.94	.09	29	5	72.0	4, 21	41.2	13	...	...
XXVI.		Dumfries	.92	— 1.98	.30	25	10	74.0	18†	36.0	12	...	...
XXVII.		Hawick (Silverbut Hall)	.78	...	.27	24	6	...	...	...	...	...	...
XXVIII.		Kilmarnock (Annanhill)	...	...	...	...	...	...	...	...	...	...	...
XXIX.		Castle Toward	1.21	— 2.28	.40	1	6	...	...	...	...	...	...
XXX.		Leven (Nookton)	.63	— 1.61	.27	30	5	75.0	19	34.0	12	...	6
XXXI.	IRELAND. <td>Stirling (Deanston)</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td>	Stirling (Deanston)
XXXII.		Logierait	1.37	...	.55	23	9	85.0	17	34.0	11	0	...
XXXIII.		Braemar	2.45	— .99	1.17	29	14	70.0	17	34.3	18	...	8
XXXIV.		Aberdeen	.95	...	.46	21	7	74.0	4	39.5	13	...	1
XXXV.		Portree	5.49	+ .71	.80	1	19	...	...	...	...	...	...
XXXVI.		Loch Broom	5.41	...	.92	8	21	...	...	...	...	...	...
XXXVII.		Inverness (Culloden)	.78	— 1.14	.21	22	17	67.8	28	35.1	12	0	2
XXXVIII.		Helmsdale	1.87	...	.47	10	11	...	...	...	...	...	...
XXXIX.		Sandwick	1.67	+ .13	.58	10	14	64.0	2	40.2	11¶	0	0
XL.		Caherciveen Darrynane Abbey	2.34	...	...	...	8	...	...	...	...	...	...
XLI.	Cork	.91	...	.43	23	9	...	...	...	...	...	...
XLII.	Waterford	1.69	— 1.30	.62	22	8	74.0	18	42.0	13	0	...	
XLIII.	Killaloe	1.48	— 2.15	.40	30	8	78.0	4†	40.0	8	0	0	
XLIV.	Portarlinton	.82	— 2.43	.20	25	11	72.0	18	37.5	12	0	...	
XLV.	Monkstown, Dublin	.82	— 1.79	.39	21	10	...	...	...	...	...	...
XLVI.	Galway	3.65	...	1.27	30	9	76.0	21	40.0	31	0	...	
XLVII.	Ballyshannon	1.85	...	.40	22	12	62.0	4	50.0	1	0	0	
XLVIII.	Waringstown	1.40	...	.39	2	10	82.0	18	38.0	13	0	3	
XLIX.	Edenfell (Omagh)	3.18	...	.75	24	13	73.0	17	35.0	21	0	0	

* And 8 & 9. † 19. ‡ 7 & 15. § And 15. || 13. ¶ 12.

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

METEOROLOGICAL NOTES ON JUNE.

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.

LINTON PARK.—A few hot days in the first week. T on 6th, followed by a period of dry cold weather, with a decided frost on the 13th, (and in some places near here on other days as well, up to the 22nd); cold N. and N.E. winds blowing night and day from 12th to 16th, and our heaviest fall of R was from that direction. Very little T, but an average rainfall, the last week being showery. On the 13th I scraped rime from glass sufficient to form a small snowball.

SELBORNE.—Frost on the 13th, by which beans and potatoes were cut; T in afternoon of 21st; prevailing wind in middle of the month N.E., afterwards S.W. Hay extremely deficient from the extraordinary drought. From the 13th of April to the 22nd of June, (70 days) less than one inch (.902) of R has fallen. Mean max. temp. 68.6, mean min. 47.4.

CULFORD.—The coldest June of which I have any record, the temp. being at or below 32° on several days; on the 12th and 20th potatoes, beans, and tender plants were severely injured, and ice was found as late as six a.m. A severe TS with H on 24th; T also on 22nd and 25th. Polar or easterly winds prevailed on 16 days, and westerly on 14 days.

BRIDPORT.—Fine till the 22nd, from which date to the end of month (8 days) 2.42 in. of R fell; 17 days of easterly wind; severe TS, with heavy R (1.19) on the 27th.

BODMIN.—Average temp. 62°·7, being 4°·4 above the average. The long drought was severely felt, and the R of the 22nd and following days was very welcome.

CIRENCESTER.—Thunderstorm on 28th, with 1.05 of R. No R fell between the 1st and 22nd.

SHIFFNAL.—This has been an ungenial June, owing chiefly to the cold nights. It opened favorably with temp. at 72°, from which it fell on 6th till (2 days excepted, 8th and 9th) the 29th. There were only slight showers on 4 days (6th, 9th, 21st, and 23rd) till the 24th, when a refreshing fall of .46 took place, but shortly to be dried up by the westerly winds which prevailed; the pastures became bare as in August, and the hay crops on uplands very light; the wheat stood the drought well, and is likely to be a good crop. Turnips and mangold wurzel scarcely grown. The nights only reached temperate twice (5th and 9th); T on 27th; cumuli clouds frequent.

ORLETON.—A very dry month, with a mean temp. of about $\frac{1}{2}$ ° above the average. Very fine and pleasant till the 12th, when cold winds set in from the N., which continued till the 22nd; variable afterwards, with showers. A great shower of R fell on the 26th at 7.15 p.m., when .20 of an inch fell in five minutes; distant T heard on 21st, 22nd, 24th, 25th, and 27th.

WIGSTON.—Owing to the continued absence of R the hay crops are not half the average, and the pastures are very poor. Corn looks well generally, but owing to the absence of sun it makes but slow progress.

BOSTON.—A very fine dry month; temp. about 1° below the average; a period of very cold weather occurring in the middle of the month. R more than an inch below the average; water very scarce. The pastures burnt up, and the hay crops very thin; wheat and other cereals looking splendid, the straw standing straight up, very level, with good heads, in ear about the 9th, which is very early; wild flowers very luxuriant; strawberries ripe in the air about the 26th; TS on the 1st and 22nd; T on 25th.

GRIMSBY.—The leaves of many ash trees have not opened fully. Hay crops very light, and the prospects of a crop of turnips very bad; most of the ponds dry, and springs very low. High bar. until the last week. TS 24th and 25th, in the after part of the day; T at 4.40 p.m. on 2nd, and at midday on the 22nd.

ARNcliffe.—Rainfall very much below the average; T on nearly every day of the last week; very high wind on 17th, from N. and N.E.,

NORTH SHIELDS.—Strawberries ripe on the 21st; TS on the 24th, four hours after the storm the hail was lying in heaps unmelted; pieces of ice fell three quarters of an inch long, cutting holes in the leaves of plants; .59 fell in one hour; another TS on the 29th.

SEATHWAITE.—Only one day on which the fall exceeded one inch, viz., the 30th, when 1.69 was measured, there being T on that day; T also on 24th, 25th, and 27th.

WALES.

HAVERFORDWEST.—.05 in. of R fell on the 1st; for 21 days after no R fell; 1.26 was measured during the last 7 days, this, however, came too late to save the country from the effects of the drought, which set in on the 13th of April, from which time till the 23rd of June only 1.32 in. of R fell. This dry season has been the most severe in this country since the memorable one of 1859, when the drought lasted from the last week in April to the second week in August. Temperature at or above 70° on nine days.

CEFNFAES.—A very dry month (only one sixth of the average); great want of water in this hilly country. Partial T showers, with heavy rains in some parts. Wind N.E. and S.E.; frosts at night.

LLANDUDNO.—The month has been remarkably dry; the prevailing winds N. and N.E.; the evenings occasionally chilly. Elder in flower on the 2nd, wheat in ear on 8th, began to cut hay on 9th, barley in ear on 18th.

SCOTLAND.

DUMFRIES.—The weather very droughty up to the 21st, and at the close of the month. On the morning of the 12th a frost, which blackened potatoes on mossy and low-lying soils, but did no injury on higher and drier land. The drought burned up the pasture on gravelly or sandy soils. Oats stunted in growth; hay, a very light crop; potatoes, where not injured by the frost, good; turnips, where sown early, very promising. Rainfall lowest since 1868: T on 25th and 26th.

SILVERBUT HALL (HAWICK).—T on 23rd. A month of extreme drought and cold E. wind; pastures burnt up from lack of moisture.

CASTLE TOWARD.—A dry warm month, with only six days of rain, the 1st, 2nd, and 3rd, and three others at intervals. Very little grass, and almost everything burnt up. Apples and pears scarce; currants plentiful; potatoes look well. Hay cutting commenced.

NOOKTON.—T on 29th.

BRAEMAR.—A very dry month; soil burnt up; hay crop light. TS 10.30 a.m. to 3 p.m. on 29th, total fall 1.17, .85 of which fell during the H storm, which lasted 35 minutes. TS on 25th, and T on 30th.

ABERDEEN.—A month of rather warm and very dry weather. The storm of the 21st was very brief, but the L damaged a house in the east end of the town. T reported every day to the end of the month in the neighbouring districts. On the 29th a "terrific" TS in Tarland district; a correspondent says, "several hours after the storm abated a hill to the S. of Aboyne continued thickly coated with S (or H) to its base, just as white as I ever saw Morven in January." In the TS on the 21st, .42 fell in 50 minutes.

PORTREE.—A very mild month; fine growing weather; the crops have made great progress; pasture grass very plentiful and cattle in prime condition. On 24th several loud peals of T, with a fearful fall of H, or rather lumps of ice, which remained in sheltered places to the depth of 2 inches for six hours after falling. On the 29th more T, with heavy R. At Sligachan H fell to the depth of 4½ inches.

LOCHBROOM.—This has been an excellent month for the farmer, plenty of sunshine and showers, with warmth without overheat; just a month to suit the working man and the growth of the produce of the soil; seldom have we such fine weather.

SANDWICK.—The rainfall of June has been below the mean of the previous 33 years. The first and last third of the month were generally pleasant, but from

the 10th to the 20th there was frequently northerly winds, with a touch of W., which made that part disagreeably cold. A gale of 45 miles an hour from 1 to 2 a.m. on the 10th.

IRELAND.

WATERFORD.—Vegetation suffered from the long drought; pastures burnt up, but revived by the welcome rain of the last few days. T and H on 24th, wind ranging from S.W. to W. and N.W.

KILLALOE.—Distant T on 24th and 25th.

BALLYSHANNON.—The month has been an unusually fine and dry one, and the crops are promising very well with the exception of the hay, as the drought has retarded the growth of the grass.

WARINGSTOWN.—An exceedingly dry month; meadows, turnips, flax, and indeed all crops, suffered much from want of rain.

EDENFELL, OMAGH.—Fine, dry, generally clear, and occasionally hot up to 21st; from that time to the end of the month, unsettled, with heavy showers. Hay harvest interrupted, but general effect of the rain exceedingly beneficial to all growing crops.

"POCKY CLOUDS."

To the Editor of the Meteorological Magazine.

SIR,—Is it too late to object to the above name? it by no means struck me as pleasant or appropriate, and reference to various dictionaries has increased rather than lessened my repugnance. How came Dr. Clouston to use such a name?

Yours truly,

E. S. H.

[We believe that although Dr. Clouston (in 1822) was the first scientific man who called attention to, and described, this cloud, it was previously well known to (and much dreaded by) Orcadian sailors, and that it was they, and not Dr. Clouston, who gave it the name above objected to. If our correspondent had carefully read the pamphlet to which we called attention, he would have noticed that Dr. Clouston speaks of "festoons or pocks)," and elsewhere of "drapery containing something heavy." The word is derived from the Saxon "*poc*," a swelling or bag; hence "pocket," a diminutive of "*poc*," i.e., "a little bag." "Pocky," therefore, which means baggy, is not an incorrect description of this form of cloud; but the expression is infelicitous on account of its more frequent use in reference to a loathsome disease.—ED.]

BOOKS RECEIVED.

BARBADOES.

Rawson, The Hon. R. W.—Report on the Rainfall of Barbadoes, and its influence on the Sugar Crop. Fcap. folio, 1874.

Rawson, The Hon. R. W.—Rainfall at Barbadoes. 1874. Single sheets folio.

BELGIUM.

Cavalier, J.—Résumé des Observations Météorologiques faites à Ostende, en 1872. 4to.

Van Rysselberghe, F.—Notice sur un Système Météorographique Universel. 8vo, 1873.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CIII.]

AUGUST, 1874.

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THE RAINFALL OF JULY 11TH, 1874.

THERE were several local heavy rains on the above date, one of which, occurring in a low-lying and densely populous part of London, caused such inconvenience as to attract general attention.

Taking the most southerly records first, our Tenterden correspondent writes :—

“The heavy fall on 11th did not extend to Smallhythe, a part of this borough, about $2\frac{1}{2}$ miles south of the town; nor was there a large fall at my Benenden gauge, though in other parts of the same parish, and also at Rolvenden it was very heavy. At Hythe there was but .11, and scarcely any generally in Romney Marsh. The storm began here at 11.25 a.m., and lasted till 1.10 p.m., giving a fall of 1.03 in an hour and three quarters, the other .25 fell in two or three showers in the evening and following night. I found .20 had fallen in one quarter of an hour, .23 in another, and .50 in another, from 12.55 to 1.10 p.m. Did not see any hail; but there was some at Rolvenden.”

At Hartley, near Cranbrook, in Kent, thunderstorms occurred on the 11th at 3 a.m., noon, and 2 p.m.; 0.50 in. fell before 9 a.m., and 1.10 in. fell after that hour; 0.90 in. fell in 35 minutes at 2 p.m., of which the greater part fell in 20 minutes.

From Tunbridge Mr. Punnett writes :—

“A most extraordinary thunderstorm passed over Tonbridge on Saturday afternoon, 11th, the violence, I should think, has never been exceeded in Tonbridge; it commenced with distant thunder in the S.W. at 2.15 p.m., with vivid flashes of lightning; at 2.30 darkness rapidly set in, and then it began to rain, or rather a sheet of water came down, for neither I nor anyone in the town, I should think, ever saw it come down so fast before: the water ran down our road like a stream. You will, of course, like to know the rate at which the rain fell; it commenced falling at 2.30 p.m., the storm and rain continued till 4.30 p.m. and the total amount of rain that fell in those two hours was 3 inches exactly. The following I have copied out of our newspaper, which may perhaps interest you :—
‘Tonbridge.—Thunderstorm.—During the destructive storm which

passed over this town on Saturday afternoon, a valuable horse was killed near Cannon Bridge. A large piece of wall was forced away by the water at the Grammar School, another piece at Bordyke, and houses at Hildenboro' and Hadlow were struck and seriously damaged by the electric fluid."

It was nearly as bad at Sevenoaks, for the Rev. J. Burn Murdoch, of Riverhead Vicarage, writes :--

"It may interest you to know that this neighbourhood was visited with a severe thunderstorm on Saturday afternoon, the 11th inst., and that the heaviest fall of rain took place in one hour (between 2.45 p.m. and 3.45 p.m.) it has ever been my lot to observe in this country, viz. : 1.82 inches. A few drops fell before a quarter to 3, and a little more rain fell between 5 and 6 o'clock, but none afterwards. The total fall between half-past 2 and 6 o'clock was 2 inches.

"The roads in this parish have sustained very great damage. On the side of one of them, near the Sevenoaks Railway Station, a huge chasm, between 40 and 50 feet long, 12 or 15 wide, and about 10 deep, was formed by the rush of water. I may mention in corroboration of my measurements and observations on Saturday, that having occasion to go to the station about half-past 6 in the evening, the book-stall manager told me that a previously empty tub standing in his yard showed a fall of 2 inches in one hour."

We believe that both of the above described rains were quite local, and so also was that in the north-east of London, respecting which the following report, abridged from the *Hackney Gazette*, will be sufficient, as we believe that it may be implicitly relied upon :—

On Saturday afternoon, shortly before four o'clock, a violent thunderstorm burst over the north-eastern district of London. The heat of the day had been intense, and at times a most sultry oppressiveness of the atmosphere prevailed. Heavy clouds rose from the south-east about the same time, and soon covered the sky, and then a terrific display of forked lightning ensued, the flashes being intensely vivid, and following each other in rapid succession. The peals of thunder were very loud. Hailstones fell, as big as beans, whilst a heavy driving wind beat them along, blowing down tree branches and leaves, breaking windows and greenhouse sashes, and destroying garden produce. The North London Railway, in some of its cuttings, was under water from the accumulation of rain ; and at one time the water was so high that it was feared that the engine fires would be extinguished. Between Blackwall and Poplar it was four feet deep, and the traffic thence to Broad-street was suspended for four hours. At Dalston Junction the greatest precautions had to be used, as the water was so high that the large piles of sleepers lying along the side ready for the new line of rails under construction were floating about, and labourers were wading knee-deep in the water to fish them out of the way of passing trains. The streets were like rivers, the water rushing along with impetuous velocity, and in many cases—owing to the stoppage of drains—flooding the cellars to a depth of a couple of feet. At Edmonton and Tottenham, the basements of many houses were filled with water, and the furniture floated about. In a part of the roadway the water was up to the horses' breasts, and, for a time, the omnibuses had to cease running. In some parts of Hackney and Homerton the same thing occurred. The rain fell so rapidly that it was impossible to see across the road ; and very few of our neighbours escaped a flooding of their basements, more particularly in Hackney on the line of the old Hackney Brook, the new sewer being found quite insufficient to carry off the storm waters.

The most evil effects of the inability of the Board of Works to cope with a tropical rain, combined with its inattention to the requirements, were again exhibited in the Richmond-road, several of the houses on the south side of which were actually the recipients of the surface water of London Fields, which was drained into them. At Mr. Bennett's, and Mr. W. U. Crook's, the water reached to the height of five feet in the breakfast rooms and kitchen, floating pianos, tables, breaking partitions, forcing doors, and doing damage which will cost some hundreds of pounds to put right. It was past two on Sunday morning before the water was carried off, and then only by the Fire Brigade pumping it out.

The wind played great havoc with a large number of unfinished houses, and many trees were uprooted. The lower parts of the houses in the Victoria Park-road, and the Prince of Wales's-road, Victoria-park, were completely submerged, whilst a refreshment tent belonging to the Queen's hotel was carried away. The rain and hail did much destruction to the corn crops and market gardens in the direction of Homerton and Leyton. Tradesmen's goods at Hackney, Bow, Kingsland, and Clapton were damaged by water to a great extent. The Lea and the Regent's Canal overflowed their banks, whilst locomotion in the streets, as above indicated, was in many instances impossible.

The following is the *Times'* report of a subsequent discussion in the Corporation :—

THE RECENT INUNDATIONS.

Mr. Deputy HORA asked whether the Metropolitan Board of Works were taking any, and, if any, what, steps to prevent the serious inundations, increasing in frequency and violence, which happen after rain-storms, causing great destruction of property, pecuniary loss, and danger to the public health.

Mr. Deputy LOWMAN TAYLOR, in reply, read a letter on the subject from Sir Joseph W. Bazalgette, the Engineer to the Metropolitan Board of Works, in which he said :—"This Board have diminished the extent and frequency of floodings by carrying off through the intercepting sewers rainfall to the amount of a quarter of an inch in depth spread over London in 24 hours. But on the 11th inst. the rainfall in the East of London amounted to an inch and a half in one hour, or 150 times more than our intercepting sewers and pumps could take. Such storms can only be carried off by what are termed "the storm overflows," which discharge by gravity into the river. These must be above the level of low water, and many of the basements connected with them are so deep, that when the sewers are full the water flows back into them. This is the great cause of flooding. This Board are, nevertheless, carefully watching, and from time to time introducing, improvements which assist the more rapid discharge of flood waters into the river, and thereby decrease the liability of these low basements to be flooded in times of rain. The subject is now under the consideration of the Works Committee, who will make some such recommendation to the Board."

We may now pass to a summary of the records with which we have been favoured :—

RAINFALL AT STATIONS WITHIN 4 MILES RADIUS FROM VICTORIA PARK, LONDON.

County.	Stations.	Depth.	County.	Stations.	Depth.
		in.			in.
Essex ...	Walthamstow	·59	Middlesex	St. Mary's Rd., Islington.	·74
Middlesex	Stamford Hill.....	1·02	"	Guildhall.....	1·14
"	Hadham House	1·70	"	" (on roof).....	1·31
"	Compton Terrace	·49	Kent	Deptford Pumping Station	1·07
			"	Royal Obs. Greenwich ...	1·03

RAINFALL AT STATIONS IN AND NEAR LONDON, BUT BEYOND THE ABOVE CIRCLE.

Surrey.....	Addiscombe	·10	Kent	Crossness Pumping Statn.	·24
Kent	Park Side, Beckenham ...	·02	Middlesex	Spring Gardens	·15
„	Fox Grove „ ..	·03	„	Royal Botanic Gardens ...	·22
„	Forest Hill	·11	„	Camden Square	·17
„	The Downs, Dartford.....	·56	„	Squires Mount, Hampstd.	·17
Surrey.....	Halford House, Richmond	·23	„	The Nurseries, Highgate.	·20
„	Kew Observatory	·20	„	Muswell Hill	·10
Kent	Eltham Green	·10			
„	Blessington Road, Lee ...	·33			

REMARKS.

WALTHAMSTOW.—The greater part fell between noon and 3 p.m., during a severe TS, which was most terrific about 1 p.m., when also the rain was heaviest. Two elms struck at Leyton.

NAVARINO ROAD, DALSTON.—Rain gauge unfortunately not observed, but rain very heavy; several houses had from two to five feet of water in their lower rooms.

STAMFORD HILL.—0·93 in. fell before 5.30 p.m.

HADHAM HOUSE, UPPER CLAPTON.—Nearly 1·70 in. fell between 4 and 6 p.m.

COMPTON TERRACE, ISLINGTON.—By far the greater part of the 0·49 fell between 4 and 6 p.m., during the prevalence of a severe TS, which did not entirely pass away for some time, and rain fell moderately at intervals for some hours.

ST. MARY'S ROAD, ISLINGTON.—Rain began about 3 p.m., fell very heavily for an hour, and ceased about 8 p.m.

DEPTFORD, PUMPING STATION.—The fall of rain (1·07) commenced at 3.45 p.m., and ended at 4.45 p.m.

ROYAL OBSERVATORY, GREENWICH.—The rain began suddenly at 3.58 p.m., by 4.2 p.m. 0·25 in. had fallen; by 4.6 p.m. another 0·25 fell; by 4.11 p.m. 0.20 more had fallen; and by about 5 p.m. a total of 1·03 had fallen.

ADDISCOMBE.—Distant T from 1.45 p.m. Steady rain commenced at 2.40, continuing till 3.10; again from 4.5 to 5 p.m.; and again, for a few minutes, about 6 p.m. Total fall, 0·10; wind, N.

PARKSIDE, BECKENHAM.—TS from about 2 to 6 p.m., with but very little R, merely a few light showers.

FOREST HILL.—We only had the southern edge of the severe TS. L only seen once; T frequent; and very dark clouds in N. and N.W. The wind here S.E.

THE DOWNS, DARTFORD.—From 3.28 p.m. till 4.1 p.m. 0·56 in. of R fell during TS. Sudden shift of wind from N. to S.

HALFORD HOUSE, RICHMOND.—The 0·23 fell during the afternoon and evening, but the exact time of beginning and ending is not known.

KEW OBSERVATORY.—R began to fall at 4.30 p.m., raining more or less for an hour, the amount recorded being ·08; at 6.55 p.m. it re-commenced, and, raining heavily for 15 minutes, increased the day's fall by ·12, making ·20.

CROSSNESS.—R commenced at 3.15 p.m., and ceased at 5.30 p.m., when ·24 had fallen. Violent T and L.

SQUIRE'S MOUNT, HAMPSTEAD.—The fall so small that no special notice was taken of it.

MUSWELL HILL.—At Edmonton, about 5 miles E.N.E., at Watford about 12 miles N.W., and in the middle of the City, 6 miles S, such heavy R fell as produced temporary floods in the two former places, whilst here the R amounted to 0·10 in. only.

Although there is no doubt that the storm was a violent one, and the rain heavy, readers of *British Rainfall* will not need to be reminded that a fall of an inch in an hour, or 1·70 in two hours, is by no means a rare phenomenon. What would be the condition of North-East London with the above-mentioned Tunbridge fall of three inches in two hours.

THE WATER SUPPLY OF NORTH-WESTERN EUROPE DURING THE SUMMER OF 1874.

WE have had the pleasure, since the publication of our last number, of receiving from Capt. Hoffmeyer the data from which the following table has been constructed. Our readers will see that it is in all respects similar to those given last month, and they will readily understand that it was only through the time necessarily occupied in postal communication that we were not able to insert it in our last.

DENMARK.

Copenhagen. Lat. 55°41' Lon. 12°35' E.			Tarm. Lat. 55°51' Lon. 8°25' E.			Smidstrup. Lat. 57°24' Lon. 10°0' E.		
Average for 13 yrs.	Actual 1873-74.	Ratio average = 100.	Average for 13 yrs.	Actual 1873-74.	Ratio average = 100.	Average for 13 yrs.	Actual 1873-74.	Ratio average = 100.
1·88	2·16	115	2·95	3·35	114	2·84	2·25	79
1·69	1·32	78	2·06	2·20	107	2·57	1·89	74
1·27	1·55	122	2·22	2·42	109	2·12	2·07	98
1·32	·29	22	1·58	·28	18	1·82	·60	33
1·23	1·76	143	1·35	1·75	130	1·52	1·67	110
1·27	1·22	96	1·22	·96	79	1·40	1·73	123
1·64	·60	37	1·46	1·15	79	1·63	1·54	94
2·24	·96	43	2·08	·94	45	2·18	·64	29

Taking the average of the ratios in the same manner as we did for other countries, we find—

	Copenhagen.		Tarm.		Smidstrup.		Average.
December to May	...	83	...	87	...	89	86
November to April	...	96	...	93	...	86	92

Whence it appears that the drought has scarcely reached so far as Denmark. February, May, and June have been dry, but in the other months the fall has been equal to, or greater than, the average.

To the Editor of the Meteorological Magazine.

SIR,—I have read with much interest the article in the July number of your magazine on the water supply of N.W. Europe, &c. This strengthens the conclusion at which I have long since arrived, that there is not only much to learn, but that the steps taken to ascertain the real state of things are quite insufficient. I believe that I have as much information as anyone on the question. 1st. I have notes of the height of water in a line of wells in the chalk near Watford since 1851, and the records of a well near here for the last seven years, as compared with the rainfall. Now one of the mistakes in the French calculation is not taking in the month of October, because though on the average of years, the rainfall does not tell on the height of the water level in the chalk in October; the rains of that month

very often replace the summer evaporation, and put the stratum so saturated into a condition to (so to speak) transmit the November rains to the water level; indeed I think October is the ruling month rather more than any other, except it be a very wet January. There is another point to be noted, the conditions of the rainfall; and here we find the necessity of diurnal registration. This season, *i.e.*, from October to April. October with me, 2·400 in., of this 1·145 in. fell in three days, 12th to 14th, and ·835 in. in three days, 22nd to 24th. Then November total, 2·105; of this 1·530 in. in six days, from 4th to 9th. Had more rain, of any amount, fallen after this, or had the remainder formed part of a continuous rain, the water level would have been affected. Then a cessation; no rain from the 10th to 23rd, and from 24th to 26th, ·370, and in December only ·517, quite sufficient to account for none percolating to the water level. Then in January, 2·280; of this ·720 on 24th and 25th, the first that touched the water level; this, assisted by February, ·520 on 15th, and ·830 on 26th and 27th, gave nearly the whole stock of water to be given out during the rest of the year; the rise of water in the well being 4 ft. 9 in. by the end of February; it has gradually declined ever since, and is now 1 ft. 6 in. above the point whence it rose, and 2 ft. 6 in. above the lowest for seven years; whether it will fall below this minimum must depend on the autumn rainfall—I am, Sir, yours, &c.,

J. C. CLUTTERBUCK.

Long Wittenham, Abingdon, July 17th, 1874.

SUPPLEMENTARY TABLE OF MONTHLY RAINFALL, JULY, 1874.

Div.	County.	Station.	Total Fall.
			in.
II.	Kent	Margate (Acol)	·63
„	Sussex	Hailsham	·95
„	Hampshire	Strathfield Turgiss	1·06
„	Oxford	Oxford (Magdalen College)	·70
„	Essex	Harlow (Sheering)	1·81
„	Cambridge	Cambridge (Merton Villa).....	·66
IV.	Norfolk	Swaffham	1·09
V.	Devon	Teignmouth (Brookbank)	·86
„	„	Torrington (Langtree)	3·38
„	Somerset	Taunton (The Castle).....	1·32
VII.	Lincoln	Horncastle (Bucknall)	·78
VIII.	Lancaster	Liverpool (Walton-on-the-Hill) ...	4·00
IX.	York	Wakefield (Stanley Vicarage)	1·83
X.	Durham	Gainford	2·47
„	Westmoreland	Shap	1·82
XVII.	Banff	Keith	1·22
XVIII.	West Ross	Strathconan	3·32
XX.	Cork	Fermoy, (Glenville)	2·59
XXI.	Westmeath	Athlone, (Twyford)	2·97
XXII.	Galway	Ballinasloe	3·35

THE DROUGHT.

To the Editor of the Meteorological Magazine.

SIR,—The dryness of the air here on Sunday afternoon (July 19th) was so remarkable, that I send you the readings of the dry and wet bulb thermometers. During the whole afternoon, from 1 p.m. to 6 p.m., during which time I was able to make observations every few minutes, the difference between the dry and wet bulb was never so small as 20 degrees, frequently from 21 to 24 degrees, and at one time, between 3 and 4 p.m., was as much as 25 degrees; the readings being: dry bulb 87°, wet bulb 62°; a difference which indicates a relative humidity of about 24°, saturation = 100. Such a degree of dryness as this has never come under my observation before, and as Mr. Glaisher, in his "Hygrometrical Tables," only gives equivalents for a difference of 23 degrees, viz., from 87° to 64°, I assume that it is something quite exceptional. My verified maximum thermometer registered 90° in the shade the same afternoon. This instrument is mounted in a Greenwich Stand, on the plan recommended by Mr. Glaisher, so as to have a free circulation of air around it on all sides. Two other thermometers, somewhat less freely exposed, indicated a temperature of 94°. The weather was brilliantly fine; sky perfectly cloudless; light airs from S.E. Maximum in shade on 16th, 17th, and 18th, 85°, 87°, and 86°.—I am, Sir, yours, &c.,

G. T. RYVES.

Buildwas, Ironbridge, Salop, July 21st, 1874.

P.S.—Our total rainfall for June was only 0·39, and a correspondent at Bishop's Castle, tells me that the fall there was only 0·33 in. In fact we have had no rain worth speaking of since May 23rd, not having come in for any of the thunder showers which appear to have been so prevalent in the S. and S.E. districts, and the extreme North.

NOTES ON THE DROUGHT.

STRATHFIELD TURGISS, HANTS.—Clover shrivelled for want of rain, and cracks in water meadows so wide from drought that young birds fall into them, and cannot get out, but perish in great numbers. River very low.

DISS, NORFOLK.—Drought much felt, and water in the neighbouring villages very scarce. All the crops greatly improved towards the end.

COMPTON BASSET, WILTS.—Pastures burnt up. Water has become so scarce that it has to be carted from a distance for the use of the sheep and cattle.

SANSAW HALL, SALOP.—Almost all trees and shrubs transplanted since September last are dying or dead. Many forest trees are dying likewise, and lilacs and laburnums suffering much. The only exception to the list of killed transplanted trees and shrubs are those which are kept alive by laborious watering. Pits and pools, the

bottoms of which have not been seen within recollection, are now dry. The fearful drought of this year will be apparent by comparison of the falls in the first seven months of the three previous years:—

1871...14·519—110 days.	1872...25·516—130 days.	1873...14·104—97 days.
1874... 8·835— 75 „	1874... 8·835— 75 „	1874... 8·835—75 „
<hr/> 5·684— 35 „	<hr/> 16·681— 55 „	<hr/> 5·269—22 „

COSTON, LEICESTER.—Vegetation much hindered by the drought. Meadows and lawns parched up; springs in some places failing; visible improvement towards the end of the month.

PARTNEY, LINCOLN.—The ground is so parched and dry that I question whether any rain has penetrated to the extreme roots of the grass since February.

STANLEY, WAKEFIELD, YORKS.—In the early part of the month the drought said to be very trying both to cattle and root crops, but towards the end vegetation much improved.

VIOLENT HAILSTORM AT BROMSGROVE.

To the Editor of the Meteorological Magazine.

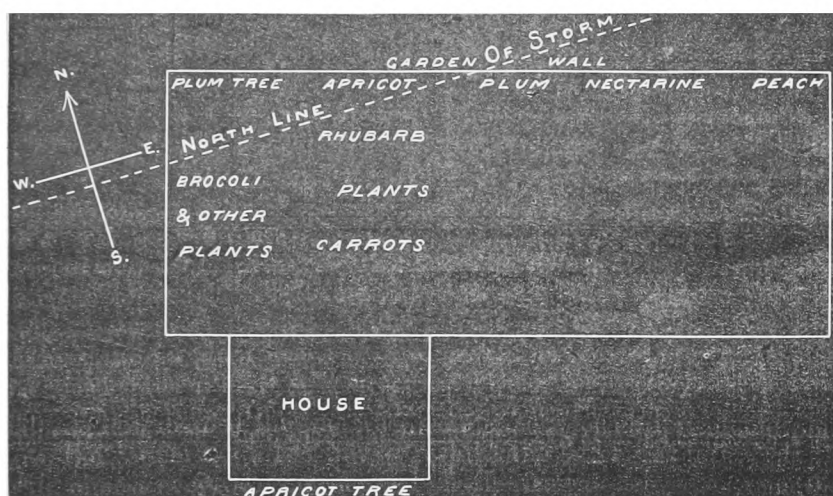
DEAR SIR,—We have had two violent storms this week; on Thursday, about 11 a.m., a very heavy down-pour of rain suddenly came on which lasted for about ten minutes, when '13 was registered by my rain gauge. I was out for a drive with my family at the time, all being drenched to the skin, and all that could not get immediate shelter were the same. A somewhat singular matter attracted my attention just previous, on passing the reformatory—all the prisoners were out with buckets carrying water from an adjacent stream on to an extensive field of kidney beans, which were suffering from the long drought; by the time we had gone half a mile we were in the midst of the deluge.

On Friday morning, the most violent hail storm occurred that was ever remembered, it caused sad havoc to the growing crops, whole fields of swedes and mangolds being destroyed; garden produce cut to pieces; trees and hedgerows denuded of their foliage or pierced as if shot (I enclose you a few croppings from my own garden, not by any means, although severe, the worst part); much of the fruit is past recovery; the quantity of glass broken by the hail is immense, in the lower part, on the East side, of Worcester Street scarcely a whole window is to be seen, many are completely broken up; green-houses demolished to a large extent, indeed the damage altogether is excessive.

About 10.30 a.m. the clouds looked very ominous, on examining the gold leaf electrometer it was apparent that the atmosphere was overcharged with electricity, in a short time loud thunder was heard, and vivid lightning seen; at 11.15 the hail storm commenced, accompanied by a little rain, such was its violence that by 11.30 when

the storm ceased, the ground in the open was covered six or eight inches deep, where obstructed it was, in some places, three feet and upwards, with stones of unusual size, some being full an inch in diameter, whilst most of the remainder varied from that size to half an inch, comparatively few were under that size.

The stones fell very obliquely, which saved many of the lower windows where houses stood opposite. The storm was singular, it being confined to a space of about one mile square, taking the lower part of the town as its centre; its direction was from West to East, the northern edge of the storm is traceable to an inch by following the destruction of the crops, the foliage of the trees, hedgerows, &c., &c.; this line passed nothing is injured. My rain gauge noted '96 for the storm, much of the hail of course would bound over the funnel and be unmeasured. I send you a rough sketch of my garden, by which you



will see how defined the line was, passing between an apricot and plum tree, the former not a leaf injured, whilst the latter was torn from the wall, almost every leaf cut off, and all the fruit destroyed. A portion of the skin of a plum I enclose, also part of an apricot growing against the south wall of house.—Yours, &c.,

G. DIPPLE

The Ford House, Bromsgrove, July 25th, 1874.

REVIEWS.

Repertorium für Meteorologie herausgegeben von der Kaiserlichen Akademie der Wissenschaften, redigirt von Dr. H. WILD, &c.
Band III. 4to. St. Petersburg, 1874. 427 pages.

THE present volume of the *Repertorium* sustains, if it does not raise, its high—perhaps unequalled—reputation. Dr. Wild leads off with two papers. The first (one of a series entitled “Studies on Meteorology

logical Instruments and Methods of Observation") is "On the determination of atmospheric pressure." Although confined to the consideration and description of modern patterns of barometer and to kinds actually in use, it is one of the longest, and on the whole, one of the best articles on barometers we have ever read. When we mention that twenty-one quarto pages are devoted to aneroids, and twenty-five to the section treating of the adjustment and verification of standard barometers, our readers will form some idea of the detailed nature of the work, which moreover bristles with references to most of the best papers in all languages, and goes thoroughly into the mathematical formulæ of every branch of the subject, especially into that of barometers of the King's barograph type, which Dr. Wild calls "Wagbarometers," or balance barometers. We think that in one or two cases it would have been better to have arranged some of the barometric comparisons in the order of barometric height, instead of in the sequence of the observations, and we should have been glad had there been more woodcuts of the instruments, but these are mere spots on the sun. The paper itself is so good that we trust that some competent person will write an abridgment of it for the use of the many thousands of English-speaking meteorologists who may not see, or be able to read, the original.

Dr. Wild's second paper is a description of a new universal magnetic instrument, to which we hope and believe the engraving does not do justice, for we are sure that neither the designer (Dr. Wild) nor the maker (Brauer) would make a magnetic instrument other than "as steady as a rock," and this is certainly not the impression conveyed by the engraving.

M. J. Pernet contributes a short paper on the periodic oscillations of atmospheric pressure at St. Petersburg, embodying the results of 50 years' observations. The hourly results for 22 years are:—

	in.		in.		in.
1 a.m.	29·866	9 a.m.	29·865	5 p.m.	29·863
2	·865	10	·868	6	·862
3	·863	11	·870	7	·862
4	·862	Noon	·870	8	·863
5	·861	1 p.m.	·869	9	·865
6	·861	2	·867	10	·866
7	·861	3	·865	11	·866
8	·862	4	·863	12	·867

The pressure averages about 29·80 during June, July and August, and 29·90 during the rest of the year.

Passing a short note on Ozone Observations, and a long one on Magnetic Intensity at Pekin, we come to one by M. Rikatcheff on the daily temperature curve at St. Petersburg on clear and on overcast days, of which it may be well to translate the second paragraph:—

"Before entering on the details of the calculations I must remark upon the insufficiency of the method of determining the daily march of temperature usually adopted. For example, if hourly thermometric readings are taken, and the day is assumed to begin at noon, the means

are usually taken of the temperatures for each hour from noon to 11 a.m. (inclusive) of the following day. By this means we only obtain the daily march during 23 hours, and its amount between 11 and noon remains unknown. It is ordinarily assumed that the mean temperature at noon at the commencement of the day is the same as that of the next day, which is incorrect. The temperature during the 24 hours rises or falls according to the season. It is therefore necessary to take into consideration this change, which represents the annual march of temperature during 24 hours. It may happen for some place, where the annual march is great, that the mean for 11 a.m. may be higher than that for noon of the previous day, but it would be unjust to conclude therefrom that the temperature at that place falls from 11 to noon. From this defect in the mode of reduction, sudden interruptions in the continuity of the curves are always found. These are usually corrected in an altogether illegitimate manner by Bessel's formula, which does not apply to the case."

M. Rikatcheff then proceeds to point out other difficulties arising from the same cause, and to show that the difference between the noon readings may be regarded as a measure of the daily heating or cooling of the air. Thence he shows that the daily march of the temperature may be regarded as consisting of two elements (1) the true daily march (2) a portion of the annual march, whence it follows that if extreme accuracy is desired it is necessary first to determine the amount of the annual march due to each 24 hours, and then to apply to the daily range corrections proportional parts of this fraction of the annual march due to each hour. A modification of Bessel's formula, which includes this correction, is given.

The author then proceeds to explain the system upon which his paper has been compiled, and gives various tables and curves to illustrate his subject. We, however, can only spare space for a few of his results :

- (1). Throughout the year the daily range is much greater on cloudless days than on cloudy ones.
- (2). The greatest average daily range usually occurs in May, and is $12^{\circ}6$; on cloudless days in that month it is $16^{\circ}6$, and on overcast ones $6^{\circ}5$. It is least (in fact almost insensible) in December, the average for the month being only $1^{\circ}6$, and that for cloudy days in that month less than 1° .
- (3). The maximum temperature occurs earlier on cloudy than on clear days, especially in summer, when on overcast days it occurs at 2.30 p.m., and on cloudless days not until 5.30 p.m.
- (4). In autumn and in December during overcast days we note that towards evening the temperature ceases to fall, and even from 8 p.m. to 2 a.m. seems to rise a little.
- (5). When the sky is cloudless the portion of the annual curve, whether it be on its ascending or descending branch, due to each day, is greater than when it is overcast ; and this daily portion is at its maximum ($3^{\circ}4$) in May (increasing) and December (decreasing) respectively.

- (6.) When it is overcast this value varies irregularly, and the following facts often occur (a) the temperature in summer not only does not increase but actually falls, and the reverse in winter; (b) the greatest daily increase occurs in December, and the greatest decrease in June.
- (7.) When the sky is clear, the effect of the sun, which is at its maximum in the long summer days, explains the great increase at that season. In the same way a cloudless sky during the long winter nights gives rise to an amount of terrestrial radiation which fully explains the cooling at that season.

(To be continued.)

Tafeln zur Berechnung der Beobachtungen an den Küsten-Stationen und zur Verwandlung der angewendeten Maasse in metrisches Maas.

[Tables for the Reduction of Observations at coast stations, and for their conversion into Metric Measures.] By G. KARSTEN. 8vo. 25pp. Paul Toeche: Universitäts-Buchhandlung, Kiel.

A VERY useful collection of tables, and noteworthy in several respects, viz., for accuracy, for fulness, for clearness of printing, and for being printed on one side of the paper only. As regards fulness we may take the table No. X. for the conversion of barometric readings made in Paris lines into their equivalents on the metric system; this table gives every hundredth of a line from 318''' (28.24 Eng. in.) to 349''' (31 Eng. in.) One hundredth of a Paris line is very nearly one thousandth of an inch (accurately $0''\cdot01 = 0\cdot00088814$ in.), the fulness of this table may therefore be realized by anyone by remembering that it is almost the same as one for English measures giving the equivalent of every thousandth of an inch from $28\frac{1}{4}$ to 31 in.

NEWSPAPER CUTTINGS.

§ At a recent meeting of the Berlin Academy, a paper was read by Professor Dove on "The General Character of Mild Winters." One fact which appears from his figures is, that several such winters often follow one another in close succession, or with little interruption. It also appears (1) that sudden exceptional moderating of the temperature in the last third of December is very frequent; but does not always betoken a continued mild January of the following year; (2) that a cool November and a cold first half of December generally point to a mild January following; and, conversely, a mildness in the former period points to a severe midwinter. The phenomena, lastly, show that the earth's surface at a determinate time falls into determinate weather systems; and the rules found for one of these are without significance for another. As these systems depend on air currents, they can have no universal application.—*English Mechanic*.

The influence of forests in drawing moisture from the heavens, says the *Californian Horticulturist*, may be seen from the experience of San Diego, California. Previous to the year 1873 there was yearly a rainy season, which made the soil nourishing and productive. In 1863, a destructive fire swept over the greater part of the country, destroying the forest, and blackening the hills. Since then there has been no rainy season at San Diego.—*Journal of Horticulture*.

JULY, 1874.

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 1860-5	Greatest Fall in 24 hours.			Max.		Min.					
				Dpth	Date.		Deg.	Date.	Deg.	Date.				
I.	ENGLAND.	Camden Town	·82	—	·97	·22	27	11	90·8	20	47·3	25	0	0
II.		Maidstone (Linton Park)	·72	—	1·26	·24	27	8	94·0	19	44·0	25	0	0
III.		Selborne (The Wakes)	1·03	—	1·17	·48	27	8	82·0	10†	44·0	6	0	0
IV.		Hitchen	2·05	+	·15	1·62	10	11	83·0	9	44·0	24	0	...
V.		Banbury	2·14	+	·08	1·18	10	12	84·0	9	41·0	6	0	...
VI.		Bury St. Edmunds (Culford)	·76	—	1·23	·39	28	7	89·0	20	43·0	29	0	0
VII.		Bridport	1·59	—	·52	·48	25	6	80·0	10‡	42·0	6	0	...
VIII.		Barnstaple	2·77	—	·09	·61	25	13	86·0	19	48·5	7	0	...
IX.		Bodmin	2·15	—	·96	·47	28	15	76·0	16	47·0	7	0	0
X.		Cirencester	1·09	—	1·35	·46	25	12	...	...	...	...	...	...
XI.	WALES. <td>Shifnal (Haughton Hall)</td> <td>1·17</td> <td>—</td> <td>1·00</td> <td>·30</td> <td>4</td> <td>12</td> <td>80·0</td> <td>10</td> <td>47·0</td> <td>27</td> <td>0</td> <td>0</td>	Shifnal (Haughton Hall)	1·17	—	1·00	·30	4	12	80·0	10	47·0	27	0	0
XII.		Tenbury (Orleton)	·80	—	1·58	·35	25	10	87·7	19	42·6	6	0	0
XIII.		Leicester (Wigston)	·61	—	1·49	·28	27	11	92·0	19	42·0	5	0	...
XIV.		Boston	1·86	—	·44	·74	29	10	92·0	9	45·0	6	0	0
XV.		Grimsby (Killingholme)	1·55	...	...	·58	28	12	81·0	2,9	47·0	6	0	...
XVI.		Derby	1·28	—	·91	·24	26	14	86·0	6,25	47·0	19	0	0
XVII.		Manchester	1·77	—	·92	·69	13	14	89·5	19	48·0	6,7§	0	0
XVIII.		York	1·18	—	·76	·31	23	10	78·5	10	41·0	6	0	...
XIX.		Skipton (Arncliffe)	3·92	+	·69	·84	31	18	86·0	10	38·0	5	0	...
XX.		North Shields	1·47	—	·34	·40	13*	11	75·2	2	45·0	7	0	0
XXI.	SCOTLAND. <td>Borrowdale (Seathwaite)</td> <td>7·20</td> <td>—</td> <td>·94</td> <td>1·60</td> <td>31</td> <td>15</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td> <td>...</td>	Borrowdale (Seathwaite)	7·20	—	·94	1·60	31	15
XXII.		Cardiff (Ely)	2·55	—	·75	·54	1	11	81·7	18	43·5	24||	0	...
XXIII.		Haverfordwest	3·41	+	·56	1·00	2	19	82·0	...	43·0	...	...	...
XXIV.		Rhayader (Cefnfaes)	1·97	—	·32	·48	12	11	81·3	19	46·0	9	0	...
XXV.		Llandudno	2·68	+	·43	·64	13	17	82·0	18	46·5	6	0	0
XXVI.		Dumfries	2·20	...	...	·75	13	13	...	...	...	...	...	...
XXVII.		Hawick (Silverbut Hall)	2·68	...	...	·44	28	16	76·4	20	42·6	11	0	...
XXVIII.		Kilmarnock (Annanhill)	2·76	—	·38	·48	2	14	76·0	18	...	...	0	0
XXIX.		Castle Toward	1·99	—	·28	·47	26	15	81·0	18	40·0	7	0	0
XXX.		Leven (Nookton)	3·58	...	...	...	...	...	...	...	...	...	...	...
XXXI.	IRELAND. <td>Stirling (Deanston)</td> <td>4·41</td> <td>+</td> <td>2·13</td> <td>·77</td> <td>21</td> <td>15</td> <td>76·3</td> <td>18</td> <td>40·0</td> <td>29</td> <td>0</td> <td>1</td>	Stirling (Deanston)	4·41	+	2·13	·77	21	15	76·3	18	40·0	29	0	1
XXXII.		Logierait	2·67	...	...	·87	14	18	77·2	18	44·5	7	0	0
XXXIII.		Braemar	2·90	...	...	·66	18	14	...	...	...	...	...	...
XXXIV.		Aberdeen	5·40	—	·67	1·27	1	20	...	...	...	...	...	...
XXXV.		Loch Broom	1·92	—	·75	·36	3	15	83·2	19	44·4	28	0	0
XXXVI.		Portree	2·85	...	...	1·05	22	12	...	...	...	...	...	...
XXXVII.		Inverness (Culloden)	2·75	+	·86	·63	14	16	72·5	18	41·9	13	0	0
XXXVIII.		Helmsdale	4·13	...	...	·58	25	17	...	...	...	...	...	...
XXXIX.		Sandwick	1·27	...	...	·36	1	10	...	...	...	...	...	...
XL.		Caherciveen Darrynane Abbey	2·38	—	·94	·47	23	15	...	...	...	...	...	...
XLI.	IRELAND. <td>Cork</td> <td>3·47</td> <td>+</td> <td>·28</td> <td>·53</td> <td>25</td> <td>21</td> <td>85·0</td> <td>16¶</td> <td>47·0</td> <td>6</td> <td>0</td> <td>...</td>	Cork	3·47	+	·28	·53	25	21	85·0	16¶	47·0	6	0	...
XLII.		Waterford	2·73	—	·81	·48	14	23	78·0	16	46·0	28	0	...
XLIII.		Killaloe	2·38	—	·05	·65	22	16	...	...	...	...	...	...
XLIV.		Portarlington	4·98	...	...	·61	21	25	73·0	15	48·0	11	0	...
XLV.		Monkstown, Dublin	3·52	...	...	·71	25	26	...	...	...	...	...	...
XLVI.	IRELAND. <td>Galway</td> <td>2·46</td> <td>...</td> <td>·48</td> <td>23</td> <td>16</td> <td>85·0</td> <td>17</td> <td>43·0</td> <td>12</td> <td>0</td> <td>0</td>	Galway	2·46	...	·48	23	16	85·0	17	43·0	12	0	0	
XLVII.		Ballyshannon	2·86	...	...	·55	27	19	76·0	18	39·0	28	0	...
XLVIII.		Waringstown												
XLIX.	Edenfell (Omagh)													

* And 23. † 20. ‡ 19 & 20. § And 25. || 28. ¶ 17.

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

METEOROLOGICAL NOTES ON JULY.

ENGLAND.

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.

LINTON.—A very dry hot month, the days being very hot all the middle part of it, but the nights not particularly so, that of the 24th being quite cool. T only on the 11th, when we had nearly four hours of it, the rain, however, not being heavy. The hottest days were the 8th, 9th, 10th, 19th, and 20th. Vegetation suffering from drought, but not more than might be expected, but water for domestic use is becoming scarce in many places, as, with the exception of July 1864, 1868, and 1869, it is the driest I have on record for twenty years.

SELBORNE.—Very hot and excessively dry month. Harvest begun on the 31st with fine crop of wheat. Great deficiency of root crops and hay; the hops as yet extremely bad. TS on 9th, and T on 10th, 11th, and on 24th. Fog on 17th and 19th. Misty morning and very hot day on the 20th. Max. bar. 30·28 on 10th; Min. 29·65 on 20th; and Mean of month 29·97.

HITCHIN.—Tremendous TS on 10th, the heaviest fall of rain on record in such a short time.

BANBURY.—TS 7.45 to 9.15 p.m. on 10th, 1·18 of rain fell. R and H on 23rd, TS on 27th, when ·50 fell in ten minutes. A little H.

CULFORD.—A month of dry hot weather. Mean. temp. of month, 64°. T was heard on 21st, 22nd, 23rd, 24th, 28th, and 29th; but R only accompanied it on 23rd, 28th, and 29th, and that to only a trifling extent. Notwithstanding the excessive drought, crops are much better than might have been expected. The wind was from easterly points on fourteen days, and from westerly the remaining seventeen days.

BRIDPORT.—A continuance of fine and hot weather to the 22nd. Wheat reaped on the 20th. On the 24th, at 2 p.m., a TS; at 3 p.m. it was very heavy. L vivid and T loud, with R and H. ·36 fell in one hour.

BODMIN.—Average temp. of month, 65°·1, being 3° above the average.

HAUGHTON HALL.—1st, Very few swallows and martins, swifts and sand martins as usual; partridges hatched in great numbers, and some able to fly. Although R fell on twelve days, it was in such small quantities and so soon evaporated by the powerful sun and drying winds, that vegetation benefited little thereby. With the exception of a fall of ·30 on the 4th, there were only a few slight showers till the 23rd. Almost a complete failure of swedes and root crops. The wind from S.W. till 6th, when it changed to W. and N.W., and so continued, with a few exceptions, till the close. Harvest began on 24th.

ORLETON.—Another very dry, hot, and brilliant month, with a mean. temp. of nearly 4° above the average, and only exceeded in July 1859 and 1868. The earth very dry, the brooks and rivers very low, the grass burning up, and all the crops except the wheat suffering severely from the drought. The falls of R have been very trifling, and have made scarcely any impression upon vegetation, and none on the land. Wheat cutting commenced on the 27th. Distant T was heard on the 10th, 24th, 27th, and 28th. On the latter day a storm passed nearly over us from S to N, about 3.45 p.m., with L and loud T, but no rain. A tree was struck in the valley within half a mile of this place.

BOSTON.—A very fine month, with almost constant sunshine during the day. Several showers towards the end of the month. On the 29th there was a very severe TS, accompanied by a heavy fall of R, ·73 falling in about half an hour. Two of the peals of T were the loudest I ever heard, and the atmosphere was so darkened that, for a short time, it was too dark to read indoors. Corn crops in very good condition; cutting commenced on the 30th, in a few places, but not generally till four days later.

GRIMSBY (KILLINGHOLME).—The air at times very dry, water scarce. The wheat crops very good, root crops on heavy land bad. More T and L than usual. More rain fell in the neighbourhood than here. 2nd, 8.30 p.m., very wild sky, a wind dog, and a cloud resembling the pocky cloud. 3rd, 2.45 p.m., dry bulb,

73°; wet, 42°. 4th, 4.30 p.m., distant T. 11th, TL and R at noon. TS on 21st, 24th, 28th. 28th, a meteor in S at 8.40 p.m.

ARNCLIFFE.—Ther. at 122° in sun on 10th.

NORTH SHIELDS.—TS on 23rd and 29th.

SEATHWAITE.—T on 20th, 21st, and 28th.

WALES.

HAVERFORDWEST.—A most fine month. The rainfall opportunely came to save the green crops, and it is said that the cereal crops, though light, will be of good average yield; the wheat will be first rate in quality and quantity. The warmest July since 1870, temp. exceeding 80° on three days; the nights very warm, some over 60°.

CEFNFAES.—The month in this district has been fine and genial. Hay crop very light, but well got in. Rains gentle. Brooks and small springs dried up; great want of water. Winds, S.W. and N.W.

LLANDUDNO.—10th, a thick sea fog passed over the lower part of the town from 1 p.m. to 3 p.m. Altogether a splendid month.

SCOTLAND.

DUMFRIES.—Copious showers and genial heat have been the characteristics of the month, and a great impulse has been given to vegetation and pastures, which were brown and bare, and are again fresh and green. Cereal crops were much benefited, but potatoes and turnips were more so. Harvest commenced on the 27th. Wheat a splendid crop. Oats are rather deficient in straw, but an average of grain. Potatoes fully an average. Turnips, with some exceptions, very good. Fruit, a good crop. Rainfall, rather above the average.

HAWICK.—Hurricane on 3rd; T and T showers on 13th and 22nd. Hay crop light, but well secured. Turnips have suffered from drought, and have not come up regular. Potatoes lift small, but clear as yet from disease. Pastures look as brown as if it was October.

ANNANHILL.—Winds principally S.W., light to fresh. S.S.W. gale on 2nd. 28th. TS, vivid L, both sheet and forked, with heavy R. Month generally fine. The R, though light, has improved pastures and brought on the wheat. Oats and hay still light, but looking better than was anticipated earlier in the season. Fruit very scarce; ozone well developed during the month.

CASTLE TOWARD.—A rather dry month, but the occasional showers have refreshed the crops, which look well in this locality. Hay crop pretty fair, and well secured. Potato disease has appeared, otherwise they, turnips, and corn look well. Grass is now abundant. Currants, above the average; gooseberries, fair; strawberries, excellent; apples, pears, plums, and cherries, scarce, considering the show of blossom. Running streams small, and water scarce.

BRAEMAR.—TS on 19th and 28th. A most excellent growing month. Crops looking remarkably well.

ABERDEEN.—Bar. pressure below the average; temp. 2°·5 above it. Winds from S. and S.W. more frequent than usual; rainfall slightly above the average. A month of warm, genial weather, but somewhat variable. TS from 11 to 12 a.m., and 4 to 5 p.m. on 14th. T also on 11th, 20th, 22nd, and 23rd.

PORTREE.—A fine growing month. Crops of all kinds looking well; cattle and sheep thriving well; pasture grass abundant.

LOCHBROOM.—A most beautiful month. The crops are luxuriant.

CULLODEN.—Distant T on evening of 2nd; T and one flash of L between 5.10 and 6.45 p.m. on 27th; a very heavy storm of T and L between 2 and 3 p.m., on 28th, with a heavy fall of R and H. Three trees (two oaks and one elm) struck between Culloden and Inverness, not all in one locality, but in same line from this place. Total fall 72 below the average of 32 years.

SANDWICK.—Distant T on 8th in evening, and on the mornings of the 9th and 11th. July has been wetter and warmer than the mean, the temperature having been 100° or more in the sun on 11 days, and even in the shade it was as high as 72°·5. The rains and heat together caused very rapid vegetation.

IRELAND.

MONKSTOWN.—22nd, TS with very heavy hail and rain at 5 p.m., '44 in 1½ hour.

BALLYSHANNON.—Although a much larger quantity of R fell during the month than in the preceding one, there has been much heat which, coupled with the moisture, has well assisted the growth of green crops, all of which are looking very promising.

EDENFELL (OMAGH).—First three days unsettled and squally, but from 4th to 19th the weather was very fine, culminating in higher temp. on 16th, 17th, and 18th, than has been here recorded for three years. From 19th showery, but not sufficient to seriously stop the hay harvest, which has been an abundant and favourable one. It is many years since crops of all kinds in this county have looked so promising.

DRYNESS OF THE AIR IN NORTHERN INDIA.

To the Editor of the Meteorological Magazine.

SIR,—In your remarks, in your February number, on M. Bulard's "Climate of Algeria," I observe that the degree of dryness noted by him is so extreme as almost to excite incredulity. Allow me to forward you a few observations to illustrate the hygrometric conditions of sub-tropical climates at certain seasons of the year.

Date.	Place.	Dry Bulb.	Wet Bulb.	Difference.
4th June, 1869	Gwalior, Central India	110°·3	69°·7	40°·6
16th Feb., 1870	do.	69°·2	50°·5	18°·7
11th May, 1870	Jutog, near Simla, } 6,500 ft. above the sea }	70°·6	49°·0	21°·6
18th Nov., 1870	do.	58°·2	37°·9	20°·3
19th June, 1873	Meean Meer, Punjab	112°·2	70°·2	42°·0
17th May, 1874	Meerut, North West Provinces	103°·2	66°·4	36°·8

I have selected the above observations as some of the most remarkable on my record, but I could fill a page with others very nearly approaching them. During the months of April and May, and the first week of June, 1869, at Gwalior, the difference between the dry and wet bulb, at 9 a.m., exceeded 30° no less than 16 times. In fact, the extreme dryness of the Algerian sirocco is reproduced day after day in the plains of Northern India, during the months of April and May.

Yours faithfully,

W. STRAHAN.

Meerut, East Indies, May 31st, 1874.

BOOKS RECEIVED.

CANADA.

Kingston, Prof. G. T.—General Meteorological Register for 1873. Toronto, 8vo.
Kingston, Prof. G. T.—General Monthly Meteorological Register for 1873. Toronto, 4to.

CEYLON.

Fyers, A. B., Lieut.-Col., R.E.—Results of Meteorological Observations at Ceylon, from 1870 to 1873.
Fyers, A. B., Lieut.-Col., R.E.—Results of Meteorological Observations at Ceylon, Feb. and March, 1874.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CIV.]

SEPTEMBER, 1874.

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

THE BRITISH ASSOCIATION AT BELFAST.

WE are not aware of any meteorological feature for which the above meeting will be memorable. The attendance of meteorologists and observers was (as will be seen from the following list) rather above the average, and the papers were quite up to the usual standard, perhaps above it, but not remarkable.

Adams, Prof. J. C. F. R. S. ... Cambridge.	Hennessey, H., F. R. S. ... Dublin.
Andrews, Dr., F. R. S. ... Belfast.	Herschel, Prof. A. ... Newcastle-on-Tyne
*Ashe, J., M. B. ... Londonderry.	Hooker, J. D., P. R. S. ... Kew.
Balfour, Prof. J. H. ... Edinburgh.	Hotchkiss, Major ... Virginia, U.S.
Barrington, E. ... Bray.	*Howlett, Rev. F. ... East Tisted.
Barrington, R. M. ... Bray.	*Hudson, H., M. D. ... Fermoy.
Belcher, R. B. ... Blockley.	Lindsay, C. ... Lanark.
Boyd, J. K. ... Belfast.	Lund, C. ... Bradford.
Brenan, Rev. S. A. ... Pomeroy.	Mahony, J. A. ... Ramelton.
*Brooke, C., F. R. S. ... London.	M'Kay, R. ... New Galloway
Campbell, Major, R. E. ... Athlone.	Moffat, Dr. ... Hawarden.
Curley, T., C. E. ... Hereford.	*Muirhead, H. ... Lanark.
Curtis, Prof. A. H. ... Galway.	*Mylne, R., C. E., F. R. S. ... London.
Deacon, G. F. ... Liverpool.	*Negretti, H. ... London.
Dyer, Prof. W. T. ... Kew.	Pengelly, W., F. R. S. ... Torquay.
Elliot, Sir Walter ... Wolfelee.	Rosse, Earl of, F. R. S. ... Birr Castle.
Enniskillen, Earl of, F. R. S. ... Florence Court.	*Scott, Prof. A. W. ... Lampeter.
Everett, Prof. J. D. ... Belfast.	Scott, R. H., F. R. S. ... London.
*Field, Rogers, C. E. ... London.	*Smyth, J., jun., C. E. ... Banbridge.
Glaisher, J., F. R. S. ... Blackheath.	Strange, Col., F. R. S. ... London.
Gott, C., C. E. ... Bradford.	*Symons, G. J. ... London.
Graves, Rev. J. ... Stoneyford.	*Talmage, C. G. ... Leyton.
Healey, G. ... Windermere.	*Woodward, C. J. ... Birmingham.

Mr. Smyth, by reading a good paper on the Meteorology of Banbridge and the Rainfall of Ulster, vindicated the province from the complaint urged against Bradford last year. As to other papers, the abstracts must speak for themselves.

THE METEOROLOGICAL BREAKFAST.

As already indicated in these pages, a "first attempt" at carrying the above idea into practice was made at Belfast. Of the result it would perhaps hardly be proper for us to speak fully, and we therefore confine ourselves to mentioning that the party mustered 15 or 16, and (as will be seen above, the asterisks marking those present at the

breakfast) included a majority of the most able meteorologists at the meeting, while nearly all the absentees stated that they were so unwillingly. In several cases it was due to the arrangements made for the local "Post Office" in the Reception Room, which were unprecedentedly defective. As it was a purely friendly meeting, there was no chairman, and there were no set speeches, but there was much pleasant and profitable conversation. No definite resolution was submitted, but it appeared to be the general wish that a similar gathering should be held annually in future. In that case we hope that the local arrangements may always be in the hands of gentlemen as efficient in every way as Mr. Smyth. We shall be glad even thus early to have an offer of assistance from some one in, or acquainted with, Bristol.

SPECIMEN AND APPARATUS ROOM.

This was a new idea, successfully carried out under the supervision of Mr. Ray Lankester. It has often been felt that a more leisurely examination of apparatus and specimens than is possible in the Sections is desirable. To afford this, a temporary museum was created by the deposit of all models, apparatus, and specimens during the whole week, save only such time as they are actually required in the various Sections.—The exhibits were, as might be expected, extremely various, ranging from Skulls to Patent Safety Cheques, and from Algæ to Railway Signals.

PAPERS ON METEOROLOGICAL SUBJECTS.

The following is a complete list of the papers read :—

- ASHE, ISAAC.—"On the cause of the progressive motion of Cyclones, and of the seasonal variations in their paths."
 BALFOUR, PROF.—Report "On the influence of forests on rainfall."
 BELCHER, R. B.—"On the artificial disturbance of the weather."
 BLANDFORD, H. F.—"On certain protracted irregularities of atmospheric pressure in the Indian Monsoon region, and their relation to variations of the local rainfall."
 EVERETT, PROF. J. D.—Report "On underground temperatures."
 GLAISHER, J., F.R.S.—Report "On luminous meteors."
 MOFFAT, T., M.D.—"On the apparent connexion between sun-spots and atmospheric ozone."
 MELDRUM, C.—"On the Cyclones of the Mauritius."
 NEGRETTE, H.—"On a new Deep Sea and Recording Thermometer."
 PASTORELLI, F.—To exhibit a gymbal-swung rain gauge.
 SCOTT, R. H., F.R.S.—"On the importance of improved methods of registration of winds on the coast, with a notice of an Anemometer designed by Mr. W. De la Rue, to furnish telegraphic information of the occurrence of strong winds."
 SMYTH, J. jun.—"On the meteorology of Banbridge for ten years, and on the rainfall of Ulster."
 STOW, REV. F. W.—"On the absorption of the sun's heat rays by the vapour of the atmosphere."
 STRANGE, LT.-COL., F.R.S.—"On the necessity for placing physical meteorology on a rational basis."
 SYMONS, G. J.—"Report of rainfall committee."
 SYMONS, G. J.—To exhibit a set of thermometers prepared to test relative sensitivity.
 SYMONS, G. J.—"On a new and greatly improved form of storm rain gauge."

ON THE ABSORPTION OF THE SUN'S HEAT-RAYS BY THE VAPOUR OF THE ATMOSPHERE.

BY THE REV. FENWICK W. STOW, M.A., F.M.S.

THE observations of Solar Radiation, which are relied on in this paper, are taken with "blackened-bulb thermometers in vacuo" suspended 4 feet above the ground, the indications of which, when compared with those of the ordinary shade thermometers, give a measure of the intensity of the solar rays.

The absorption of the direct solar heat-rays by the vapour of the atmosphere is proved in several distinct ways:—

1. It is found that the elastic force of vapour is less on the ten days in each month on which radiation is most powerful than on an average of the whole month. This is proved by five years' daily observations at Strathfield Turgiss, Hants, 1869-74; two years' at Hawsker, near Whitby, Yorkshire, (1869-71); and one year's observations in 1872, at Harpenden, Herts.

2. It was also found by the above observations that N. and N.W. winds, which contain little moisture, are very favourable to solar radiation, whereas S. and S.E. winds are usually accompanied by much less powerful sunshine. The N.E. winds of spring, which are excessively dry, are also accompanied by intensely powerful solar radiation.

3. By frequent observations during cloudless weather, with nearly constant vapour-tension, curves are obtained representing the daily variations in solar radiation produced by the changes in the sun's altitude and consequent alteration of the length of the path which the beams pursue through the atmosphere. From these the per-centage of the sun's heat-rays, which would be absorbed by the atmosphere if the sun were vertical, can be approximately determined, assuming that the tension of vapour remained as it was on the day or days of observation. It is then possible to calculate the amount of radiation due to the altitude of the sun at noon in the middle of each month for a constant vapour-tension, and to compare this with the amount actually observed in each month on cloudless days. In this way it is found that when the tension of vapour falls below the amount on the day which furnishes the data for calculation, the radiation rises above the calculated amount, and *vice versa*. In fact, the sun's rays are more intense in winter than in summer, when the difference of altitude at noon is allowed for, because the absolute amount of vapour in winter is so much less. About ten or twelve per cent. is the minimum of absorption of the sun's heat rays, while the maximum equals or even exceeds 20 per cent.

The paper concludes with a few observations on the increase of solar radiation with elevation above the sea level, from which the difference would appear to have amounted, between the heights of 470 to 1800 feet, to about 5 per cent. of the amount observed at the lower station when the sun's altitude was 20°, and to above 3 per cent. when the altitude was 26°.

THE RAINFALL OF AUGUST 13, 1874, AT DUBLIN.

To the Editor of the Meteorological Magazine.

SIR,—The exceptional character of the rainfall attending the bourrasque of the 12th, 13th, and 14th of August last in this neighbourhood, seems to me worthy of being placed on record in your *Magazine*. I shall therefore briefly describe the conditions preceding and accompanying that rainfall, and give you such information respecting the amount of rain registered in and around Dublin as I have been able to gather from my fellow-observers here.

Early on the morning of the 12th August, the barometer, which until then had been recovering from a depression which travelled

slowly to the eastward across Scotland, again began to fall. A few hours later clouds increased, and the wind backed to S.W., ultimately falling calm. From 8 p.m. the weather was rainy, and at 11 p.m. a very light easterly air was felt in Dublin. By 9 a.m. on the 13th, $\cdot 100$ of an inch of rain was registered. The barometer had by this time fallen to 29.336 in. ; the sky was overcast, with a damp atmosphere, and a light breeze from E.N.E. The centre of a rather serious depression was clearly passing N. Eastward, a little to the S. of Dublin. The weather remained fine, but overcast and gloomy until 2.30 p.m., when rain began to fall heavily, with a sudden shift of wind to N. From 3 p.m. rain fell in torrents, and at 4.30 p.m. thunder was heard to S.E. (Kingstown and Dalkey). By 6 p.m. the barometer had reached its minimal reading—29.266 in. The wind now backed still further to N.N.W., and freshened somewhat. At 9 p.m. I emptied the rain gauge, which yielded, as the result of $6\frac{1}{2}$ hours fall, 2.124 in. After about four hours' additional fall (0.358 in.) the rain ceased, the wind meanwhile rising to a fresh breeze from N.W. At 9 a.m. on the 14th the rainfall proved to be 2.482 in., all of which fell in some $10\frac{1}{2}$ or 11 hours. The total fall during the passage of the bourrasque was therefore 2.582 in., or 20.6 per cent. of the total rainfall here from January 1st to August 12th, 1874.

I now give you the returns from other observatories near Dublin, roughly specifying their relative position to my gauge, as regards bearing and distance.

To the S. or S.E. :—

Fassaroe (12 miles)	2.250 in.
Kingstown (6 miles)	2.380 in.
Monkstown (Easton Lodge,) (5 miles)	2.355 in.
„ (Dean's Grange,) (6 miles)	2.290 in.
Sandford (1 mile)	2.070 in.

To the W.N.W. :—

Ordnance Survey Office, Phoenix Park (4 miles)	1.710 in.
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To the N. or N.N.W. :—

Grafton Street (Mr. Yeates, $\frac{3}{4}$ mile)	1.450 in.
Dame Street (Commercial Buildings, $\frac{1}{8}$ mile)	1.450 in.
Eccles Street ($1\frac{1}{2}$ miles)..... ..	1.670 in.
Botanic Gardens, Glasnevin ($2\frac{1}{2}$ miles)	1.620 in.

Mr. Yeates' gauge and that at the Commercial Buildings are both about 70 feet above the ground, and within a furlong of each other. The similarity of the amounts registered by them affords, therefore, satisfactory evidence of their accuracy. In consequence of their elevation, however, their readings lose much of their value in the present inquiry.

It appears from the whole series of observations that the line of heaviest rainfall crossed the south side of Dublin, and reached to Monkstown, Kingstown, and Fassaroe, on the S. and S.E. of the city. To the W. and N. of the city the fall was much less, in no instance exceeding $1\frac{1}{4}$ inches. Probably the heaviest down-pour occurred at

Dalkey, two miles S.E. of Kingstown, for the thunder and lightning were close to that place at 4.30 p.m. So far as I know there is no rain gauge at Dalkey.

A cause for the heavier fall along the S.W. coast of Dublin Bay, and over the S. of Dublin, is not far to seek, when we remember that the rain came with a N. and N.W. wind, which was blowing *towards* a chain of mountains 2000 feet high, and situated a few miles S. of the city, and that, owing to the very high humidity (mean for the 13th, 91·7 per cent.), the rain-laden clouds were so low as to impinge directly on even the lower slopes of those mountains. The country to the N. of Dublin being at a greater distance from the mountains would almost escape whatever portion of the rainfall was due to this local influence. —I am, Sir, yours truly,

J. W. MOORE, M.D.

40, Fitz William Square West, Dublin, Sept. 2nd, 1874.

To the Editor of the Meteorological Magazine.

SIR,—I have much pleasure in complying with your request for some particulars as to the fall of rain which occurred here on Thursday, the 13th inst., by far the greatest I have registered since I commenced about 35 years ago.

For some days previous the weather was very unsettled, the barometer alternating rapidly between 30·00 and 29·50; wind also very variable. At 8 a.m., on the 12th, the barometer stood at 29·77, at 8 p.m. at 29·65. It then commenced to fall rapidly, and at 8 a.m., on the 13th, it stood at 29·40, falling to 29·34 in the afternoon, when it commenced to rise.

The morning of the 13th was very dark, with heavy clouds in all directions; wind about south, moderate, gradually backing to N.E., at which it stood from 11 a.m.

Every appearance indicating an unusually heavy fall of rain, I took the precaution of emptying the gauge, which had about 1·50 in it, fearing it might overflow before I returned home from Dublin. It was fortunate I did so. The fall of rain commenced about 2 p.m., moderate at first, at 3 o'clock it was heavy, and at 4 the downfall was excessive, streets flooded, &c. I returned home in the 4.30 train from Westland Row Station. On arriving at Black Rock at 4.45, I found the line and rails covered, and a regular torrent running along it. We could only cross the line on planks. I arrived home at 5 o'clock, and immediately examined the gauge, and found about what I expected—1·20 in it. From 5 to 6 I watched the rain with great interest; there was an amazingly heavy downfall, with very little wind. At the latter hour one of my sons came home, and immediately called my attention to the gauge, which was just about to overflow! Thus, from 5 to 6 o'clock, 0·80 fell. We immediately emptied it, drawing off 2 inches. For some time longer the rain continued to fall heavily, but diminished rapidly after sunset, and ceased at 10 o'clock, at which time there was 1·14 in the gauge, thus making the total fall 3·14 in 8 hours.

I never registered anything like this before the nearest approach to it was on February 25th-26th last, when I registered 2·54 in 17 hours. As to the recent fall, a friend of mine, about half a mile distant, recorded 3·04; and I have heard of others in this district who measured between 2·50 and 3·00. I cannot find that the great fall extended over a large area. At Wexford, 70 miles south, the day was very fine, and to the northward, a friend of mine coming up from Belfast told me the day was fine until within 20 or 30 miles of Dublin. Eastward, the mail packet from Holyhead had a fine passage till within an hour of Kingstown, when she encountered a violent storm, with B T and L. I have not heard anything definite from the westward. From 4 to 6 there was here a great deal of T and L, which seemed to me to be *above* the clouds. I was unable to perceive it had any effect on the fall of rain, which appeared uniformly steady throughout the greater part of the time it continued.

If I can give you any further information, I shall most gladly do so.

I am, yours very truly,

THOS. BEWLEY.

Rockville, Black Rock, near Dublin, Aug. 20, 1874.

REVIEW.

Horizontal Wells.—A new application of geological principles to effect the solution of the problem of supplying London with pure water. By J. Lucas, F.G.S., of the Geological Survey of England. 4to., viii-86 pages, 3 plates. Stanford.

ENGLISH science owes much to the staff of H. M. Geological Survey, and in the present work Mr. Lucas proves himself a worthy member of that body of clear thinking and very hard working men.

The conciseness and good arrangement of the work may be imagined from the terseness of the following—

SYNOPSIS.

The materials made use of in the following paper will be arranged in chapters, under certain headings, viz:—

- 1.—To show need of a fresh supply of drinking water to London.
- 2.—Sketch of Geological Principles on which the proposition contained in this paper is based.
- 3.—The Principles applied to the case of London. Account of Geological Formations from which supplies may be drawn.
- 4.—Account of the excellent quality of their waters.
- 5.—Statement of the main Proposition—How to obtain the largest possible proportion of quantity of Rain falling upon them.
- 6.—Positions and heights above sea level of Galleries.
- 7.—Calculations as to probable quantities to be collected by them.

All details will be found to fall under one or another of these heads.

An Appendix, embodying the result of such observations as I have been able to make, has been added since the writing of the paper.

There is one special merit in this work, viz., that the author has spared no trouble in collecting facts, and, as far as we have examined,

does not advance opinions without evidence to support them. We do not share his preference for water from the chalk (even when softened by Dr. Clark's process) but on the contrary believe the water of Loch Katrine, Ullswater, Bala, and kindred districts best suited for all the wants of mankind, but we nevertheless share his objection to the Thames water in its recent or present condition, and are not prepared to deny that softened chalk water would be better than the present supply from the Thames. Mr. Lucas has devoted much care to contouring the water level of the chalk, and gives a map of a portion of Surrey, epitomizing his results, which is extremely interesting. One of the special features of his book, in fact that which gives rise to its short title, is a suggestion which we think may be briefly described as for constructing underground galleries crossing the subterranean chalk streams at their point of maximum yield. This is obviously a good plan, far better than either sinking a well hap-hazard, as is generally done, or than merely supplementing such a vertical shaft by an adit run at any imaginable angle to the probable direction of the subterranean stream. It appears to us that the author has not rendered his proposal complete, inasmuch as though he suggests where these galleries are to be run, he says nothing as to storage reservoirs, and leaves it uncertain whether reliance is to be placed on the natural storage power of the chalk, or upon reservoirs constructed in the usual manner. If the former, we believe that unless the galleries are of enormous size, much water must be allowed to run to waste, and from the rapidity with which water percolates chalk (see *Meteorological Magazine*, vol. i, diagram p. 28) the summer yield might fall short. If, on the other hand, storage be adopted, the argument as to temperature on page 24 must be abandoned—in fact, in any case, Mr. Lucas would have done well not to have quoted an argument which derives all the little weight it possesses from having been printed in an appendix to a blue book. The idea of engineers like Mr. Bateman, or Messrs. Hemans and Hassard, laying the water mains for the supply of London so near the surface that the water would by freezing burst the pipes, is almost worthy of our contemporary *Punch*; however, the onus of publication rests with those who admitted such rubbish into the Appendix to the Report of the Royal Commission, rather than with Mr. Lucas, who has merely reproduced what appeared in good company, and under high auspices.

Although Mr. Lucas speaks in the most humble manner of the "few observations" he has made, several of his tables show that the term *few* has a very different meaning in his work to that which it has in those of most other people. We wish therefore that he had been able to recommend some easier mode of measurement than that which he has suggested, for if, with his large experience, he cannot do so, we fear matters are not very promising for the *Dii minores*. After remarking that "A lead or iron clock weight, not too heavy to carry comfortably, is indispensable" for the accurate measurement of the depth from surface to top of water, he proceeds on the next page as follows :

"An ordinary tape line is practically useless for measuring wells on the chalk.

Very few are so shallow as 66 ft., and a large number run above 300 ft. I therefore had a line made by the Messrs. Stanley, of Great Turnstile, 400 ft. long.

Its weight, $22\frac{1}{2}$ lbs., is unfortunately so great as to make it impossible to carry it for any distance."

He then proceeds to explain certain alterations, whereby

"This would make the weight 16 lbs., below which I do not see that it could be reduced. This however is quite a portable weight."

Perhaps so, but 16 lbs. + the clock weight + sundry necessary little addenda, are more comfortably carried 5 miles than 15, and Mr. Lucas may rest assured that the number of observations made will increase with every reduction in the weight of the apparatus, and with every facility offered for the conduct of such observations.

During the last eight or ten years we have frequently urged the benefits derivable from observations such as are given in this work; we join Mr. Lucas in hoping that they will become much more numerous, but our experience of government work does not lead us to concur in his hope that "a series of such observations may be authorized by Government, and an observatory for the purpose, established on the lower greensands of Surrey." We would far rather see such observations inaugurated and carried out by private enterprise. For so desirable an object, we are sure that if the proper course were pursued, there would not be the least difficulty in obtaining any necessary amount of moral or material support.

We greatly regret that this very suggestive and useful work is marred by one error, which runs through all the calculations as to the volume of subterranean water, or at any rate through all that we have tested. It would not be fair to make such a statement without proof; we therefore take as an instance the first clearly-expressed quantity which we have noticed—viz., on p. 42, where the following paragraph occurs:

"The amount of percolation or absorption corresponding with this rainfall is 12.16 inches, which is equal to 89,229,388,800 gallons, on $51\frac{1}{4}$ square miles, or an average flow of 244,464,078 gallons daily for one year."

As we cannot tell in what stage of the calculation Mr. Lucas has been mistaken, we must start from the fundamental facts that there are 144 square inches in one square foot, and 43,560 square feet in an acre, and therefore—

$$43,560 \times 144 = 6,272,640 \text{ square inches in one acre.}$$

Secondly, it was settled by Act of Parliament, June 17th, 1824, that the imperial gallon should contain 277.274 cubic inches, and therefore—

$$6,272,640 \div 277.274 = 22,623 \text{ gallons per acre} = 1.00 \text{ in. of rain.}$$

This is the value given in *British Rainfall*, 1865, Appendix p. vi., and in various other works, but under the circumstances we have thought it better to show how this value of 22,623 gallons per acre is obtained.

As there are 640 acres in one square mile, we have next—

$$22,623 \times 640 = 14,478,720 \text{ gallons per square mile} = 1.00 \text{ in. of rain.}$$

Then it only remains to introduce from the paragraph quoted above the depth (12·16 in.), and area ($51\frac{1}{2}$ square miles), and we have

$14,478,720 \times 12\cdot16 \times 51\cdot25 = 9,023,138,294$ gallons per annum.
while the author gives $89,229,388,800$ „ „
or (within a trifle) ten times the real quantity.

That there may be no doubt about the matter, we will work out the *daily* supply in an entirely different way, viz., by the rule given by Prof. Galbraith.*

“ If the drainage area is measured in square miles (M), and the annual available rainfall in inches (i), then the daily supply will be found by—

$$40,000 M i = \text{gallons in daily supply.}$$

(*This is in excess by only 8 per mille, which in practice is negligible.*)”

Substituting the values of M and i, we have

$$40,000 \times 51\cdot25 \times 12\cdot16 = 24,806,400 \text{ gallons per day,}$$

while the author gives $244,464,078$ „ „

We need hardly say that this serious error destroys the arguments founded on the assumed large quantity of water penetrating the chalk, beyond that discharged by the springs and streams. But it still leaves the work one which must find a place on the shelves of all who are interested in the great question of subterranean water supply, for it still remains sole repository of many useful data, and of several good suggestions.

SUPPLEMENTARY TABLE OF MONTHLY RAINFALL, AUGUST, 1874.

Div.	County.	Station.	Total Fall.
			in.
II.	Kent	Acol	1·17
„	Sussex	Hailsham	—
„	Hampshire	Strathfield Turgiss	1·24
„	Oxford	Magdalen College	1·53
„	Essex	Harlow (Sheering Rectory)	1·17
„	Cambridge	Cambridge (Merton Villa).....	1·25
IV.	Norfolk	Swaffham.....	1·66
V.	Devon	Teignmouth (Brookbank)	2·40
„	„	Torrington (Langtree)	5·30
„	Somerset	Taunton (The Castle).....	1·99
VII.	Lincoln	Horncastle (Bucknall)	1·83
VIII.	Lancashire	Liverpool (Walton-on-the-Hill) ..	3·26
IX.	York	Wakefield (Stanley Vicarage)	1·50
X.	Durham	Gainford	3·16
„	Westmoreland	Shap	—
XVII.	Banff	Keith	6·58
XVIII.	West Ross.....	Strathconan.....	5·91
XX.	Cork	Fermoy (Glenville).....	3·68
XXI.	Westmeath	Athlone (Twyford) ..	4·60
XXII.	Galway	Ballinasloe	5·15

* *British Rainfall*, 1865, Appendix p. xv.

THE THUNDERSTORM OF JULY 11TH.

To the Editor of the Meteorological Magazine.

SIR,—After reading the account of the thunderstorm on July 11th, in the *Meteorological Magazine* for this month, I am induced to send you a report of our experiences in this place, which far exceed anything you have described. The rain began to fall about 6 p.m. I mark the hour by the arrival of the London train due at Welwyn station at 5.50; some friends of mine travelled by it, and had time to get into an open carriage before the storm began; they were, however, induced by the threatening look of the clouds to wait in a shed at the station till it was over, and arrived at my house, about one mile off, before 7 o'clock, having waited for the heaviest rain to cease, and driving home without inconvenience: this marks the limits of the duration of heavy fall. My gauge was emptied that evening, the receiver had overflowed; we got what we could out of the body of the gauge itself with a sponge, and 2.50 was the result,—how much more should be allowed for leakage and splashing I don't know. The effects of the storm were very inconvenient if not actually dangerous, scarcely a house in the village but was more or less flooded; wherever there was a back yard or other ground at all higher than the door the rain-fall, which could not escape through ordinary drains, poured through the houses, even of the better sorts; roof-pipes and gutters were quite inadequate to carry off the mass of water which fell on the roofs. The roads, some of which are hollow between banks and hills, were turned into water courses, and were left like the beds of torrents, the fine silt and binding being washed away, leaving the large foundation stones exposed; large portions of fences were carried away, and the top soil, with roots growing in it, swept from several hilly fields. The thunder and lightning, I am told, were very alarming (I was not at home at the time), but the attention of all seems to have been chiefly concentrated on the rain. I may add that another gauge about two miles off corroborated mine, showing 2.90. The storm appears to have moved in a line, the width of area of greatest fall being very limited.

On the evening of July 10th there was also a heavy storm, when a neighbouring church was struck and burnt, my gauge giving .86.

I remain, your obedient servant,

C. L. WINGFIELD.

The Rectory, Welwyn, Herts.

COLOURING DEGREE MARKS UPON THERMOMETER TUBES AND SCALES.

To the Editor of the Meteorological Magazine.

SIR,—For some time past I have been in the habit of rendering graduations on glass more distinct by filling them with a silicious pigment, which is white or black, according to the purpose for which the scale is to be employed. The processes are as follow:—

White Pigment.—The scale is thoroughly cleaned by scrubbing with a hard brush dipped in a mixture of strong aqueous caustic soda,

with methylated spirit in equal volumes ; it is then well rinsed with water, and lightly dried. Equal weights of precipitated baric sulphate (sulphate of baryta) and precipitated zinc oxide are next placed in a mortar, and stirred with enough syrupy sodic silicate to form a somewhat thick paste. A little of this paste is placed on the finger, and rubbed into the divisions without delay ; in a few minutes it will begin to harden, and the excess must be instantly removed with the edge of a piece of brown millboard. This pigment is decidedly brilliant.

Black Pigment.—The process is carried out exactly as above ; but the sodic silicate is mixed with precipitated manganic dioxide (which alone gives a dark brown), to which a little lampblack has been added.

The scales may be exposed to the weather in about a week's time. Both pigments are very permanent ; and, in the long run, they become so thoroughly incorporated with the glass itself, that they cannot be wholly detached, unless by the file. The black one is materially improved by tinting when a week old with aniline black, which is sold at the druggists as "jetoline."

All the materials are cheap, and the process is very easy.

I am, Sir, your obedient servant,

EDMUND J. MILLS.

"POCKY CLOUDS" *alias* "INVERTED CUMULI."

To the Editor of the Meteorological Magazine.

SIR,—A correspondent in the July magazine, asks if it is too late to object to the above name, and many of your readers will endorse your own editorial comment that the expression is "infelicitous."

If I understand correctly the kind of cloud intended, it is one which my late brother and myself were accustomed, as very young observers, to call "tucked-up" clouds, and to which more recently (although still many years ago) my brother applied the term "inverted cumulus." By this name I have always since described it in my own notes, and in the absence of any better suggestion I venture to propose the name for adoption. It has at least the advantage of indicating the real analogies of the cloud, which appears to be closely allied to the ordinary cumulus. The typical cumulus is essentially a thunder-cloud, and so is its "inverted" variety ; and whatever kind of force it may be that moulds the form in the one case, giving rise to those magnificent masses of sharply cut, white or copper-coloured cloud that we see in thunderstorms, there can be little doubt that the same force operates in the other case, producing the sharp definition and the rounded "tucked-up" contour of the "inverted cumulus." In all probability the same cloud which is "pocky" below is cumulus above, an identical formative influence being at work on both the upper and lower surfaces.

According to my own observation, the "inverted cumulus" never occurs in a marked degree except in the near neighbourhood of a thunderstorm.

GEORGE F. BURDER, M.D.

Clifton, 8th Sept. 1874.

BOOKS RECEIVED.

DENMARK.

- Bulletin Météorologique du Nord, publié par les Instituts Météorologiques de Norvège, de Danemark et de Suède. April—July, 1874. Oblong 4to.
 Hoffmeyer, Capt.—Specimen Meteorological Charts of Europe and North Atlantic. December 1–6, 1873. Single sheets, folio.

FRANCE.

- Belgrand, M. E., and Lemoine, M. G.—Abaissement probable du débit des eaux courantes du bassin de la Seine dans l'été et l'automne du 1874. 4 to.
 Raulin, Prof.—Sur les Observations Pluviométriques faits dans le sud-ouest de la France, 1861–70. 8vo. Bordeaux, 1874.

GREAT BRITAIN.

- Airy, Sir G. B.—Report to the Board of Visitors of the Royal Observatory, Greenwich. 4to. 1874.
 Lucas, J., F.G.S.—Horizontal Wells: a Solution of the Problem of Supplying London with Water. 4to. 1874.
 Main, Rev. R., M.A.—Results of Meteorological Observations made at the Radcliffe Observatory, 1871. 8vo. Parker, Oxford, 1874.
 Meteorological Committee.—Report for the year ending December 31st, 1873. 8vo. Spottiswoode, 1874.
 Meteorological Committee.—Quarterly Weather Report of the Meteorological Office, April—June, 1873. 4to. 1874.
 Miller, S. H.—Fenland Meteorological Circular, Nos. III.—VI. 4to. Leach and Son, Wisbech.
 Pastorelli's Wind and Weather Indicator.
 Perry, Rev. S. J., F.R.S.—Results of Meteorological and Magnetical Observations at Stonyhurst College Observatory, 1873. Post 8vo. Robinson, Preston, 1874.
 Scott, R. H., F.R.S.—Report on Weather Telegraphy, presented at Vienna by the Committee appointed at Leipzig. Published by authority of the Meteorological Committee. 8vo. Stanford, 1874.
 Waterhouse, J., F.R.S.—Eight years' Meteorology of Halifax. 4to. 1874.

INDIA.

- Chambers, F.—On the Diurnal Variations of the Wind and Barometric Pressure at Bombay. 4to.

PRUSSIA.

- Karsten, G.—Ergebnisse der Beobachtungsstationen an den deutschen Küsten über die physikalischen Eigenschaften der Ostsee und Nordsee und die Fischerei. March—October, 1873. Oblong 4to. Berlin, 1874.

RUSSIA.

- Wild, H.—Annalen des Physikalischen Central Observatoriums, Jahrgang, 1872. St. Petersburg. 4to. 1874.
 Wild, H.—Repertorium für Meteorologie, Band III. St. Petersburg, 1874. 4to.

UNITED STATES.

- Abbe, Cleveland A. M.—Historical Notes on the Systems of Weather Telegraphy. 8vo.
 Abbe, Cleveland A. M.—Observations on the Total Eclipse of the Sun in 1869. 8vo.
 Abbe, Cleveland A. M.—Annual Report of the Director of the Cincinnati Observatory, 1870. 8vo.
 Loomis, Prof. Elias.—Results of an Examination of the United States War Maps for 1872 and 1873. 8vo.
 Journal of the Telegraph, Nos. 156, 157, and 159.

AUGUST, 1874.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					No. of Days on which -01 or more fell.	TEMPERATURE.				No. of Nights below 32°		
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.						
				Dpth	Date.			Deg.	Date.	Deg.	Date.	In shade	On Grass	
		inches	inches.	in.										
I.	Camden Town	1.32	— 1.32	.28	4	16	84.0	23	45.5	23	0	0		
II.	Maidstone (Linton Park)	2.07	— .64	.44	10	15	81.0	20	40.0	24	0	0		
„	Selborne (The Wakes)	3.07	— .11	.51	13	14	76.0	22	41.6	22	0	0		
III.	Hitchen	1.11	— 1.24	.22	29	17	74.0	2+	40.0	22	0	1		
„	Banbury	2.09	— .04	.45	7	17	79.0	20	41.0	5	0	0		
IV.	Bury St. Edmunds (Culford)	1.18	— 1.26	.47	10	12	79.0	2	37.0	25	0	0		
V.	Bridport	2.39	— .20	.44	11	13	77.0	19+	43.0	17	0	0		
„	Barnstaple	5.65	+ 1.46	1.68	12	21	83.0	21	48.5	10	0	0		
„	Bodmin	4.79	+ .93	1.18	31	22	76.0	19	48.0	17	0	0		
VI.	Cirencester	3.18	+ .34	.94	7	19	...	...	...	...	...	...
„	Shifnal (Haughton Hall)	2.62	— .25	.40	12	17	74.0	19	42.0	12	0	0		
„	Tenbury (Orleton)	2.64	— .24	.41	31	18	83.8	20	41.5	17	0	0		
VII.	Leicester (Wigston)	2.55	+ .36	.39	27	19	85.0	20	39.0	21	0	0		
„	Boston	1.97	— .32	.31	27	16	81.0	20	42.0	24	0	0		
„	Grimsby (Killingholme)	2.11	...	.33	7	18	76.0	19	44.0	4, 22	0	0		
„	Derby	2.54	— .06	.48	16	17	81.0	20	45.0	22	0	0		
VIII.	Manchester	4.35	+ .85	.49	8	20	77.8	20	43.0	5	0	0		
IX.	York	2.34	— .37	...	...	...	77.0	19	42.0	24	0	0		
„	Skipton (Arncliffe)	9.52	+ 3.58	1.20	30	23	80.0	19	35.0	4	0	0		
X.	North Shields	1.55	— 1.30	.28	30	18	74.3	19	43.0	30	0	0		
„	Borrowdale (Seathwaite)	18.60	+ 4.52	2.46	30	23	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
„	Haverfordwest	6.11	+ 1.23	1.15	31	16	76.8	20	43.5	22§	...	...
„	Rhayader (Cefnfaes)	5.50	+ .84	.90	28	16	79.0	...	44.0	...	...	...
„	Llandudno	2.81	— 1.01	.44	13	17	77.9	19	49.3	29	...	...
XII.	Dumfries	6.25	+ 2.38	1.75	30	22	74.5	20	39.0	5	...	...
„	Hawick (Silverbut Hall)	5.03	...	1.00	30	20	...	...	...	...	...	...
XIV.	Kilmarnock (Annanhill)	5.55	...	1.02	6	23	73.8	24	43.0	13	0	0		
XV.	Castle Toward	4.49	— 1.81	.72	7	22	75.0	22	...	...	...	...
XVI.	Leven (Nookton)	3.97	+ .98	.80	30	19	80.0	22	37.0	28||	0	1		
„	Stirling (Deanston) .....	...	...	...	...	...	...	...	...	...	...	...
„	Logierait	3.06	...	.43	6	19	...	...	...	...	...	...
XVII.	Braemar	6.79	+ 2.95	2.67	13	21	75.3	22	40.2	22	0	1		
„	Aberdeen	6.72	...	1.78	10	24	74.9	19	38.6	24	0	0		
XVIII.	Loch Broom	4.15	...	.56	8	26	...	...	...	...	...	...
„	Portree	7.31	— .14	.69	6	26	...	...	...	...	...	...
„	Inverness (Culloden)	6.40	+ 3.15	1.27	14	15	72.8	22	37.0	24	0	1		
XIX.	Helmsdale	3.91	...	...	...	...	...	...	...	...	...	...
„	Sandwick	5.00	+ 1.29	.55	5	23	62.8	28	40.8	24	0	0		
XX.	Caherciveen Darrynane Abbey	4.41	...	.61	31	16	...	...	...	...	...	...
„	Cork	1.66	...	.30	13*	14	...	...	...	...	...	...
„	Waterford	3.08	— .87	.59	27	18	76.0	18	46.0	12	0	0		
„	Killaloe	7.83	+ 2.90	1.01	30	24	83.0	19†	42.0	12	0	0		
XXI.	Portarlinton	4.19	— .31	.83	14	25	78.0	19	44.5	11	0	0		
„	Monkstown, Dublin	4.38	— 1.17	2.36	13	17	...	...	...	...	...	...
XXII.	Galway	3.65	...	.46	27	20	82.0	24	46.0	3, 13	0	0		
„	Ballyshannon	5.51	...	.68	6	23	...	...	...	...	...	...
XXIII.	Waringstown	4.72	...	.99	13	21	83.0	23	44.0	28	0	0		
„	Edenfell (Omagh)	3.26	...	.53	29	23	76.0	23	41.0	29	...	...

* And 26. † 20. ‡ 22. § 27. || 30.

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

METEOROLOGICAL NOTES ON AUGUST.

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.

LINTON PARK.—Brisk winds on 4th, 5th, 8th, 10th, 11th, 13th and 15th, with T on 10th and 25th. Fine and warm from 19th to 28th, in fact the month as a whole may be considered a fine one, but the lack of R is felt in many ways.

SELBORNE.—T, L and H on 10th from 2.30 to 4 p.m.; TS on 29th at 2 p.m.; violent wind from S.W.; T in the night of 31st; dense fogs on 19th, 20th and 21st, and very dense early on 25th. Fine harvest weather after the middle of the month till the 27th; wheat a good crop, and mostly well got in; hops extremely bad all round here.

BANBURY.—T, L and H on the 10th.

CULFORD.—The mean temp. of the month was $57^{\circ}5$, and westerly winds prevailed on 28 days. T, L and H on 10th; TS also on 29th.

BRIDPORT.—Gales on 12th, 13th, 30th and 31st, principally from S.W.

HAUGHTON HALL, SHIFFNAL.—R fell daily with one exception (6th) from the 3rd to 16th inclusive, sufficiently to refresh the burnt up pasture without materially injuring the grain, but too late to save most of the turnips, of which on some farms there was almost a total failure, while on the next there were good crops, those on the light soils better in general than on the strong. From the 16th no R fell till the 27th, when a good supply came till the close of the month. Heavy storms with gales from the W. on 11th and 12th. The max. ther. never exceeded 74° , and averaged $62^{\circ}5$; the min., although as low as 42° and 44° on two nights, averaged 51° . Mushrooms sprang in great abundance, and wasps increased so as to be very destructive.

ORLETON.—The first two days were fine and hot; from the 3rd till the 16th R fell each day, but generally in small quantities, which renewed the greenness of the pastures, but did not penetrate far into the dry earth. From the 16th to the 26th another warm period occurred, with many bright and cloudless days, and no R. Much R fell in the remaining five days, which moistened the earth and appears to have broken up the long drought; T was heard on the 4th, 10th and 29th, but was never loud or near. The temp. of the month was about the average. Nearly all the grain crops have been harvested in fine condition.

WIGSTON.—The fine showers have improved the appearance of the pastures, and also the root crops. The corn harvest may be said to be finished, and, taken altogether, it has been secured in good condition.

BOSTON.—Almost continuous high winds for the first fortnight, interfering very much with the harvest operations, which commenced generally in this neighbourhood about the 3rd, and finished about the 31st. The first new corn was delivered at market on the 12th, nine days earlier than the average of the last 17 years; crops generally very good, and the yield of wheat above the average.

GRIMSBY.—Wheat cutting became general about the 6th. T and L on 7th and 10th, and T on the 29th. The showers in the former half of the month refreshed the pastures, but did nothing towards filling the ponds; the fine weather of the latter half enabled the farmers to secure their harvest in excellent condition. Gossamer and garden spider webs, an almost infallible sign of fine weather for a few days at this season, on 22nd.—[*Erratum.* The hygrometrical values for July 3rd should have been, dry 73° , wet 59° , humidity 42.]

MANCHESTER.—T and L on 7th, 8th and 10th, and T on 13th.

NORTH SHIELDS.—TS on 10th and 13th.

SEATHWAITE.—L on 2nd, T on 9th and 13th, TS with H on 29th. 2.00 of R fell on the 6th, and 2.46 on the 30th; the total fall being 18.60, or 4.52 above the average, though no rain fell between the 18th and 27th.

WALES.

HAVERFORDWEST.—The first half of the month very wet, close and sultry at times. Very stormy about the 12th; a fine, warm, dry week from 15th to 23rd; the last week stormy, with T L and R.

CEFNFAES.—Violent storms of R and H, with heavy gales during the month, but nine days without R; T early in the morning of the 29th.

LLANDUDNO.—Wheat cut on 1st, oats on 3rd, and barley on 6th. No R between the 15th and 27th, but frequent haze during that time.

SCOTLAND.

DUMFRIES.—The month just closed has been the wettest (6·25) August since 1861, when 7·55 fell; up to the 15th there was R every day, R also on 17th, then fine weather to the 27th, after which heavy R to the close of the month. The violent T S on 13th came from the south-east about 9 p.m.; the L was very vivid, and occasionally it assumed the form of a ball of fire, with diverging rays; the T was very loud, and accompanied by heavy R. By 10 o'clock the storm had in a great measure abated. At Tinwald Shaws 30 sheep, or rather 29 ewes and a lamb were killed—the sheep were all lying close to a stone dyke which faced the east, there was a slight hollow in the hill-side where the sheep had gone for shelter; several of the carcasses had a narrow mark of singeing from the loin on the left side towards the neck, and others on the back; but none of the carcasses were injured. The carcasses were all lying within a distance of twenty yards in clumps of six and seven carcasses. No trees were growing within a quarter of a mile of the spot where the animals were killed; none of the other sheep were injured. At Kiddingwood, Kirkmahoe, the electric fluid struck a large spruce fir, about 30 feet from the ground, and split it, breaking the trunk across at 10 feet from the ground, and splitting to the base; a small plane tree was also struck and split to the ground. The trees were growing on the east side of a considerable wood, chiefly spruce fir. The fir struck would be about 55 feet in height, and near the base of the trunk was 4 feet 6 inches in girth. On 30th very extraordinary heavy R, 1·75. Notwithstanding the frequent showers, harvest work well forward before the 27th.

SILVERBUT HALL.—Rainy month, with cold blustering winds; T and much L on the 13th; potatoes not much affected with disease, but showing a little in the surrounding districts; turnips are now looking very promising.

ANNANHILL.—Wind generally S.W. and W., light to fresh; month cloudy and unsettled. Several T SS, some of them doing much damage, being accompanied by heavy R, which, in some places, submerged the crops; pastures and foliage of all kinds luxuriant. Great growth of mushrooms during the month. Ozone well developed, marking 10 on 6 days. Oat harvest well advanced on 12th; harvest operations in full vigour on 23rd; grain nearly all reaped, and potatoes lifted.

CASTLE TOWARD.—There having been rain on 22 days has rather interfered with the harvest, but a good breadth has been cut down with the reaping machines since the 22nd. Potato crops look bad, and disease has set in within the last fortnight, and to all appearances it is general. The carrots are this year a complete failure, all other vegetables are abundant, and of good quality. Winds during the month principally W. and S.W.; loud T on the 28th.

NOOKTON.—T from 6 to 7 p.m. on 8th.

BRAEMAR.—A month of fine growing weather, crops looking well. T on 12th, and flooded rivers on the 13th from a fall of 2·67.

ABERDEEN.—A month of average temperature, with heavy R and much T and L. Heavy floods in the rivers on the 14th. The fall of R, 6·72, is 3·63 above the average (18 years) and exceeded only once (1868) in the 18 years.

LOCHBROOM.—A boisterous month; the first 20 days were rainy without an exception; the rest of the month sunshine and showers alternately, but there was a genial warmth throughout the whole which ripened the grain and made reaping universal. The potato disease made its appearance very suddenly about the 25th or 26th; no sooner in the shaw than in the root, but its progress seems arrested in the meantime, and, if stopped, there need be no general clamour about its extent.

PORTREE.—A wet, dark, and gloomy month; distant T on 31st; gale on 5th from S.W. to W. No corn cut as yet; it will take three weeks before harvest can be general here. Potatoes free from disease, in fact all kinds of crops look well, and cattle are thriving well on pastures, and free from disease. The prospects of the farmer never promised better in this island than at present.

CULLODEN.—The rainfall during the week ending with the 15th (4·82 in.) was unusually heavy, and although greater falls have occurred within 24 hours than on this occasion, there are few instances in the past 34 years when such a quantity of rain has fallen in succession on the same number of days. The total rainfall for this month (6·40 in.) is greater than in any August since 1868, when it was 6·62, and in the same month in 1863, 6·67.

SANDWICK.—A heavy shower at 6 p.m. on 9th, when ·41 fell in about 40 minutes; a shower of sleet on the 1st, T and L on 29th. August has been much wetter than the mean, indeed there have been only two Augusts since the commencement of the observations, 34 years ago, in which more rain fell. Aurora on 23rd.

IRELAND.

DARRYNANE.—Prevalent winds N.W., 19th to 26th very hot and oppressive. Heavy showers with T and L on night of 28th.

MONKSTOWN.—The beginning of the month was very showery and cold, the middle and end fine and warm. The fall on the 13th (2·36) the heaviest fall in 24 hours registered here since 1864; wind N.N.E. to N.W.; at Blackrock 3·14 was registered. L and T on 15th.

BALLYSHANNON.—The first half of the month was unusually wet, but the temperature was higher than at any other period of the year. The latter half was fine and favourable for the harvest, which, generally speaking, promises to be a plentiful one. Gale from the S.W. on 2nd, from the W. on 8th and 9th, and from S.W. on 10th.

OMAGH.—First half of the month unsettled and boisterous, with occasional heavy rain; from 16th to 26th fine and dry, and on several days very hot; remainder of the month rainy and unsettled. As far as the harvest has proceeded all crops promise great abundance.

THE DROUGHT.

To the Editor of the Meteorological Magazine.

SIR,—It is singular that whilst we observe the effect of the drought this year in the shortness of water in the river and the general fading of trees and grass, more than I ever remember, we have had a slightly *greater* amount of rainfall *here* than in 1870. This year, to August 1st, we have had 6·29 inches—in 1870, to August 1st, we had 6·28 inches; but I can partly account for its greater effect this year by referring to the rainfall in December, 1869, when we had 3·85 inches, while last December we only had 0·45 inches, showing how much more influence on vegetation rain falling in the Winter has, than occasional rain in the Summer.—Yours truly,

JAMES NUTTER.

Cambridge, Aug. 24th, 1874.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CV.]

OCTOBER, 1874.

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METEOROLOGY OF JAPAN.

*From Observations made in Yokohama from 1863 to 1869, inclusive,
by J. C. HEPBURN, Esq., M.D.*

[From the "Japan Weekly Mail," June 27th, 1874.*]

THE city of Yokohama is situated in lat. $35^{\circ} 26' N.$, and long. $139^{\circ} 39'$ East from Greenwich. It lies on the west side of the bay of Yedo; about 37 miles from Cape King, the nearest point on the Pacific, and about 20 miles from Yedo, which is at the head of the bay. The bay at Yokohama is about 12 miles wide. The city is for the most part built upon a plain about from two to ten feet above high water mark, at the mouth of a valley opening on the bay. The valley is about a mile wide, and extends back in a westerly direction some three miles, gradually narrowing to a quarter of a mile. It is bounded on each side by a low range of hills, about 120 feet high. It is cultivated in paddy fields, is consequently wet and marshy, and is exposed to the sweep of N.E. and easterly winds from across the bay, and to S.W. and westerly winds through the valley.

The climate of the Japan Islands generally is much influenced by their position being on the edge of, and even within, the great ocean current called *Kuro-shio*, which flows from the equatorial regions in a northerly and easterly direction.

The N.E. and S.W. monsoons which blow with so much regularity on the coast of China are not much felt on the coast of Japan: the winds being at all seasons exceedingly irregular, frequently violent, and subject to sudden changes. The N.E. and easterly winds are generally accompanied with rain, with a high and falling barometer, and are usually not violent. The S.W. and westerly are generally high, often violent, and accompanied with a low barometer. It is from the S.W. that the cyclones almost invariably come, with one, and sometimes two, of which we are visited yearly. On clear and pleasant days, which are in excess of all others, there is a regular land and sea breeze at all seasons. As may be seen from the Table, the rainfall is above the average of most countries, varying much, however, from one to another. About two-thirds of the rain falls during the six months from April to October.

The steady hot weather, when it is considered safe to change to

* Copy kindly forwarded by H. St. John Joyner, Esq.

light summer clothing, does not generally set in before the latter decade of June or first of July, and ends often very abruptly about the middle of September.

The snow-fall is for the most part very light, not often exceeding two or three inches; though on one occasion, in the winter of 1861, it fell to a depth of 20 inches.

The ice seldom exceeds one inch or an inch and a half in thickness. Fog is rarely noticed; hail is also rare.

Thunderstorms are neither frequent nor severe. Earthquake shocks are frequent, averaging more than one a month; but hitherto since the residence of foreigners in Yokohama no very severe or dangerous shocks have occurred.

The Fall of Rain in Inches.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Amount
1863...	3·65	2·25	5·90	5·34	5·64	1·40	2·75	7·76	7·16	4·10	3·44	1·17	50·56
1864...	·83	1·92	2·01	9·37	4·10	9·11	4·48	5·71	17·83	3·97	4·47	7·64	71·44
1865...	1·30	6·59	2·47	7·07	4·47	6·29	9·52	3·11	5·32	6·71	1·97	5·90	60·72
1866...	1·81	3·53	4·45	6·16	3·73	7·69	5·84	7·81	10·08	3·15	4·69	6·22	65·16
1867...	2·35	1·81	2·18	6·53	4·40	8·52	1·31	·34	7·50	2·29	2·00	3·39	42·62
1868...	4·52	2·62	6·69	4·82	10·24	17·96	24·04	17·05	19·27	11·62	2·21	1·63	122·67
1869...	1·98	2·32	11·69	6·90	8·10	6·35	9·58	5·17	4·19	16·64	5·41	·84	79·17
Average	2·35	3·01	5·04	6·59	5·81	8·19	8·22	6·71	10·19	6·92	3·46	3·82	70·33

The Number of Rain Days.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total No.
1863...	5	5	10	11	10	7	8	12	13	8	9	4	102
1864...	5	8	8	12	9	11	6	9	15	5	5	7	100
1865...	1	9	8	11	8	16	18	7	14	6	8	4	110
1866...	3	7	11	11	12	12	11	9	12	1	5	3	97
1867...	8	3	4	11	9	10	8	2	11	4	4	4	78
1868...	4	6	11	9	7	18	12	16	9	13	4	5	114
1869...	5	5	7	3	4	5	7	10	9	12	11	3	81
Average	4·4	6·1	8·4	9·7	8·4	11·3	10·0	9·3	11·9	7·0	6·6	4·3	..

Monthly and Yearly Average of the Thermometer.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Average
	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.
1863...	40·1	41·0	49·0	55·0	64·0	72·0	80·0	82·0	69·0	60·0	53·0	42·0	59·0
1864...	35·5	38·1	43·3	57·4	64·0	69·1	76·5	79·6	70·4	62·6	52·1	44·3	58·0
1865...	39·3	44·5	46·4	58·6	65·4	71·1	73·0	80·2	72·5	61·3	51·2	44·5	59·1
1866...	39·5	38·6	48·0	54·3	61·3	65·5	74·1	77·5	68·2	61·6	50·6	42·3	57·0
1867...	42·3	39·4	49·5	56·2	64·1	70·6	76·0	80·4	71·5	63·6	51·4	45·6	59·3
1868...	42·3	41·3	45·5	57·3	65·5	69·4	77·0	75·3	70·5	60·5	53·3	45·0	58·5
1869...	42·5	45·4	46·4	53·5	63·4	69·2	71·3	75·4	73·1	62·4	51·2	41·3	58·1
Average	40·2	41·2	46·9	56·0	64·0	69·6	75·4	78·6	70·7	61·7	51·8	43·6	58·4

The Monthly Maximum and Minimum of the Thermometer.

	1863.		1864.		1865.		1866.		1867.		1868.		1869.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
January	deg. 54	deg. 29	deg. 58	deg. 20	deg. 62	deg. 25	deg. 57	deg. 25	deg. 59	deg. 29	deg. 56	deg. 28	deg. 64	deg. 28
February	52	28	47	20	66	32	63	23	52	29	54	25	59	31
March	67	32	65	25	69	33	63	34	66	35	66	31	67	34
April	72	44	71	40	74	48	73	42	73	38	77	40	66	39
May	78	50	77	50	78	46	77	35	76	51	77	52	76	50
June	87	54	81	51	82	58	82	51	80	61	84	59	77	59
July	90	67	89	70	86	64	86	57	88	61	87	66	84	62
August	89	71	89	70	91	70	87	66	90	71	84	65	86	64
September	86	60	86	59	86	55	81	58	89	59	82	60	85	63
October	71	50	76	47	77	48	72	48	75	40	75	45	73	52
November	68	40	69	37	68	32	72	31	70	34	66	35	67	34
December	59	21	68	30	67	27	56	26	59	31	57	32	60	26

THE BRITISH ASSOCIATION AT BELFAST.

(Continued from page 115).

REPORT OF THE UNDERGROUND TEMPERATURE COMMITTEE.

Professor Everett said that during the past year a fresh series of observations has been received from the great well at La Chapelle, Paris, which is 660 metres deep in its present stage, and 1·35 metre in diameter in the smallest part. They show the temperature at the bottom to be 76 deg. F., whereas the former series made it 83½ deg. F. The difference arises from the fact that when the former series were taken, the boring tool had been at work up to within a week of the observations, whereas the last series were taken when the water had been left undisturbed for a year; and had, therefore, had time to lose the extra heat due to the percussion of the tool. At the depths of 100, 200, 300, 400, 500, and 600 metres, the temperatures, according to the new observations, are respectively—59·5, 61·8, 65·5, 69·0, 72·6, and 75·0; whereas the permanent temperature in the caves under the Paris Observatory, at a depth of 28 metres, is 53·1. A very valuable set of observations has been received from a mine 1,900 ft. deep, at Pzibram, in Bohemia. The temperatures at the depths of 68, 299, 621, 939, 1,290, 1,414, 1,652, and 1,900 feet are respectively—47·9, 48·8, 50·7, 57·8, 58·3, 59·4, 61·2, and 61·4 F. The rate of increase shown by these numbers is unprecedentedly small, being on the average only 1 deg. F. for 135 feet. Observations have also been received from two of the mines of the Société Cockerill, at Seraing, in Belgium. At the depths of 232, 310, and 505 metres, the temperatures are respectively 77, 78, and 87 F. The temperature of the ground at Brussels, which is about fifty miles distant, and about ten miles further North, is known to be 53·6 F., at a depth of from 12 to 24 feet. If we assume a temperature of 54 F. at the depth of five metres at Seraing, we have an increase of 33 deg. in 500 metres, which is at the rate of about 1 deg. in fifty feet. A few observations have come to hand from the Australian gold fields, but they are not sufficiently complete to justify any definite inference regarding the rate of increase. Three thermometers have been sent to the Smithsonian Institution, Washington, at the request of Professor Henry, and will be employed in the observation of temperature in some Artesian wells near Chicago.

THERMOMETRIC EXPERIMENTS.

Mr. G. J. Symons exhibited a series of fourteen very carefully made thermometers, all differing either in the size or shape of the bulbs, or in the material with which they were filled, some being filled with mercury and some with alcohol. They had been specially constructed with a view to testing the relative sensitiveness of different patterns and sizes. The results of the experiments had been printed in the *Quarterly Journal* of the Meteorological Society, and were as follows:—(1) That very large spherical mercurial bulbs are very little better than those filled with alcohol, but that with ordinary and small bulbs mercury is much more sensitive. The new minimum thermometers (the bifurcated and the double cylinders), introduced respectively by Mr. Casella and Mr. Hicks, were highly praised. Mr. Symons said that he brought them before the section mainly in order to offer the loan of the entire series to any experimentalist with more leisure than himself, and who would develop and complete the inquiry which he had begun.

DEEP SEA TEMPERATURES.

Mr. Negretti exhibited a very clever invention in connection with thermometers for ascertaining deep sea temperatures. An ordinary deep sea minimum thermometer will register the lowest temperature through which it passes, so that if a layer of water above the bottom of the ocean is colder than the water quite at the bottom the temperature of the deepest water cannot be ascertained. But by his invention, mechanical apparatus made the thermometer at any desired depth turn over, and discharge all the mercury above a certain level into another arm of the tube, whence the temperature at the instant of reversal could afterwards be observed.

Mr. Symons, the Chairman, and others agreed that it was a remarkably ingenious invention, and as far as they could see faultless.

SOLAR PHYSICS.

Colonel Strange, F.R.S., read a paper advocating solar observations at the Government expense, to ascertain whether the light and heat emitted by the sun are uniform, or so variable as to affect the seasons.

METEOROLOGY OF BANBRIDGE.

Mr. John Smyth, M.A., read a paper on "The Meteorology of Banbridge and the Rainfall of Ulster." This meteorological station is situated in the valley of the River Bann, twenty miles from its source, in lat. $54^{\circ} 23' N.$, long. $6^{\circ} 18' W.$, and 200 feet above sea level. The meteorological instruments are made by Negretti and Zambra, and are of the most approved construction. They have been tested by the standards at Greenwich. Meteorological observations were commenced in 1861, and since carried on without intermission. They are published quarterly by the Meteorological Society, and, through Mr. Glaisher, by the Registrar-General of Births, Deaths, and Marriages. Tables of the results of these observations and diagrams of the thermometer-stand and rain-gauge were exhibited, whence it appeared that the mean pressure of the atmosphere at Banbridge for ten years is 0.133 in. less than that of Greenwich for thirty-two years; that June has the highest mean monthly pressure and January the lowest. The year 1870 shows the highest mean annual pressure, and 1872 the lowest.

The mean temperature of the air is $48^{\circ} 0$ or $1^{\circ} 2$ below that of Greenwich. For fifteen years July has the highest mean monthly temperature, viz., $59^{\circ} 2$, or $2^{\circ} 5$ below Greenwich. January has the lowest— $38^{\circ} 4$, or $0^{\circ} 3$ higher than Greenwich. February is $2^{\circ} 0$ deg. higher at Banbridge than at Greenwich. The Winters are, therefore, warmer, and the Summers cooler, than at Greenwich.

The highest reading was 83° , on August 4th, 1868; the lowest, 1° , on January 3rd, 1867.

The prevailing wind has been from the South, and the least frequent from the East.

The mean rainfall for the ten years from 1862 to the end of 1871 has been 29·2 inches. October is the wettest, and June the driest month of the year. The year 1872 is the wettest recorded, the amount being 46·6; and 1864 the driest (25·1). The greatest fall in twenty-four hours was 2·3, October 12th, 1865. The mean evaporation is 15·6 in. At the Bann Reservoir, lat. 54° 15' N., long. 6° 2' W., height above sea 440 feet, the mean rainfall was 46 in. The wettest year was 1866 (54·6), the driest 1869 (28·9). The rainfall for the exceptional year 1872 was 61·2, and the greatest fall in twenty-four hours (3·3) on October 29th, 1865.

I ceased to observe Ozone in 1873, as I found when the same volume of air was examined by means of an aspirator the same amount was registered, except in a heavy fog. I was led to expect this from finding the intensity of the wind correspond with the intensity of Ozone.

THE VELOCITY OF THE WIND.

Mr. R. H. Scott F.R.S. read a paper showing how local causes, such as houses and hills, interfere with accurate registration of the force and direction of the wind, and how desirable it is to have observing stations on the tops of mountains, the expense being the impediment. Mr. Warren de la Rue had invented an anemometer, which would indicate results at a distant place by electricity, and this would save the expense of salaries of observers on the hill tops, if the apparatus itself could be preserved from damage by mischievous people.

REPORT OF THE COMMITTEE ON THE INFLUENCE OF FORESTS ON RAIN.

PROFESSOR CUNNINGHAM read, in the Botanical Section, a report from the Committee, on the Influence of Forests on Rainfall, which consisted of Professor Balfour (chairman), Dr. Cleghorn, Mr. Robert Hutchison, Mr. Alexander Buchan, and Mr. John Sadler. It appeared from the very elaborate report that the operations of the Committee during the past year had been restricted to making meteorological observations at Carnwath, Lanarkshire. In order to carry on these observations and extend them, a grant from the Association of not less than £25 would be required for next year. They did not propose to commence observations at any new station.

Mr. G. J. Symons said that he had attended that section in order to ascertain how far the Committee had acted up to the suggestion made last year that they should enlarge the scope of their enquiry (not of their observations) by extending it to other countries where clearances of vast extent had been made within living memory and by comparisons instituted, for instance, between the present and past discharge of some of the great American rivers. While acknowledging the pains Mr. Buchan had taken with the report, he felt bound to repeat what he said last year, that the way in which the subject was being treated by the Committee was, in his opinion, neither worthy of themselves nor of a matter of such high importance.

Prof. Balfour, F.R.S., was understood to support the views of the previous speaker.

The President (Dr. Hooker, Pres. R.S.) said that although they were much obliged by the report, it evidently did not properly come within the province of that section, and he recommended Professor Balfour to take it to the Physical Section, and there have it fully discussed.

ON THE APPARENT CONNECTION BETWEEN SUN-SPOTS AND ATMOSPHERIC OZONE, BY T. MOFFAT, M.D., F.G.S., ETC.

At the last meeting of the British Association, Mr. Smith, of Birmingham, gave me a record of the number of new groups of Sun-spots which had appeared in each year for a number of years, and he asked me to compare the mean daily quantity of ozone in each year with the number of groups. I have done so, and

in the following table I have given the mean daily quantity of ozone for nineteen years (1851-1869) with the number of groups.

Years.	Total number of new groups of spots which have appeared in each year.	Mean daily quantity of Ozone.	Total new groups arranged in order of number.	Corresponding mean daily quantity of Ozone.
1851	141	2.6	224	1.9
1852	125	1.9	211	2.1
1853	91	2.0	205	2.2
1854	67	3.4	204	1.9
1855	28	.8	202	1.5
1856	34	.7	166	2.6
1857	92	1.1	141	2.6
1858	202	1.5	130	2.0
1859	205	2.2	125	1.9
1860	211	2.1	124	3.5
1861	204	1.9	101	1.7
1862	166	2.6	98	1.1
1863	124	3.5	93	2.4
1864	130	2.0	91	2.0
1865	93	2.4	67	3.4
1866	45	1.7	45	1.7
1867	25	1.5	34	.7
1868	101	1.7	28	.8
1869	224	1.9	25	1.5
			Mean, 122	2.0

Mean, 2.2

Mean, 1.7

It would appear from these figures that the maximum of Sun-spots gives a maximum of Ozone, and that the minimum of Sun-spots gives the minimum of Ozone. The years 1854 and 1863 appear to be exceptional. In 1854, however, Ozone observations at Hawarden were suspended for three months, which may account for the irregularity in that year. There is, I think, in these results, sufficient to induce others to observe.

REPORT ON THE RAINFALL OF THE BRITISH ISLES FOR THE YEARS 1873-74.

By a Committee consisting of:—C. BROOKE, F.R.S., Chairman, J. GLAISHER, F.R.S., J. F. BATEMAN, C.E., F.R.S., T. HAWKSLEY, C.E., C. TOMLINSON, F.R.S., ROGERS FIELD, C.E., G. J. SYMONS, Secretary.

THE attention of your Committee during the past year has been mainly directed to completing work previously commenced, and to the carrying out of all measures likely to tend to still greater accuracy on the part of the observers.

Position Returns.—It will be in the recollection of the Members of the Association, that as a partial substitute for the expensive, although most important, practice of personal inspection of rain gauge stations by our Secretary, we issued in 1872 to every observer a blank form, on which he was to send full particulars respecting the position of his rain gauge. A specimen of this form is given in our 1871 report p. 99. Upwards of 800 were duly filled up by the observers, and returned to our Secretary, and they have all during the past year been examined and reduced to the compact form shown on page 259 of our last report. The number is, however, so great that they would occupy nearly 100 pages of the annual volume, even if further condensed, and the utmost economy of space exercised. Your

Committee, therefore, although fully impressed with the great value of the information which they have thus obtained, do not insert them in the present report, which is necessarily rather heavy from other causes, and reserve them for next year, when these causes will be absent.

Examination of Rain Gauges in situ.—Your committee have always regarded this as the most important branch of their work. Only those who have personally inspected large numbers of stations can realize fully the variety of details which it is the duty of an inspector to notice, and have rectified. It is worse than useless to collect masses of statistics, unless, at the same time, every effort is made to ascertain that the observations have been in *all* respects properly made. It is therefore with much pleasure that we are able to state that the number of stations visited by our Secretary in the preparation of our last report is 50, being, as will be seen by the following table, considerably above the average.

Number of stations inspected and rain gauges tested *in situ* :—

1862	51	1867	50	1872	24
1863	44	1868	40	1873	27
1864	20	1869	115	1874	50 (to August 12th).
1865	17	1870	39		
1866	60	1871	21		

The total number tested up to the present time is 558, and they are tolerably well scattered over Great Britain, as is shown by the accompanying map, whereon the locality of each station which has been visited by our Secretary is marked by a red disc. We can only once more express our regret that the limit of our grant prevents our providing that which the present system of rainfall observation imperatively requires, viz.: one permanent travelling inspector. The results of the inspections since December 4th, 1872, are given in the appendix to this paper. We are glad to state that a steady approach towards accuracy appears to prevail amongst observers, and also a firm conviction that if it is to be attended to at all it should receive very careful attention.

List of Stations.—In our last report we stated that we hoped “at an early date to present a revised edition of the list of stations published in the reports of this Association for 1865,” which, mainly in consequence of the work under the auspices of your Committee, had become obsolete, as it does not contain more than two-thirds of the data now collected. This work, though mentioned last year for the first time, has been in progress under the supervision of our Secretary for upwards of five years, and is now in a forward state, and will form a remarkably complete index of all rainfall observations ever made in this country, and a voluminous one too, for it will occupy 60 or 70 pages of the annual volume, instead of less than 50 pages, which was the case with the last one.

Gauges in the Eastern Lake District.—In the autumn of 1866 thirteen gauges were placed in the watersheds of Ullswater, Haweswater, Easedale Tarn, &c., by Mr. Symons. These were transferred to your Committee in 1869, and the observations continued at their expense. At their meeting in September 14th, 1873, the Secretary reported that seven years had elapsed since their erection, that several of them were out of order, and new observers were in charge of others, concerning which personal instruction was desirable. Thereupon he was directed to take such steps as he thought expedient for securing accurate observations, at a moderate cost. The following is an abstract of his report :—

“The returns from Wet Sleddale have at all times been sent with great irregularity, and for two years none have been received. As a new station had been organized at Shap, that at Wet Sleddale was abandoned. If, however, a good position and a good observer could be obtained in the Sleddale valley, it would be very advantageous.

“At Mardale Green the gauge was found to be in perfect order, but the measuring rod had been broken, and clumsily mended. A new one was supplied.

“At Measandbecks, Haweswater, the observer had been obliged to move the

gauge, and had placed it on ground sloping too precipitously. It was removed a few feet, so as to place it on a level plateau.

"The Matterdale Common and Gowbarrow gauges were not visited, as they were repaired some time previously, and the observer reports them to be in perfect order.

"Owing to the removal from, and subsequent death of, the observer at the Green-side Mines, in Patterdale, the series of observations instituted there, which embraced gauges at 500 ft., 1000 ft., 1500 ft., and 2000 ft., were stopped. Aware of the great importance of accurate observations from that locality, our Secretary visited it, and had the pleasure of finding that the manager of the mines had resumed observations at 1000 feet, the gauge (a very accurate one) being well placed.

"The gauges at Wythburn, Easedale Tarn, and Watendlath, were in perfect order, and the observations made by the observers originally appointed.

"The observer of the gauge at Birkside, Helvellyn, died a few years back, and the gauge had become out of order. The gauge was sent to Keswick for repair, and a new observer instructed in the duties.

"The gauges at Seathwaite were in good order, except the large float one, which was repaired at Keswick.

"A new observer had been appointed to Kirkstone Pass, who consequently had not received personal instruction; neither of his gauges were in perfect order, but both were put so, and the subsequent records are very satisfactory.

"The returns from Skiddaw, though carefully kept, have always been excessively small for the altitude (1677 feet) of the gauge. This is probably due to its very exposed position on the S.W. flank of the mountain. In accordance with a suggestion by the observer (who is on the mountain in all weathers) a second one has been placed on Skiddaw, the new site being at the head of Whitbeck."

Map of Stations in operation.—In consequence of the intimation conveyed to your committee last year, they have discontinued entirely the issue of rain gauges on loan, and have endeavoured to induce gentlemen to purchase gauges for themselves. With a view to determining the districts in which additional gauges are most needed, a map was prepared showing the site of every rain gauge known to be in operation. It was shown from it, that large as is now our field of operation, there are many districts in which all our efforts to obtain observers have been futile. This is especially the case in the West of Ireland.

Gauges along the Highland Railway.—Your Committee are happy to be able to report that the observations by the station agents of this company appear to be carefully and correctly made, but this is another matter which would be much improved if it were possible to provide a travelling inspector. At present the demands upon the time of our Secretary have been such that he has not been able to visit any of these stations, but he is still hoping shortly to do so. With a view of lessening as far as possible the heavy cost of travelling, your Committee purpose applying to the railway companies for a free pass for their Secretary when travelling for such an essentially national purpose.

Rainfall of the British Isles during the year 1872 and 1873.—The very exceptional character of the rainfall of 1872 was mentioned in our last report, but in accordance with a custom which has now prevailed for twelve years, it was only incidentally referred to, the details being deferred until the two years 1872 and 1873 could be published together. This course, which was originally adopted with a view to economy in printing, has in the present instance had the fortunate result of bringing together two very remarkable features of each, of which we must speak separately.

Rainfall of 1872.—Records of rainfall have been collected and discussed in our previous reports, which enable us to compare the total fall in any year from 1726 to the present time with the mean fall. One of these tables (that facing page 286 Brit. Ass. Report 1866) contains nine long registers, extending over 140 consecutive years, but the greatest excess even at a single station was only 58 per cent. (at Oxford in 1852). In 1872 this value was largely exceeded at a number of stations, as is shown by Tables I. and II., whence it appears that at 14 stations out of 115, or 12 per cent., it exceeded this previously unparalleled

value. At 13 the excess was greater than 60 per cent., and it reached or exceeded 70 per cent. at the following stations :—

Shropshire, Shifnal	-	Rainfall	77	per cent. above average 1860-69.
"	Shrewsbury	"	75	" "
"	Hengoed, Oswestry	"	70	" "
Northumberland, Bywell	-	"	77	" "
Haddingtonshire, East Linton	"	"	70	" "
Aberdeenshire, Braemar	-	"	78	" "

No similar falls have occurred since 1726, and there is no evidence of such a fall since rainfall observations were commenced, nearly two centuries ago. Full details respecting the monthly fall of rain in this very remarkable year are given in the Appendix to this report, and we think it may be regarded as fortunate that so remarkable a fall has occurred at a period when the system of observation is in a state unprecedentedly near perfection.

The Rainfall of 1873.—If this year had stood by itself it would merely have been classed as a rather dry year, and would have soon passed into oblivion. Coming, however, immediately after such an exceptionally wet year, it has produced the unusual result of giving two consecutive years, one with twice the rainfall of the other, and in many instances with much more than twice. How rare is this occurrence may be judged from the fact that there is no case in the 140 years' table just referred to. The nearest approaches are—Chatsworth, in 1788 19·86 inches, in 1789 36·31, the former being 55 per cent. of the latter. A still nearer approach occurred at Cobham, in Surrey, in 1851 and 1852, when the totals were 17·38 and 34·19 inches respectively, the former, being 51 per cent. of the latter. Nearly 60 cases are quoted in the report, every one of which is more remarkable than either of the above. The districts in which these exceptional ratios occur are (as might be expected) principally those in which the excess in 1872 was greatest, but there are also a few of which the explanation is not so obvious. It is very satisfactory to feel that these two exceptional years have found in the British Isles the most nearly perfect system of observation in the world.

Your Committee cannot close their report without expressing, as far as words can do so, the loss which they have sustained in the death of Professor Phillips, one of the original members appointed in 1865, who, notwithstanding the numerous demands upon his time, was always as willing as he was able to assist the Committee in any of the various difficulties which the extent of their operations inevitably involve.

REPORT OF OBSERVATIONS OF LUMINOUS METEORS DURING THE YEAR 1873-4.

The paper was the work of a Committee of the following gentlemen :—James Glaisher, F.R.S., of the Royal Observatory, Greenwich; R. P. Greg, F.G.S., F.R.A.S.; C. Brooke, F.R.S.; Professor George Forbes, F.R.S.E.; and Professor A. S. Herschel, F.R.A.S.

Mr. Glaisher proceeded to read the paper, which was an exhaustive report on the subject. Referring to the appearance of luminous meteors during the year 1873-4, the report states that the months in which such phenomena were most abundant were September, December, and January; in April and June, and again in the last few days of July and beginning of August. Professor Galle's calculations regarding the real cause and probable path of two large meteors which passed over Austria on the 12th and 19th of June last are adverted to, and it is remarked that if a mass of burning sulphur, found on the ground after the disappearance of the later meteor, is not considered meteoric, no occurrence of a fall of aerolites is known to have taken place during the past year. The annual star showers have been carefully watched during the time named; and, while little important information has been added, the cometary meteor showers of Nov. 14th and 27th, connected with Tempel and Biela's comets, were most remarkable by their non-appearance. After reviewing the principal events which transpired

in connection with the subject under consideration during the past year, the Committee conclude as follows :—Following the method of Dr. Weiss, viz., to calculate the radiant points of those comets of early and recent times whose orbits are believed to pass near the earth, a list of such comets for both the Northern and Southern hemispheres is annexed to Mr. Greg's catalogue, and the cases where they corroborate each other are pointed out. Many important and well-known comets are found to have meteor showers as their present representatives, as would perhaps be still more apparent if more reliable orbits of comets could be used ; but the coincidences are, however, numerous enough, and sufficiently exact to make desirable the further cultivation of cometary astronomy, by the help of star-shower observations.

Mr. Glaisher, F.R.S., having concluded the reading of the report, supplemented it by a few remarks, in which he referred to the assiduous researches of Professor Herschel and the other gentlemen of the Committee.

Professor Herschel followed, and referred at some length to the observations made on meteoric displays by Captain Tupman in the Mediterranean ; he also exhibited the charts drawn by that gentleman, referring to them as a most valuable contribution to the cause of science.

CANNONS AND TEMPESTS.

Mr. R. B. Belcher read a paper, in which he attempted to prove by a long list of coincidences that great battles were usually followed by thunderstorms.

The President (Professor Everett) considered the subject, which was not a new one, well worthy of consideration. In several parts of America the farmers, in order to produce rain, would gather a large quantity of wood and burn it at their respective farms on the same day. He believed that while great battles and fires tended to produce rain, it did not necessarily follow.

Mr. Brooke, Dr. Carpenter, and Mr. Symons, while agreeing that the subject was worth attention, did not believe that rain would necessarily follow from cannonading or large fires.

ON THE CAUSE OF THE PROGRESSIVE MOTIONS OF CYCLONES, AND OF THE SEASONAL VARIATIONS IN THEIR PATHS.

In his paper on the above subject, Dr. Ashe pointed out the importance of arriving at a knowledge of the probable path of cyclones over the ocean, and of the variations which had been found to occur in their paths at different seasons. To trace their paths we must first arrive at a knowledge of the causes of their onward progress. The author resolved these causes into two classes ; those which were inherent in the cyclone itself, and those which depended on the trade-wind, or other general current, within which the cyclone might originate. The resultant of the paths due to these two causes would give the actual path along the surface of the ocean. Now, cyclones were found to move directly to polewards when they were near the tropics, where they were free at once from the influence of the trade-winds and that of the counter-trades, and the author therefore considered that this was the direction of path belonging to the cyclone itself, which he accounted for by supposing that the eastern half of the cyclone had an excess of motor force over the western, in consequence of the air which it drew in from equatorwards adding to the speed of the wind's motion, since it moved eastward faster than the centre, while air from polewards retarded the motion of the western half of the cyclone, since it moved more slowly to eastward than the centre. When the motion of the trade-wind to N.W. in the Southern hemisphere, and to S.W. in the Northern, was added to the proper poleward motion of the cyclone, we arrived at the very path which observation had shown these cyclones to follow. Similarly, the motion of the counter-trades to N.E. in the Northern, and S.E. in the Southern hemisphere gave, when combined with the

poleward motion of the cyclone itself, the exact path observed to be followed outside the tropics. The difference in the force of the trade-wind at different seasons of the year would thus be seen to be the cause of the variations observed in the path of cyclones, and the results so arrived at by this theory were in strict accordance with the facts so observed. Hence the author hoped that a step might be considered gained by this theory towards a knowledge of the probable path of any given cyclone which a mariner might find himself involved in at sea.

ON CYCLONE AND RAINFALL PERIODICITIES IN CONNECTION WITH THE SUNSPOT PERIODICITY.

In the absence of Mr. Charles Meldrum, the author of the above paper, it was read by Mr. J. W. L. Glaisher. The paper commenced by stating that the catalogue of cyclones experienced in the Indian Ocean, from 1847 to 1873, submitted last year, indicated that during that period the number of cyclones in the space between the Equator and 34° S. lat. and the Meridians of 40° E. and 110° E. was much greater in the years of maximum than in the years of minimum sunspot frequency. The author shows that not only the number of cyclones, but their duration, extent, and energy were also much greater in the former than in the latter years, and that there is a strong probability that cyclone fluctuation is consistent with a similar fluctuation of the rainfall over the globe generally.

ON CERTAIN PROTRACTED INEQUALITIES OF ATMOSPHERIC PRESSURE IN THE INDIAN MONSOON REGION, AND THEIR RELATION TO VARIATIONS OF THE LOCAL RAINFALL.

Mr. Henry F. Blandford, F.G.S., in reading his paper on the above subject, drew attention to a fact disclosed by a discussion of the barometric registers for the last seven years, viz., that the abnormal peculiarities of relative pressure distribution, which may appear in any season, tend to last for many months, and in some cases throughout several alternations of the monsoons, throughout variations of pressure even when these are such as accompany monsoons, neighbouring regions are found to maintain a nearly constant difference of pressure which only decays very gradually. In noticing the rainfall, he said that the heaviest was found to be in advance of the centre of the cyclone. A satisfactory determination of their relations cannot be obtained until the pressures in different Indian districts are better known.

MEASURING DEEP WELLS.

To the Editor of the Meteorological Magazine.

SIR,—In your notice of Mr. Lucas' book on "Horizontal Wells," you quote from him his difficulty in measuring deep wells. Having had considerable experience in this matter, the way in which I solved the difficulty may be of use to others. I found that a tape of 100 feet in length frequently was out of order, besides which its length was not sufficient for the deep wells in the chalk. I returned to the use of the ordinary 66 feet tape, and made up the deficiency with fine silk twist. That I first adopted had been used as a fishing line, and was, therefore, properly stretched. I have since that procured a reel of silk (machine twist, No. 32), from Messrs. Pearsalls, in Cheapside, and, after having stretched it both wet and dry, find that it answers its purpose ad-

mirably. Then as for its use. The object is to measure the entire depth of the well, and also to the surface of the water. I have a small float of light wood, 4 or 6 inches square, with a hole pierced in the middle—a red hot poker does this admirably; a pierced leaden bullet, say an ounce weight, such as is used to sink casting nets, is attached to the line, which is passed through the hole in the float. When the float rests on the surface of the water, a little play should be given to the line, which, when raised, the striking of the bullet on the under side of the float, if carefully manipulated, will be easily felt. This will show on the line the depth to the water, even if the well be 300 feet deep. Then to find the depth of the water, and the total depth of the well, the line should be allowed to run till the weight, striking the bottom, is felt, as it will be if the line be passed over the forefinger. When the line is drawn up, the difference on the line when it strikes the bottom of the well and the under side of the float will be, of course, *the depth of water* in the well, and the whole line run out will, in the same way, be *the total depth of the well*. Then as to the preparation of the line, so as to fit it for any depth. We have 66 feet in the tape; take two lengths of the silk twist, 50 feet long, and as many more in 100 feet as wanted. Attach a small ring to one end, and a small swivel with a hook—such as used in fishing tackle—to the other end of each length. In use, the 50 feet length will be at the bottom, and its end will be attached to the bullet. If the well is over 66 feet deep, it will require the hook on the upper end of the 50 feet length of twist to be hooked to the ring of the tape, and so on with the other lengths, till the water, or the bottom of the well, is reached. If the line is properly stretched, and the lengths correct, the deepest wells, after a little practice, may be measured by an apparatus easily carried in the pocket.—Yours faithfully,

J. C. CLUTTERBUCK.

Long Wittenham, Sept. 26th, 1874.

A COVERING OF SNOW AS PROTECTION AGAINST FROST.

“Ebermayer gives, in his recent work on the influence of forests, a table of observations showing the temperature of the earth covered by snow during the very cold weather of December, 1871, in Bavaria. The fact has been generally known that snow is the best possible protection against the penetration of frost into the earth, and that it is the natural protection of seeds, young plants, and other vegetation against frost. It is, however, satisfactory to be able to refer to the exact observations made on this subject by Ebermayer, and as an indication of the extent to which snow does protect the earth, it may be stated, for instance, that on the 8th and 12th of December, the temperature of the air at Vienna fell to minus 26°·8 Fahrenheit, while the temperature of the earth beneath the snow was no lower than plus 33°·8, and four feet below it was 42°·8. So long as the snow lies, the variations of temperature under the earth's surface are very slight.”
—*Public Opinion.*

SEPTEMBER, 1874.

Div.	STATIONS. <small>[The Roman numerals denote the division of the Annual Tables to which each station belongs.]</small>	RAINFALL.					Days on which 40 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.			Deg.	Date.	Deg.	Date.		
												inches.	inches.	in.
I.	Camden Town	2.62	+	.36	.99	30	18	78.2	25	43.3	19	0	0
II.	Maidstone (Linton Park)	3.02	+	.80	.57	30	15	80.0	26	35.0	18	0	...
III.	Selborne (The Wakes)	2.76	+	.32	.73	3	14	72.5	25	38.0	14	0	...
IV.	Hitchin	3.01	+	1.15	.91	3	14	68.0	1,25	41.0	9,17	0	...
V.	Banbury	3.21	+	.84	.72	3	17	72.0	26	40.5	13	0	...
VI.	Bury St. Edmunds (Culford).	3.14	+	1.53	1.36	3	14	76.0	1	38.0	13§	0	0
VII.	Bridport	...	...	...	...	...	...	...	...	...	...	...	...
VIII.	Barnstaple	5.93	+	2.17	.99	3	21	79.0	28	44.0	13	0	...
IX.	Bodmin	7.08	+	3.41	1.18	3	24	72.0	25	46.0	10	0	0
X.	Cirencester	5.45	+	2.59	.65	30	17	...	...	...	...	...	...
XI.	Shifnal (Haughton Hall)	2.88	+	.93	.68	30	20	69.0	25	42.0	14	0	...
XII.	Tenbury (Orleton)	3.67	+	.99	.55	36	17	75.3	25	40.3	14	0	0
XIII.	Leicester (Wigston)	2.79	+	.58	.90	16	18	...	...	...	...	...	...
XIV.	Boston	2.43	+	.86	.79	16	10	74.0	1,27	45.0	10	0	...
XV.	Grimsby (Killingholme)	1.91	...	...	.55	30	14	72.0	1	42.0	14	0	...
XVI.	Derby	2.74	+	.40	.45	15	18	71.0	25|||	41.0	14	0	...
XVII.	Manchester	3.86	+	.17	.50	8,30	21	76.0	27	41.2	14||	0	0
XVIII.	York	2.85	+	.52	.63	8	15	71.0	27	41.0	9	0	...
XIX.	Skipton (Arncliffe)	7.19	+	2.23	1.59	11	24	70.0	27	32.0	13	0	...
XX.	North Shields	1.76	+	.06	.47	11	12	67.0	1	41.0	14	0	...
XXI.	Borrowdale (Seathwaite)	16.06	+	2.85	1.80	15	23	...	...	...	...	...	...
XXII.	Cardiff (Ely)	6.05	+	2.30	.88	9	17	...	...	...	...	...	...
XXIII.	Haverfordwest	4.47	+	.76	.80	8	14	69.0	26	35.0	13	0	...
XXIV.	Rhayader (Cefnfaes)	4.65	+	.81	1.00	9	19	71.0	...	37.0	...	0	...
XXV.	Llandudno	2.53	+	.19	.67	30	17	74.3	27	45.0	14	0	...
XXVI.	Dumfries	3.30	+	.57	.83	21	25	64.5	1,2	36.0	14	0	...
XXVII.	Hawick (Silverbut Hall)	3.33	...	...	.65	21	19	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill)	5.41	...	...	1.05	10	24	64.0	1,21	38.6	17	0	...
XXIX.	Castle Toward	6.91	+	2.29	1.00	22	25	63.5	9	...	...	...	...
XXX.	Leven (Nookton)	2.48	+	0.00	.55	21	17	66.0	1,3*	34.0	17	0	4
XXXI.	Stirling (Deanston)	...	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Logierait	3.80	...	...	.63	21	16	...	...	...	...	...	...
XXXIII.	Braemar	3.34	+	.70	.48	21	23	60.3	15	32.3	6	0	1
XXXIV.	Aberdeen	2.14	...	...	.54	21	17	66.2	1	36.3	17	0	2
XXXV.	Loch Broom	4.28	...	...	.69	3	26	...	...	...	...	...	...
XXXVI.	Portree	13.74	+	2.98	2.49	14	30	...	...	...	...	...	...
XXXVII.	Inverness (Culloden)	2.73	+	.04	.74	12	25	68.4	1	39.0	13	0	0
XXXVIII.	Helmsdale	4.63	...	...	1.02	2	19	...	...	...	...	...	...
XXXIX.	Sandwick	4.86	+	1.20	.91	28	26	61.0	2	39.0	7	0	0
XL.	Caherciveen Darrynane Abbey	5.19	...	...	.78	28	21	...	...	...	...	...	...
XLI.	Cork	3.36	...	...	.75	20	20	...	...	...	...	...	...
XLII.	Waterford	3.37	+	.24	.66	28	19	67.0	26	42.0	10¶	0	...
XLIII.	Killaloe	5.15	+	.99	.79	28	19	70.0	25+	...	...	...	...
XLIV.	Portarlinton	3.51	+	.23	.57	29	27	68.0	25	38.5	29	0	...
XLV.	Monkstown, Dublin	1.59	—	.40	.53	21	10	...	...	...	...	...	...
XLVI.	Galway	4.00	...	...	1.06	23	16	76.0	8	33.0	11**	0	...
XLVII.	Ballyshannon	4.77	...	...	.63	9	21	...	...	...	...	...	...
XLVIII.	Waringstown	2.92	...	...	.70	29	17	68.0	1,††	34.0	30	0	1
XLIX.	Edenfell (Omagh)	4.33	...	...	.71	21	21	61.0	15‡	35.0	7	0	...

* And 4. † 27 & 28. ‡ 16, 24, & 25. § 18. || 15. ¶ 30. ** 26.

||| And 27. †† 28 & 29.

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

METEOROLOGICAL NOTES ON SEPTEMBER.

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.

LINTON.—First twelve days mostly dull and showery, afterwards dry till 28th, the 25th, 26th, and 27th being very warm, dry, and sunny, equalling those in July. Brisk winds on 22nd and 29th; T on 23rd, 28th, and 30th, with heavy rain on the last-named day. On the whole a fine growing month, but, except the few days alluded to, not a bright or sunny one.

SELBORNE.—Tempestuous weather on 1st, T at 3 a.m.; L on 9th at 10 p.m., and at 10.50 p.m. on 28th; fogs on 16th, 17th, 24th, 25th, 27th, 28th, and 29th. A fine harvest month, hops very few in this neighbourhood. Prevailing winds S.W.

CULFORD.—A month of genial growing weather, westerly winds prevailing during 25 days. The maximum temperature of the month (76°) was on the 1st, and the mean temperature $57^{\circ}.3$. T on 9th and on the night of the 30th. On the 3rd 1.36 in. of rain fell.

BODMIN.—Average bar. of month 29.92 ; average temperature $59^{\circ}.7$. Rainfall more than 3 inches in excess of the average of the last 25 years.

ORLETON.—Much rain fell on the first eleven days and on the last three, the remainder of the month was fine and pleasant, and very warm from the 22nd to the 28th. The mean temperature of the month was above the average; a favourable month for closing the harvest. Distant T was heard on the 2nd and 10th. Violent wind on the 22nd.

GRIMSBY.—T, L, and R at 1.30 on the 2nd, with strong squall; T at 3 p.m. on 10th; T at 12.45 p.m. on 24th. A warm dry month. The potato crop splendid and more free from disease than for many years past. A welcome rain on the night of the 30th.

NORTH SHIELDS.—TS on the 2nd.

SEATHWAITE.—Six days on which the fall of R exceeded an inch, on five of those days it exceeded or nearly reached $1\frac{1}{2}$ in. TS on 2nd, 9th, and 21st. Total fall during the month, 16 inches.

WALES.

LLANDUDNO.—Weather very variable, but the latter half of the month very fine. T on 2nd.

SCOTLAND.

DUMFRIES.—Only five days without rain, but it was heavy only on six days, and as it was generally followed by strong drying winds, the harvest was less impeded than was expected; by the third week the crops were generally secured in good condition. The month closed with much R and TS. T on 2nd, 3rd, 21st, and 29th. Mean temperature more than 3° above the average.

HAWICK.—A wet and slow harvest month; sharp frost on the 13th. Potatoes are looking pretty sound and free from disease; turnips looking well.

CASTLE TOWARD.—A wet disagreeable month, only 5 days without R, and but little sun; prevailing winds W. and S.W.; heavy gales occasionally from the W.; T on 1st, 2nd, and 9th. Corn crops in this quarter are later than in other districts; a good quantity standing to cut, and little or nothing has been put in stack-yard, and to all appearance no hopes of the weather improving, as the rain still continues; shocks in fields are getting green. Cattle of all kinds healthy, and pastures abundant.

NOOKTON.—L at 9 p.m. on 2nd.

BRAEMAR.—A genial month, but very unsettled. TS on 1st, meteor seen on 9th.

ABERDEEN.—Lochnagar white with snow on 5th. The month has been slightly above the average in temperature, with a deficiency in the rainfall. A low barometer, and strong wind.

LOCH BROOM.—Too wet a month for harvest operations ; precisely the same number of wet days as in the last month, which contributed very much to retard and injure the cereals, but may have, in a measure, prevented the spread of the potato disease, which at one time was very threatening.

PORTREE.—The wettest September on record, except 1863, when the fall was 13·76. The crops are in a very sad state, much of the corn is still uncut, and the stalks are quite bleached, the straw quite destroyed ; the hay crop is also unsecured, and much of it is rotting on the ground ; the potatoes are also suffering from the wet, but not from disease. Cattle and sheep healthy.

SANDWICK.—September has been much wetter than the average of the last 33 years, indeed its rainfall has never been exceeded in any September during that time, except in 1847. T and L on 1st and 29th ; aurora on 10th. Eleven swans were seen returning on the 28th. Grain crops are nearly all cut.

IRELAND.

DARRYNANE.—Very changeable showery month, prevailing wind N. W. ; H on 9th ; T on 22nd. Potatoes being lifted fast in this neighbourhood, and generally a very good crop, very little blight ; rest of harvest very backward.

WATERFORD.—21st, great storm during the night and early morning ; thick fog on 25th and 26th.

BALLYSHANNON.—The month has been marked by frequent falls of heavy R, and very high winds. This has seriously retarded the completion of the grain and hay harvest in this neighbourhood. Strong gale from N. E. on 9th.

WARINGSTOWN.—A fine, seasonable month. Harvest operations all satisfactorily finished in this neighbourhood.

EDENFELL, OMAGH.—With the exception of a few fine intervals of short duration, the weather of the month has been wet, inclement, and very unfavourable for harvesting grain, a fine crop of which yielded to the sickle, but is still out in stack, and in some danger.

SUPPLEMENTARY TABLE OF MONTHLY RAINFALL, SEPTEMBER, 1874.

Div.	County.	Station.	Total Fall.
II.	Kent	Margate (Acol)	2·85
„	Sussex	Hailsham	4·30
„	Hampshire	Strathfield Turgiss	3·32
III.	Oxford	Oxford (Magdalen College)	3·16
„	Cambridge	Cambridge (Merton Villa).....	2·81
IV.	Essex	Harlow (Sheering Rectory)	2·23
„	Norfolk	Swaffham.....	2·77
V.	Devon	Teignmouth (Brookbank)	5·06
„	„	Torrington (Langtree)	6·03
„	Somerset	Taunton (The Castle).....	5·87
VII.	Lincoln	Horncastle (Bucknall)	1·87
VIII.	Lancashire	Liverpool (Walton-on-the-Hill) ..	2·42
IX.	York	Wakefield (Stanley Vicarage)	1·76
X.	Durham.....	Gainford	2·82
„	Westmoreland	Shap	6·56
XVII.	Banff	Keith	2·79
XVIII.	West Ross.....	Strathconan	4·71
XX.	Cork	Fermoy (Glenville)	4·37
XXI.	Westmeath.....	Athlone (Twyford) ..	4·52
XXII.	Galway.....	Ballinasloe	—

FINE METEOR.

To the Editor of the Meteorological Magazine.

SIR,—A remarkable appearance was seen by me at 8.50 last evening. There seemed to be a beautiful flash of sheet lightning, but which I expect was the light from a meteor, as immediately afterwards there was a bright light, like a comet with two tails, near the Pole Star, which I thought was the comet which we have heard was to be seen. This continued two or three minutes, and the tail seemed to draw up to the disc, and at last disappeared. I hope it was observed by others, and that we shall hear more about it.

Yours very truly,

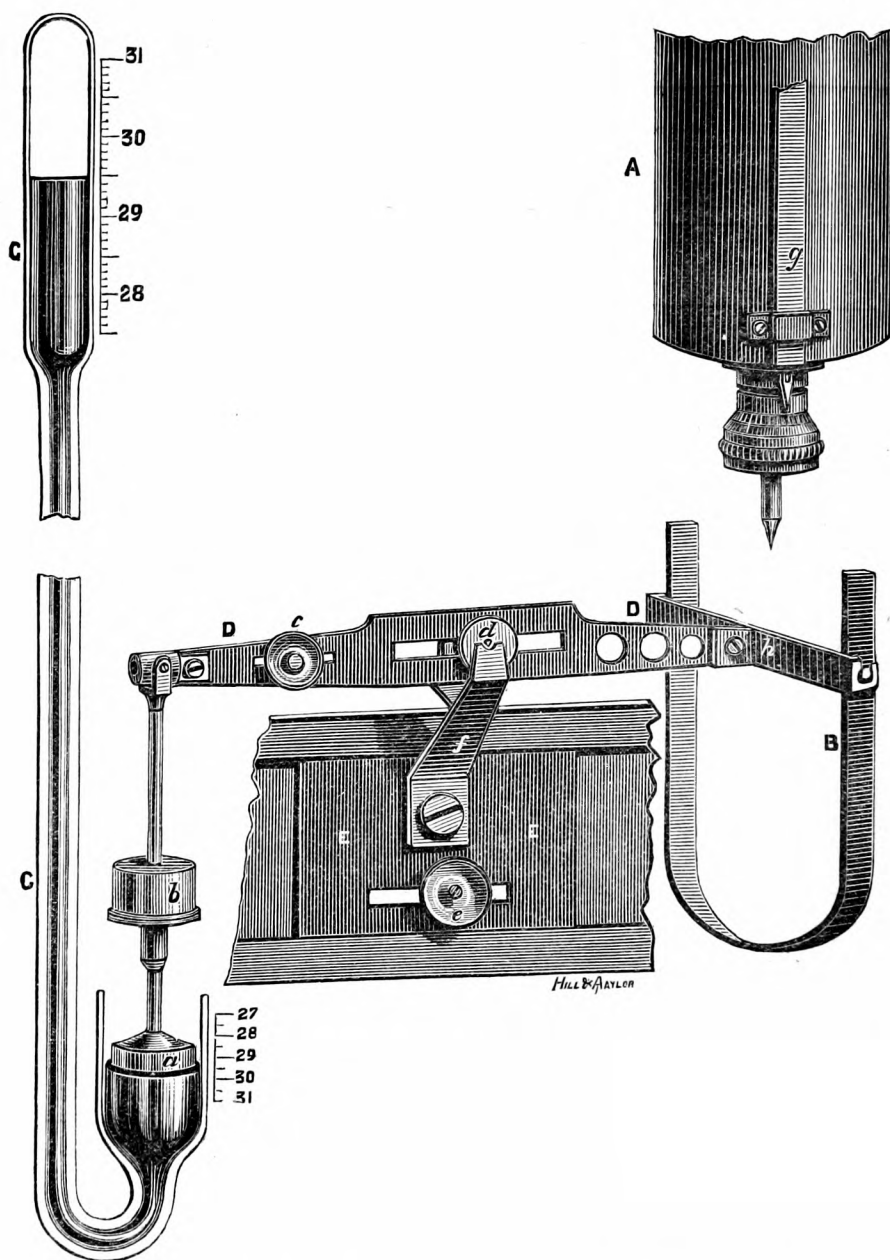
J. NUTTER.

Cambridge, Oct. 12th, 1874.

[The above was undoubtedly a fine meteor; our assistant saw it from Camden Square, and reported as follows: "At 8.50 p.m. on the 11th, a single bright flash of light from N.E., apparently at a considerable altitude. I was going south-westward, and immediately turned to see its origin, but the sky was nearly overcast, and I saw nothing more." We were at Brighton, and walking westward with Mr. Sawyer, F.M.S., when both saw the light, and we instantly exclaimed, "Oh, what a fine meteor!" It was too cloudy to see anything, except that the light came from between E. and N., and that the time by our pocket "E. J. Dent" was 8h. 51m. 0s.—ED.]

NEW METEOROLOGICAL STATIONS.

We understand that the Meteorological Society are taking steps to organize a small number of observing stations of the second order, at which all the arrangements are to be as nearly identical as possible; where no instrument is to be employed until its correction has been determined and recorded at the Society's office; where the observations are to be made daily with the strictest punctuality at 9 a.m. and 9 p.m., local time; and where, in short, every care will be taken to secure observations of the best quality obtainable, without exceptional demands upon either the time or the purses of the observers. We believe that the Society have already received several offers of assistance, and we are sure that any others promptly submitted to the assistant secretary would be carefully considered by those who have charge of the organization.



NEW METHOD OF CORRECTING FOR BAROMETRIC ERROR.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CVI.]

NOVEMBER, 1874.

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

THE BAROMETRIC ERROR IN CLOCKS.

WE hold so strongly the necessity of Meteorologists possessing accurate timekeepers, that we willingly travel occasionally slightly beyond our special province, when by so doing it appears likely that we can in any way tend to further that object.

Our present subject is one which, in its detection and removal, is a proof of the extreme degree of accuracy to which clocks of the highest class have been brought.

It will not need a moment's reflection for all our readers to observe that a pendulum vibrating in a vacuum will have less resistance to overcome than one vibrating in the atmosphere, with a barometric pressure of thirty inches. Admitting this, it would still be doubtful whether the slight variations on each side of the mean atmospheric pressure (say $28\frac{1}{2}$ to $30\frac{1}{2}$ inches) would be sufficient perceptibly to affect the rate of a good clock, with a pendulum whose sectional area is perhaps 27 inches, and whose weight is 24 lbs. It has for some years been known in an indefinite and inaccurate manner, that there was a sensible error due to this cause, and a (very troublesome) mode of correcting it was suggested. Recently, however, matters have advanced rapidly.

In August, 1871, Messrs. E. Dent and Co. erected in the Magnetic basement (that position being selected on account of its equable temperature) of the Royal Observatory, a new Standard Sidereal Clock, which the Astronomer Royal described * as "an excellent specimen of horology." Owing, we suppose, to the smallness of all other errors, the Astronomer Royal shortly turned his attention to the possibility of correcting the barometric error. Thereafter several papers were read upon the subject at the Royal Astronomical Society, the general result being to show that with first class astronomical clocks, the error was about $0^{\circ}22$ per diem for each inch of the barometric pressure.

* Report to Board of Visitors, June 1, 1872.

We now proceed to describe the arrangement contrived by Sir George Airy, and applied to the above clock by Messrs. E. Dent and Co.

Evidently the desideratum is to make the ratio constant between the gravity of the pendulum and that of the resisting medium. The annexed engraving shows how this has been done: A is the lower part of the pendulum bob; *g* is one of a pair of bar magnets whose poles are opposed to those of the horse-shoe magnet B, over which they oscillate; CC is a large syphon barometer, carrying on its shorter leg the float *a*; the magnet B is counterpoised by the weight *b*; the beam DD, resting on a knife edge at *d*, and supported by the two bearers *f*, carries at one end the float, and at the other (by cross bar *h*) the magnet B; the weight at C, the plate EE, and the screw *e*, are merely for securing accurate adjustment.

The arrangement is so simple that it is almost needless to point out that as the barometer rises (*i.e.*, the density of the air increases) the mercury falls in the shorter leg, the float *a* follows it, and therefore the magnet B is brought nearer the bar magnets at *g*, and hence the increased magnetic action, due to this proximity, has the effect of increasing the weight of the pendulum, while it does not increase its area. Of course, with a falling barometer, the result is the reverse.

It would almost appear presumptuous for us to criticize work carried out by Messrs. E. Dent and Co., under the supervision of Sir George Airy. and indeed it appears to us that there is room only for praise. There are, however, two questions which have occurred to us, and which we cannot answer, and which to the best of our knowledge have neither been put nor answered. (1.) When visiting a Magnetic Observatory some years since, we were asked to empty our pockets of knife, keys, &c. for fear of affecting the magnetic indications, and we recollect hearing that when this very clock was being erected, only one screw-driver at a time was admitted into the regions sacred to the Magnetometers. What is to be said respecting the introduction of three magnets into these regions? (2.) Is it not the case that so-called permanent magnets lose their strength by age? and, if so, would it not have been well to have rendered the barometer tube movable, so that it might from year to year be slightly lowered to compensate for this loss of strength? But perhaps sufficient adjustment in this respect might be obtained by shifting the pins which carry the magnet.

As, however, the Astronomer Royal reports, * "The arrangement for correction of the barometric inequality, to which I alluded last year, has been applied to the Sidereal Standard Clock, with satisfactory results," there can, we should think, be little doubt that it is now the most nearly perfect clock yet made.

* Report to Board of Visitors, June 6, 1874.

SUPPLEMENTARY TABLE OF MONTHLY RAINFALL,
OCTOBER, 1874.

Div.	County.	Station.	Total Fall.
			in.
II.	Kent	Margate (Acol)	2·75
"	Sussex	Hailsham	3·75
"	Hampshire	Strathfield Turgiss	3·93
III.	Oxford	Oxford (Magdalen College)	3·14
"	Cambridge	Cambridge (Merton Villa).....	1·80
IV.	Essex	Harlow (Sheering Rectory)	4·01
"	Norfolk	Swaffham	1·84
V.	Devon	Teignmouth (Brookbank)	6·34
"	"	Torrington (Langtree)	5·61
"	Somerset	Taunton (The Castle).....	—
VII.	Lincoln	Horncastle (Bucknall)	1·52
VIII.	Lancashire	Liverpool (Walton-on-the-Hill) ...	4·50
IX.	York	Wakefield (Stanley Vicarage)	1·66
X.	Durham	Gainford	2·37
"	Westmoreland	Shap	14·82
XVII.	Banff	Keith	3·03
XVIII.	West Ross.....	Strathconan	9·01
XX.	Cork	Fermoy (Glenville).....	5·26
XXI.	Westmeath	Athlone (Twyford)	5·03
XXII.	Galway	Ballinasloe	—

From the above, as well as from the regular table on page 157, the exceptional rainfall of the western coast, and especially in the vicinity of mountain masses, is evident. The fall at Seathwaite (30·18 in.) has only been equalled in the following months :—

1848, February... ..30·55	1862, October.....32·13
1852, December .....32·83	1872, January .....32·14
1861, November .....35·41	

The large monthly total is due to frequent heavy rains, but is largely increased by the fall of the 5th-6th (5th 5·14, 6th 2·75 in.), of which we append notes from other stations, and of the 20th, which was very heavy in Wensleydale, and when also Seathwaite had 4·31 in.

EXTRAORDINARY RAINFALL IN THE LAKE DISTRICT.

To the Editor of the Meteorological Magazine.

SIR,—I take the liberty of sending this to say that I registered 1·90 of rain this morning—the largest quantity that has fallen in the same time for the last three years according to my gauge. During that time it has only on two previous occasions exceeded 1 inch.

Yours truly, SAMUEL KING.

Elswick Lodge, Gt. Eccleston, Garstang, Oct, 7, 1874.

SIR,—You will, no doubt, receive reports from other quarters of an extraordinary rainfall which has been experienced in this district. I registered as follows :—

Monday, October 5th... ..	0·76 in.
Tuesday, 6th (11 p.m.)	3·33 in. }
" (9 a.m. following morning)	0·18 in. } = 3·51 in.

The River Kent rose to a height considerably above any flood ever remembered, and great damage has been done to property.

Yours truly,

G. F. BRAITHWAITE, JNR.

Kendal, 10th Oct. 1874.

To the Editor of the Meteorological Magazine.

SIR,—On Tuesday last, in the $21\frac{1}{2}$ hours commencing at 1 o'clock, a.m., and ending at 10.30 p.m., wind S.W., we had rain as below :—

1 o'clock a.m. to 10 a.m.	... ..	790
10 a.m. to 6 p.m.	... ..	1700
6 p.m. to 10.30 p.m.	... ..	1650

Total in $21\frac{1}{2}$ hours ... 4140

The rain produced the heaviest flood in living memory, being, by well authenticated marks, about 14 or 15 inches higher than the flood in Feb. 1831.

I believe this is the heaviest continuous fall of rain that has been registered here. I am endeavouring to have the papers of the late Mr. Marshall examined to verify this point, and will let you know the result.—Yours sincerely,

JOHN J. WILSON.

Underfell, Kendal, Oct. 15th, 1874.

To the Editor of the Meteorological Magazine.

SIR,—From the 15th February up to end of June we had hardly any rain here. In two days (end of June) we had $2\frac{1}{2}$ in. ; then a fine July, with some very severe rain ; August and September wet. But I write to tell you of the most remarkable rainfall I have ever known. In four days (1st—4th) we had heavy rain, with hours of glorious weather ; the total fall was 1.17 in. The 5th was a glorious day up to about 9 p.m. On the 6th, at 9 a.m., we measured 1.64 ; at 5 p.m. on the 6th I measured myself 2.20,—it never ceased raining for one minute ; at 9 a.m. on the 7th, 1.27 more was measured, making 6.28 in. for 6 days, as follows :—

1st, 9 a.m., to 5th, 9 a.m.	... ..	1.17 in.
6th, 9 a.m.	... ..	1.64 „
7th, 9 a.m.	... ..	3.47 „

Total 6.28 „

Total fall in 36 hours, 5.11 inches.

The Lake rose 3 feet in all—a trifle over 2 feet in 36 hours. It kept rising till 1 p.m. on 7th, and then began to fall ; at 5.30 p.m. it had gone down $\frac{1}{2}$ in. ; at 10 o'clock this morning, 9 in. ; and own at 5 p.m., 13 inches.

The height of flood on the Lake was 9 inches higher than has been known for 20 years.

On the morning of the 6th, about 3 a.m., we had rain in such torrents (I cannot prove it) that I think nearly an inch must have fallen in less than an hour, and this I find was purely local.

Yours very truly,

H. W. SCHNEIDER.

Belsfield, Windermere, 8th October, 1874.

REVIEWS.

Report of the Meteorological Committee of the Royal Society, for the year ending 31st December, 1873. 8vo., 66 pages. Spottiswoode.

WE are glad to find in this report a promise of a paper on Atlantic weather in August, 1873, by Captain Toynbee, analogous to his excellent one on the "City of Boston" storm.

Another satisfactory feature is the strong way in which the Committee urge the necessity of establishing communication with the North-West Coast of Ireland. In demanding the extension of the Postal Telegraph system in that direction, the Committee might rely on any support which could be needed, and we believe that they have only to speak out strongly in the proper quarter in order to obtain that which is a *necessity*.

With reference to the system of synchronous observations suggested by Brigadier-General Myer, we think that a mistake has been made. The Committee state that they have received more than sixty promises of returns in response to invitations issued by them—whence it is obvious that they sent out *more* than sixty invitations. The original American idea was, we believe, to publish a map of the Northern Hemisphere for each day, plotting upon it the observations collected. Surely this daily map would not be more than 3 ft. by 2 ft., and if not, the area of the British Isles would be about one inch square. The impossibility of plotting sixty sets of observations on a single square inch is sufficiently evident. Unless, therefore, there is some farther object in view than we are aware of, we think that the records of the self-recording instruments at the Committee's own observatories would have afforded all that is necessary.

We object most strongly to unnecessary Sunday work, but we hold with equal steadfastness the desirability of continuing on that day any work that tends to the preservation of human life. Storm-warnings have this object, and achieve this end, or else they are a farce; they are not a farce, and therefore the work should not be interrupted on Sundays or holidays. Moreover, the time occupied would be very trivial, for it appears from page 13, that not only the receipt and discussion of all the telegrams, but also the preparation of the Daily Weather Report is completed by 11 a.m. daily; hence the reception and discussion alone would be completed still earlier. If the difficulty lies with the Postal authorities, the Committee should show their readiness to do their part, and leave the onus of shipwrecks and disasters at the door of the real obstructives.

It is satisfactory to see at last some prospect of obtaining accurate records of the temperature of the sea around our coasts, and we hope that the steps taken will be followed up at every Lightship around the British Isles.

We may, in conclusion, call attention to a good *précis* of the proceedings of the Vienna Congress.

*Report on Weather Telegraphy and Storm Warnings, presented * * * at Vienna.* [Published by authority of the Met. Com.] 8vo. 60 pages. Stanford.

SINGULARLY enough after penning the remarks on the necessity for Sunday telegrams in the previous review, we find in this the next work which we have to notice, the following recommendation:—

“In order to make the system of warnings as perfect as possible, according to the present state of the Science, the Sub-Committee must indicate that it is desirable that the observations and reports based thereon should be made as complete and continuous (as regards the former) as is possible, *i.e.*, neither Sundays nor holidays should make a difference to them, and there should not be a complete interruption during the night.”

This is the recommendation of no less authorities than MM. Buys Ballot, Neumayer, and Scott; and is given after considering the opinions printed at length in the work under notice. The authors of these opinions were—

F. Allison.....	Halifax, Nova Scotia.	Prof. Mohn	Christiania.
H. F. Blandford	Calcutta.	Dr. A. v. Oettingen.....	Dorpat.
C. Chambers, F.R.S. ...	Bombay.	Prof. Prestel.....	Emden.
G. B. Donati	Florence.	Rev. F. Redford	Silloth.
F. Da Silveira	Lisbon.	Capt. Rikatcheff	St. Petersburg
F. Gaster	London.	Prof. R. Rubenson	Stockholm.
German Commission, presided over by		W. W. Rundell	Liverpool.
Prof. Dove	Berlin.	Dr. Schenzl	Pesth.
Capt. Hoffmeyer	Denmark.	Scottish Meteorl. Soc ..	Edinburgh.
G. T. Kingston	Toronto.	R. Strachan	London.
Prof. J. K. Laughton ...	Greenwich.	G. J. Symons	London.
Maj.-Gen. Lefroy, F.R.S.	Bermuda.	Capt. H. Toynbee	London.
C. Meldrum	Mauritius.	G. V. Vernon	Manchester.
Meteorological Society..	London.	Prof. Wild	St. Petersburg

With such a series of data to work upon, and such a sub-committee as that we have named, it is not remarkable that this report is of very great value. We agree with almost every sentiment and statement in it, and as it costs only a few pence, refer our readers to it with the assurance that it will well repay careful perusal.

Annuaire Météorologique et Agricole de l'Observatoire de Montsouris pour l'an 1874. By M. MARIE-DAVY, Director. 16mo. xxxvi.—272 pages. Paris, Gauthier-Villars.

THE introduction to this *Annuaire* explains so clearly the aims and

duties of the Montsouris Observatory, that a few extracts will be interesting as well as useful :—

“The study of the atmosphere and its variations, and of the soil and of its waters, considered both in relation to pure science, and in their bearings on health, and agriculture, this the field in which the observatory of Montsouris will labour.”

“The regular observations are printed in extenso, in the *Bulletin Mensuel*, which by agreement with the publisher (M. Gauthier-Villars) is sold to the public at a reduced price.”

“The *Annuaire* on the other hand should give an abstract of this work, and show plainly their practical results—by its form as well as by the documents which it will contain, it should yearly render useful services to agriculture.”

“The harvests which contribute so much to public wealth are subject to all caprices of the weather. The *Annuaire* will contain in its early tables, abstracts of meteorological observations as far back as they have been regularly recorded, and they will also give the daily details for the previous year. These various tables will enable farmers to compare existing weather with that of previous years, both for the guidance of his operations, and to enable him to estimate his future crops. On this last point, however, the means of comparison are still incomplete. In order to follow accurately the influence of atmospheric changes on the ripening of the crops, it is necessary to submit the plants to analysis, at regular intervals from germination to harvest. This is one of the enquiries which can only be undertaken by a special establishment provided with a staff of trained observers, and it is one which we have already commenced.”

“The farmer demands that we tell him that his soil contains such and such fertilizers, his harvest will take away so much of this and so much of that ; therefore in order to maintain at its maximum the fertility of his fields, he must give to them exactly what they require, but no excess ; he must employ such a quantity of such manure, containing such constituents ; thus the greatest possible result would be obtained by the simplest arithmetical operations. This is the issue towards which the labours of chemists and physicists are tending, but the problem is still unsolved.”

After epitomizing some of the results already obtained, and referring briefly to some of those given in the *Annuaire*, the introduction thus closes :—

“Eminent chemists have devoted themselves to the study of the problems of agricultural science. The Observatory of Montsouris is the only French establishment having a staff appointed for the regular observation of the facts calculated to solve these problems, and it is fully aware of the services which it may render to the country in the path which has been chosen for it.”

The work itself is one which well repays perusal ; indeed, but for limit of space and time, we should be glad to place translations of several chapters before our readers ; as it is, we must content ourselves with noting their contents, and recommending to this pleasantly written volume, those interested in French meteorology and agriculture. Chapter I. gives an epitome of the history and results of thermometric observations at Paris, from 1666 to 1872, and occupies 41 pages. Chapter II., treating of the barometer, is much shorter. The third chapter gives a history of rainfall observations at Paris Observatory, from 1682 to 1872, and not only a history, but also the monthly totals throughout this long period, excepting only when the observations were occasion-

ally interrupted. The mean amounts on the top of the observatory, about 70 ft. above the ground, have been :—

1689 to 1717 (no records for 1697-8)	= 19·76 in.
1748 to 1754	= 19·84 „
1773 to 1788	= 21·01 „
1788 to 1797	= 18·70 „
1804 to 1818 (new gauge)	= 19·76 „
1819 to 1848	= 20·12 „
1849 to 1872	= 20·50 „

Chapter IV. is devoted to magnetic observations, and is, we presume, added for the sake of completeness, for it can hardly be looked upon as connected with agriculture, but no one could object to the few pages it contains, when five of them give the declination for nearly three hundred years, from 1550 to 1873.

This is followed by a series of instructions for observers, by a summary of the Montsouris observations, by a series of numerical tables useful for farmers, and the work closes with two excellent papers, one on the action of water on vegetation, and the other on that of atmospheric air on agriculture.

We have little doubt that copies could be obtained through any of the foreign booksellers for half-a-crown, and we are sure that no meteorologist or farmer would regret investing that amount in a work which does credit to Montsouris Observatory and its able director.

On Mirage. By Prof. J. D. EVERETT, M.A., D.C.L., &c. [From the Proceedings of the Belfast Natural History Society, 1872.] 8vo., 16 pages, 3 plates.

A CAPITAL paper, explaining with precision the physical conditions which are necessary to produce mirage, and the optical principles to which the varied appearances are due—nay more, explaining how a careful manipulator can produce a mirage for the instruction and gratification of himself and his friends. The apparatus required consists of (1) a glass vessel, with plane parallel sides; (2) a pipette; (3) a strong solution of alum; (4) pure water; (5) Scotch whisky, mixed with enough sugar to make its specific gravity intermediate between those of the other two liquids. The last named liquid must be introduced last by means of the pipette. Prof. Everett thus describes the effect of looking through this arrangement when placed in a window :—

“Every object in the landscape was tripled, the middle image being inverted, and the three images seen at once; and the vertical breadth of the strip of landscape thus tripled at one view, extended from the top of the hills down to the houses on the Lisburn road. When the sun was shining on the front of the row of houses represented, which was nearly half a mile distant, I was able to see distinctly the chimneys and windows, and even to see whether the blinds were up, down, or half-way down. It was easy to fancy that the inverted trees and houses were the reflections of the upper ones in water. But a much more striking effect, as of water, was at the junction of the middle and lower image. This had all the

appearance of a calm bay or lake glistening in the sunshine. There are only two natural objects to which this peculiar glistening belong, with brightness far surpassing that of all the dry and solid parts of a landscape. One of these is water, and the other is the sky. A bit of sky has in fact been trapped between two portions of land; and it is a similar trapping of sky in the midst of dry land, that produces the irresistible impression of a lake of water in the mind of the traveller in the desert."

FINE METEOR ON OCTOBER 11TH.

We are glad to be able to supplement the notes in our last with several other accounts; and we are very glad to find that, with the exception of the Culford Parish Clock, a very fair approach to accuracy in the time is manifested. The times are—

Cambridge	Mr. Nutter	8.50
Camden Square		8.50
Brighton	Mr. G. J. Symons	8.51
March	Mr. Green	8.50
Cambridge	Mr. Talbot	8.52
Keswick	Mr. Chamberlin	9.0 (about)
Beccles		8.55
Culford	Mr. Grieve	9.0
Rainhill, Lancashire	Mr. Higgins	8.55
Wisbeach	Mr. Balding	8.50

CULFORD.—An exceedingly luminous meteor was seen here on the night of the 11th, at the time the Parish Church clock was striking 9. It flashed from N.E. to S.W., and for an instant rendered the dark night as light as day, and left a brilliant trace upon that portion of the sky it appeared to pass over, nearly as bright as the nucleus itself, both gradually disappearing with a tremulous motion, which was visible for at least two minutes; the sky was quite clear, with many stars shining.

SIR,—Perhaps the following description of the wonderful meteor of Sunday night will not prove uninteresting to those of your readers who were not fortunate enough to see it:—At about 8 minutes to 9 o'clock on Sunday night, there appeared suddenly an intensely bright light, something like an enormous flash of lightning and of a bluish-white colour. It lasted for about three seconds, and was of such a brilliancy as to dazzle and almost blind one for the moment, and rendered all the surrounding country as light as at noonday. I have been told that it was accompanied by a slight explosion, followed by a hissing noise, but for my own part, I heard neither the one nor the other. This light seemed to concentrate into a fiery meteor which shot up (or seemed to do so) from near the earth to about the zenith of the sky at the edge of the Milky Way; here it became stationary, and immediately afterwards two streaks of light were thrown out from the nucleus from opposite sides, and formed a straight line, stretching across the Milky Way, and making an angle of about 15 degrees with it. Each streak of light was of about the same length, and had somewhat the appearance of that made by an ordinary meteor in its passage through the air, except that it was broader, brighter, and lasted a considerable time. Meanwhile the meteor itself appeared to be in a state of rapid combustion, and it seemed as if either flames, or smoke, or both, were given off from it, and hung suspended towards the earth, wreathing and twisting about like smoke blown about by the wind. After exhibiting this extraordinary appearance for about 40 seconds, it gradually grew fainter and fainter, or rather it seemed to burn itself out, and the streaks of light

entirely disappeared, but the burning centre might have been easily distinguished from the nebulae for the space of three minutes afterwards. It was a wonderful, startling, and magnificent spectacle, and such a one as I have never before seen. I should be glad if any of your readers can supply any information about it.

I am, Sir, yours truly,
Cambridge, October 16th, 1874.

PERCY W. TALBOT.

Mr. G. M. CHAMBERLIN, of Eaton, vouches for the following phenomenon:—While walking to Keswick, going down the Harford Hill, about nine o'clock on Sunday evening, I heard a slight sharp report in the air. Immediately, and only for a few seconds, the whole heaven was lit up in a most brilliant manner with a peculiar sort of yellow light, and on looking up overhead I saw a huge streak of fire in the sky, similar in appearance to the tail of an enormous comet; this lasted for about a minute, and then slowly faded away. One gentleman writes from Beccles—About 8.55 p.m. what appeared a most vivid flash of lightning illuminated the entire neighbourhood. Hearing, however, some one near exclaim, "Well, I never saw anything like that before," he was induced at once to look upwards, when to his surprise he discovered a line of light in the heavens, just as though a splendid rocket had exploded, and taking out his watch he found that what the Germans would term "fire-mist" remained in view exactly three and a-half minutes before it disappeared. He further states that he made enquiries of several persons whom he met, as to whether they had seen the brilliant light, that they answered in the affirmative, and he then directed their attention to the singular appearance recorded above.

"BRIGHT METEORS.—At 8.55 this evening (October 11th) a party of six observed a meteor in the constellation Aries, or below it, which emitted light sufficient to cast a bright gleam on the neighbouring trees. The body of the meteor shot rapidly along a course extending about 20°. It then seemed to explode suddenly, and its track was luminous for a short time. The granular *débris* of the meteor continued to pursue with very much retarded velocity a path slightly deflected from its former course: it continued to do so for several degrees, and it was, I think, fully a minute after the explosion that several of us almost simultaneously exclaimed, "It is falling." It resembled the expiring light of one globe of a rocket charged with golden rain. The falling motion was very slow. I think it was visible for two minutes after the explosion, but though we tried to consult more than once our watches, the light was insufficient.—HENRY H. HIGGINS."—*Nature*.

"AN exceedingly brilliant meteor was seen here about 8.50 (Wisbech, Oct. 11th) on Sunday evening, which was so bright that it attracted general attention, the light from it being as strong as an unusually bright flash of lightning, but more white. On looking up I saw, near the zenith, a long almost straight and uninterrupted ribbon of light, somewhat pointed at the end towards the north-east. After watching it for some time and noticing that it retained its brilliancy, I began slowly counting, and counted up to twenty before there was any noticeable diminution of luminosity. The last portion visible was the end opposite the pointed end, which appeared as a faintly luminous patch as large as the apparent disc of the moon. I consider that, from its appearance, it was visible from 80 to 100 seconds.—A. BALDING."—*Nature*.

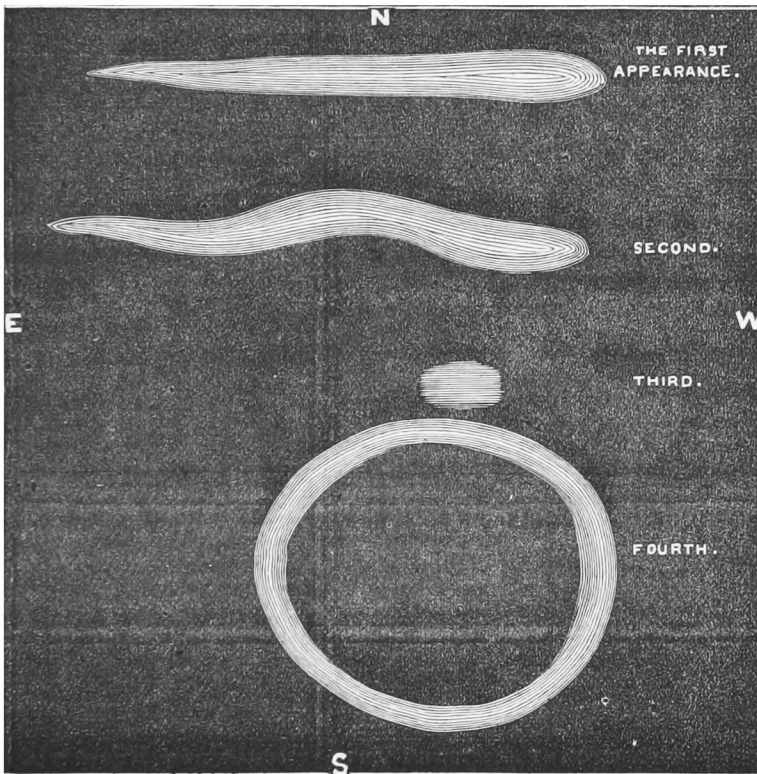
SIR,—While proceeding in a westerly direction at 8.50 on the night of the 11th October, I was surprised by seeing a vivid blueish white light. On looking up to see the cause of this strange phenomenon, I saw, near the zenith (but inclining to the N.E.), the remains of what must have been a beautiful meteor, which consisted of a very bright straight line of light. It was faint and pointed at the N.E., but

brighter at the opposite end. After a few seconds the tail became bent as though blown by the wind. It then began to disappear, beginning at the pointed end, and continued to do so till the head only was left, which was then a square luminous cloud, or patch of smoke. It then opened in the centre, and enlarged into a ring of light, which, when it had attained a considerable size, disappeared. I heard no noise, and most people thought that it was a very bright flash of lightning.

Very truly yours,

JAS. GREEN.

March, November 2nd, 1874.



RAINFALL AND YIELD OF WELLS.

To the Editor of the Meteorological Magazine.

SIR,—In the August number of the *Meteorological Magazine*, you inserted a letter of mine remarking on an article on “The Water Supply of the N.W. of Europe,” and I then spoke of October as the ruling month with reference to the transmission of rainfall by percolation to the chalk water level. The late month, taken in connexion with September, verifies that assertion. I tried to show that the amount of rain falling, and the conditions under which it fell, in the Autumn and Winter of 1873-4, easily accounted for the lack of subterranean water up to July last. It was shewn that the January and February rainfall of 1874 gave nearly the whole stock of water to be given out during the rest of the year, until augmented by the Autumn rainfall. In September, 2·775 was registered from the 4th to 12th inclusive—on the latter day the water in the well under observation rose 2 inches, shewing that the rainfall had reached the water level—32 ft. 6 in. from the surface of the ground. From the 25th September to the 10th of October, the water maintained its level. From the 1st to the 11th of October, 1·960 was registered. On the 11th the water again rose gradually, the total rise up to the present date, Oct. 31st, being 7 in. from its lowest point about Sept. 6th.

The prospect of water supply this year, 1874-5, as compared with 1873-4, is better. The water level was rather lower at this period last year, the Autumn rains not having been sufficient so to saturate the soil as to enable the rainfall to reach the water level, though the total rainfall up to the present time is 2·761 less than in 1873; but to set against this, the rainfall of September and October exceed that of 1873 by 2·140. Thus, by the amount of wet concentrated as it has been, the earth is in a better condition to transmit the November rainfall to the water level in 1874, than it was at the same period in 1873, and it is quite possible that the stock of water for the coming year may far exceed the usual average, though at the close of the year the total yearly rainfall may be considerably below the average. It is the conditions under which the rain falls that rule the subterranean supply.

I am, yours faithfully,

J. C. CLUTTERBUCK.

Long Wittenham, Oct. 31st, 1874.

OCTOBER, 1874.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which .01 or more fall.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.								
				Dpth	Date.		Max.		Min.			
		inches	inches.	in.			Deg.	Date.	Deg.	Date.	In shade	On grass
I.	Camden Town	3.34	+ .75	.59	29	18	68.1	1	34.8	6	0	0
II.	Maidstone (Linton Park)	3.59	+ .49	1.14	30	16	70.0	1,12	31.0	5,23	4	...
III.	Selborne (The Wakes)	6.28	+ 2.07	1.08	1	22	63.0	1,15	33.5	6	0	1
III.	Hitchen	2.59	+ .04	.72	1	19	61.0	1,13	34.0	5,22	0	...
IV.	Banbury	3.13	+ .70	.91	29	21	63.0	1	33.0	6	0	...
V.	Bury St. Edmunds (Culford).	2.08	— .63	.38	7	15	66.0	13	30.0	23	2	5
V.	Bridport	...	...	...	...	...	...	...	...	...	0	...
"	Barnstaple	4.44	+ .32	.95	6	25	64.0	1*	41.5	29	...	...
"	Bodmin	5.69	+ .37	1.26	6	25	61.0	10	42.0	20	0	0
VI.	Cirencester	3.81	+ .32	1.02	6	22	...	...	...	...	...	...
"	Shifnal (Haughton Hall)	1.65	— .59	.42	6	22	62.0	15	34.0	6,123	0	3
"	Tenbury (Orleton)	2.11	— 1.12	.44	6	20	62.7	11+	32.0	20	1	2
VII.	Leicester (Wigston)	...	...	...	...	...	...	...	...	...	0	...
"	Boston	1.72	— .40	.38	6	17	65.0	15	35.0	24	0	...
"	Grimsby (Killingholme)	1.92	...	.50	6	18	63.0	15+	35.0	24	0	...
"	Derby	1.90	— .94	.45	6	23	63.0	15	37.0	17§	0	0
VIII.	Manchester	3.76	— .05	.60	6	22	67.5	15	37.0	20	0	0
IX.	York	2.17	— .35	.35	6	18	63.0	15	34.0	23	0	...
X.	Skipton (Arnccliffe)	8.47	+ 1.81	1.47	20	28	64.0	14	30.0	4	2	...
X.	North Shields	1.66	— 1.62	.35	29	16	61.8	25	34.5	23	0	0
XI.	Borrowdale (Seathwaite)	30.18	+ 13.86	5.14	5	26	...	...	...	...	...	...
XI.	Cardiff (Ely)	...	...	...	...	...	...	...	...	...	...	...
"	Haverfordwest	6.16	+ .97	1.36	6	19	61.0	12	33.0	7	0	1
"	Rhayader (Cefnfaes)	4.79	— .81	1.00	6,27	12	61.0	...	36.0	...	0	...
"	Llandudno	3.42	— .54	.81	6	21	66.4	15	43.8	17	0	...
XII.	Dumfries	5.13	+ .21	.75	18	24	62.5	15	33.5	26	0	0
"	Hawick (Silverbut Hall)	4.83	...	.92	6	19	...	...	...	...	...	...
XIV.	Kilmarnock (Annanhill)	6.18	...	.85	12	21	59.9	16	32.0	31	1	4
XV.	Castle Toward	9.47	+ 3.72	1.12	13	23	59.0	1	...	...	0	...
XVI.	Leven (Nookton)	3.32	— .43	.94	12	13	61.0	15	27.0	31	5	21
"	Stirling (Deanston)	...	...	...	...	...	...	...	...	...	...	...
"	Logierait	4.02	...	.81	12	21	...	...	...	...	...	...
XVII.	Braemar	5.72	+ 2.97	.91	12	23	56.3	11	23.2	31	9	18
"	Aberdeen	2.29	...	.58	12	18	59.3	7	28.9	31	3	13
XVIII.	Loch Broom	11.04	...	2.54	3	27	...	...	...	...	...	...
"	Portree	15.69	+ 4.91	2.18	20	28	...	...	...	...	...	...
"	Inverness (Culloden)	2.88	+ .22	.87	5	20	60.5	15	31.7	30	1	10
XIX.	Helmsdale	4.94	...	1.18	21	22	...	...	...	...	...	...
"	Sandwick	4.10	— .82	1.15	20	22	55.0	17	39.0	5	0	0
XX.	Caherciveen Darrynane Abbey	6.44	...	1.35	14	20	...	...	...	...	...	...
"	Cork	3.26	...	.60	7	22	...	...	...	...	...	...
"	Waterford	6.32	+ 1.92	1.09	28	23	60.0	13**	36.0	28	0	...
"	Killaloe	...	...	...	...	...	...	...	...	...	...	...
XXI.	Portarlinton	3.26	— 1.87	.56	7	26	59.0	18	32.0	7	1	...
"	Monkstown, Dublin	2.75	— 1.17	.58	28	19	...	...	...	...	...	...
XXII.	Galway	6.73	...	1.03	12	22	60.0	3,18	33.0	4	0	...
"	Ballyshannon	5.08	...	.57	14	24	...	...	...	...	...	...
XXIII.	Waringstown	3.66	...	.51	14	19	61.0	18+	30.0	8	2	7
"	Edenfels (Omagh)	3.82	...	.65	12	20	56.0	18	28.0	7	4	...

* And 12 & 19. + 25. † 19. § 23. ** 17

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

METEOROLOGICAL NOTES ON OCTOBER.

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 Hall; S for Snow.

ENGLAND.

LINTON PARK.—Very high wind on 21st; also on 2nd, 7th, and 25th. Slight frosts on 5th, 6th, 23rd, and 24th, but not severe enough to injure dahlias or other tender plants. T and L on 15th and 30th, with very heavy rain (1·14 in.) on the latter occasion. A mild growing month, with some fine dry weather in the middle of it; the 28th being unusually bright, warm and sunny.

SELBORNE.—Very wet month, (6·28 in.) 2·23 in. above the average of October for the last 12 years. Violent wind and heavy rain on 7th; wind veered from S. to N.W. Fog on 12th, 14th, and 16th; that on 14th very dense. Vivid L at 5.30 p.m. on 15th. Prevailing winds, S.W. till the last week, then E. and N.E.

CULFORD.—Swallows last seen on 6th. Gale of wind on 21st. Max. temp. 66° on 13th; min. 30° on 23rd; mean of month 51°·2. Easterly winds prevailed during 9 days, and westerly on 22 days.

HAUGHTON HALL, SHIFNAL.—The remarkable features of this month have been—first, the total absence of frosts, except on the grass on three nights, 2nd, 20th, and 23rd; the warmth of many of the nights was unusual, especially at the close of the month, the last six averaging 49°·0; while that of the day averaged only 54°. Second, the small amount of R (1·65 in.), compared with the number of days on which it fell, viz., 22, on 6 of which only ·01 in. fell. Dahlias, mignonette, and other tender plants remained unscathed to the end. The wind, with few exceptions, from W. and S.W., changing from thence on the 29th to N.E. and E., with R. A severe storm on the 20th and 21st; dense fog on 26th. Potatoes a good crop, and almost free from disease. Great display of gossamer on the 16th.

ORLETON.—Upon the whole the weather was warm and pleasant, with many bright days, and frequent slight falls of R till the 24th, when it became very cloudy, dark and damp, with misty R every day, and no sunlight for eight days; mean temp. was about 2°·5 above the average of the month; no L seen or T heard. Aurora visible at 7 p.m. on the 4th. Violent gale on 21st, which did much damage to trees and to roofs of buildings. Only two frosty mornings during the month.

BOSTON.—A great many wet days, but the total fall 0·58 in. below the average. The want of R is now seriously affecting the rivers; there being no water coming down to scour out the deposit brought up by the tides; the bed of the river has been raised more than 11 ft. above its natural bed by this deposit, and neap tides often do not reach the quays. On the 26th there was a very high tide, the water rising 16·54 ft. above ordnance datum, or 3·25 ft. above high spring tides.

GRIMSBY, KILLINGHOLME.—Many pleasant days; ponds still dry; end of the month dull and cloudy, with E. winds and no frost. High wind on 6th; T at 2.30 p.m. on 7th; lunar corona on 18th; stormy on 20th, and on 21st with heavy squall at 10 a.m.; force about 9 Beaufort scale. High tide in the Humber on 26th.

ARNCLIFFE.—Wild night on 20th; Bar. fell ·75 in. during the night. Dahlias uninjured by frost at the end of the month.

NORTH SHIELDS.—Stormy on 21st.

SEATHWAITE.—Ten days on which the fall of R was 1 in. or more, six on which it exceeded 2 in., three exceeding 3 in., and one on which the fall in 24 hours exceeded 5·00 in.; the total fall during the month was upwards of 30 in.

WALES.

HAVERFORDWEST.—A mild wet month. Very heavy gales on 2nd, 3rd, 20th, and 21st; no frost; grass lands looking remarkably well. Much sickness among children.

CEFNFAES.—Month damp, with haze on the hills; warm for the season.

LLANDUDNO.—Weather variable, about half of the month fine, the remainder wet and stormy; a very heavy gale on the morning of the 21st; the lime trees devested of their leaves by the 22nd.

SCOTLAND.

DUMFRIES.—This month has been a very wet one, only seven days without R, but the temp. has been very mild; the mean having been $48^{\circ}\cdot9$ or $4^{\circ}\cdot4$ above the corresponding month of last year. On the morning of the 21st the most violent gale experienced for many years; many trees were blown down, and other damage was done, but no injury to life in this neighbourhood. The last two days of the month very fine and spring-like.

SILVERBUT HALL, HAWICK.—A mild month, but violent gales on the 20th and 21st, which tore up by their roots many fine old trees, and made sad havoc with the slates and chimney cans. Though there were frosts on the nights of the 12th and 21st, many of the beauties of the flower garden are blooming as if it were midsummer; I gathered a dish of fine green peas yesterday, and expect to gather another to-morrow.

ANNANHILL.—Prevailing wind S.W. and W.; usually moderate; strong W.S.W. gale on 2nd. Great storm on 20th and 21st, from W.S.W. and W.N.W.; very destructive both on land and on the coast; calculated to have reached a velocity of 78 miles per hour during the height of the gale; rainfall again in excess. Rather frosty towards the end of the month.

CASTLE TOWARD.—A wet disagreeable month, but few dry days, and even when dry but little sunshine. On the 20th we were visited by a dreadful hurricane, commencing about 10 o'clock p.m. and continuing till 6 a.m. on the 21st; it blew in a succession of squalls, the wind at first being nearly due S., but from 4 a.m. it veered about in a most extraordinary way, doing great damage, uprooting trees without number, many snapped across the centre; corn stacks were blown over, roofs blown off, fences blown down, and very great damage done.

NOOKTON.—Storm of wind on night of 20th, and lasting till noon of the following day.

BRAEMAR.—Weather very changeable, but crops well secured; potato disease rather prevalent. S on 13th; hurricane on the morning of 21st, and S in the afternoon. Falling stars on 11th and 13th.

ABERDEEN.—A month of average temperature, with low and very unsettled bar., and frequent very heavy gales; weather rather dry. Bar. pressure and rainfall below the average; temp. very slightly above it. Terrible gale from 3 a.m. to 5 p.m. on 21st. Auroræ on 8 nights; fog on 3 days.

LOCHBROOM.—The 3rd and 4th were the stormiest days ever seen here; from the evening of the 2nd to the morning of the 4th we measured 4'00 in. of R, an unprecedented fact here. On the 21st it blew a perfect hurricane, which caused fearful loss of life and property on the west coast. This (11'04 in.) is the largest fall of R recorded by me, except in the month of February, 1868, when it was 12'72 in.

PORTREE.—The wettest (15'69 in.) and the stormiest October since 1862. Gale from S. on the 8th, and a solar halo; hurricane from midnight of 20th to 9 a.m. on 21st; height of gale from 4.30 to 6.30 a.m. on 21st (and almost equal to the storm on the 3rd October, 1860); many of the corn stooks blown into the sea. Corn not all cut here yet, and most of that which is cut is still out and greatly damaged. The hay crop nearly all lost, having rotted on the fields with the wet. Cattle and sheep doing well on the pastures. Five days on which the R exceeded an inch.

CULLODEN.—Aurora on 4th, 5th and 6th. Bar. at 7 p.m. on the 2nd, 28'33 in. corrected, the lowest this year since January 18th, when it was 28'31 in. Wind S.S.W. veering to W., S.W. & W. Another great depression of the bar. on 21st, min. at 6 a.m., 28'273 in. A heavy storm felt throughout the whole of Scotland, and also in England and Ireland was at this time causing great destruction to trees, houses and other property. Wind S.S.W. to S.W. on night of 20th, veering to W. and W.N.W. and N.W. by the morning of 21st.

SANDWICK.—October is generally our wettest month, but this year its rainfall is less than that of August and September, and less than the average. The storm of the 21st was one of our strongest, breaking out suddenly from the N. at 8 a.m. at the rate of 68 miles an hour, and blowing very strongly for two days; the bar. gave good warning of its approach, falling from 29·32 at 9 p.m. on 20th to 28·50 at 8 a.m. on 21st, and it had probably been lower at an earlier hour. Aurora on 8 nights; pocky clouds seen at Kirkwall at 3 p.m. on the 3rd; aurora coruscating to the zenith and S. sky on the 4th.

IRELAND.

DARRYNANE.—Early part of month changeable, with N. and N.W. winds; the last week fine and bright, with N.E. and E. wind.

MONKSTOWN.—Month unusually mild; frost on one night only; very severe gale on night of 20th.

BALLYSHANNON.—The first part of the month was wet and stormy, and unfavourable for the completion of the harvest; but the latter part has been fine, with easterly winds and slight frosts at night. Gale from W. on 1st, 2nd and 3rd.

EDENFELL, OMAGH.—Weather persistently rainy and damp up to the 20th, causing great difficulty in securing the grain, already kept too long out by a wet September. Fine from 20th to the end of the month.

THE METEOROLOGICAL SOCIETY.

At the Ordinary Meeting of the Society, to be held by kind permission of the Council of the Institution of Civil Engineers, at 25, Great George Street, Westminster, on Wednesday, the 19th instant, at 7 p.m., the following papers will be read and discussed:—

“Report concerning the Meeting of the Conference on Maritime Meteorology in Loudon, August 31st, 1874.” By the PRESIDENT.

“On the Weather of Thirteen Springs.” By R. STRACHAN, F.M.S.

“Table for facilitating the determination of the Dew Point from observations of the Dry and Wet Bulb Thermometers.” By WILLIAM MARRIOTT.

“On the Heat and Damp which accompany Cyclones.” By the Hon. RALPH ABERCROMBY.

The attendance of the Fellows and their Friends is invited.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CVII.]

DECEMBER, 1874.

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THE OBSERVATORY OF MONTSOURIS.

ALTHOUGH we may not all be able fully to follow the details of Meteorological progress in France, there are some features which are indisputable. Of these the utility of the Montsouris Observatory, and of the work carried on there by M. Marié-Davy, is probably the most certain. Respecting this work we desire to say a few words, and we can hardly introduce it better than by translating some paragraphs from the introduction to the volume of the *Bulletin** for 1874.

“Everybody knows that heat, light, and moisture are indispensable to the most fertile fields, but if we ask in what proportion, no answer can be given even as regards the most ordinary crops of every country. Also, when we try to compare the yield of the harvests in various years as they pass, with the meteorological observations made during those years, one meets with endless contradictions, so that if it were possible to indicate, even one year before hand, the series of events which would occur at any place throughout the whole period of vegetation, the farmer, though drawing therefrom an inestimable advantage, and placing all the favourable chances on his side, could not tell what would be the result, nor upon what harvest he might reckon.”

“Obedient to the idea which presided over its foundation, viz., the formation in France of an establishment charged with the study of Meteorology by itself, and also in its applications to agriculture, the Observatory of Montsouris endeavours to employ all the resources of science in the study of the atmosphere, and of the effects which its variations produce upon vegetation. In this respect the situation of the Observatory has been happily chosen; the surrounding grounds are sufficient, but as the whole organization and apparatus had to be arranged, and obtained, it is only gradually that it can get into working order. The year 1873 was almost wholly devoted to preparatory studies, which

**Bulletin Mensuel de l'Observatoire de Montsouris, Jan.-July, 1874.* Paris: Gauthier-Villars, Quai des Augustins. 4to.

led to the conviction that in researches on vegetation, whatever might be their nature, one could not leave altogether the domain of Chemistry. It has therefore been necessary for us to provide laboratories adapted for the most delicate operations on the chemistry of the atmosphere in those branches which touch on agricultural chemistry. Thanks to this addition, it will be possible for us to study the constituent or occasional elements of the atmosphere, and to follow, step by step, the progress of the harvests in their relation to successive changes in the weather."

"A considerable portion of this Bulletin will be devoted to these studies, under the title of "The Physics of Vegetation." We shall not wait to give memoirs as nearly perfect as possible, but we shall record in it the series of facts successively observed, with every possible care, and by methods most carefully considered."

"The 'Bulletin Mensuel' is then, properly speaking, even in its letter-press, a record of the Meteorological and Agricultural observations made at Montsouris, either in the open air or in its laboratories, by the staff of the establishment or by the scientific men admitted there to carry on researches of a similar nature."

Having let the Director speak thus far, we will next run rapidly through a few numbers of the Bulletin so as to enable our readers further to realize the nature of the work in progress at Montsouris. The first paper on "The Physics of Vegetation," describes chemical methods for the analyses of winter wheat, and of rye; then follows a diagram (not so well printed as it might be) of the principal Meteorological elements, and then a series of tables giving in great detail the very numerous and interesting Meteorological observations made at Montsouris. We may, perhaps, on some future occasion describe in detail the Meteorological arrangements at this Observatory, but for the present it will suffice to say that they are already very extensive, and are being rapidly developed.

The February number opens with a notice of the "Bulletin Météorologique du Nord," gives under the Physics of Vegetation a notice of the congress of Agriculturists and Foresters held at Vienna, and then passes on to a resumé of arrangements made for collecting rain water for analysis by means of a funnel made of enamelled iron, which seems too small for M. Marié-Davy's wishes, (why he does not have a large one made in glass we do not know); however, as he has surmounted many far greater difficulties there is no fear of his being beaten by this. Certain large vessels filled with earth, containing plants, have at their bases arrangements for collecting the effluent water, its analysis follows next, and then that of certain typical plants collected weekly. This number ends with some Magnetic observations, a list of presents received, and the usual diagram and tables.

March opens with a graceful tribute to the memory of Quetelet, then notices Brigadier-General Myer's synchronous system of observations, gives next a most alarming *looking* paper by M. Ragona, then the usual analyses of typical plants and of rain water.

The special notes in the April number are on the humidity of the soil as determined by raising and drying equal volumes from various depths, and further notes on the analysis of rain water. In that for May we have notes on Aurora, on the analysis of the air, and on evaporation from plants. In June, the analyses and general details of the progress of vegetation occupy almost the whole number; but in July Meteorology is again in the ascendant, and M. Davy gives a paper on Actinometry, or perhaps more properly, on Solar Radiation, which is much too good to be noticed at the end of an article. It must be taken by itself.

Our summary of what is being done at Montsouris need not be long, for it must either occupy many pages, or be dismissed in a few lines. We think the latter is the preferable course. Our readers may take our word for it, that they can hardly suggest anything which should be done in order to determine the relations between Meteorology and Agriculture without our being able to reply, it is already being done. One word more. No one should lightly intrude on the valuable time of such a man as the Director of this Observatory, or even on that of the assistants; but, on the other hand, we can assure those of our readers who are familiar with Meteorology, Agriculture, and the French language, that if they can obtain permission to visit the Observatory (which is in the extreme south of Paris), they will learn more in an equal time than they ever did elsewhere.

THE WINTER OF 1874-5.

To the Editor of the Meteorological Magazine.

SIR,—I had hoped to have seen, in your Magazine ere this, Mr. Brumham's forecast of winter mean temperature, as deduced from a table such as he contributed to your magazine for April last.

I trust he will give us the results of the rainfall at his 50 stations for the months of April and May, July and August, in your next number.

I am, yours obediently,

C. SOAMES.

Mildenhall Rectory, Marlborough.

To the Editor of the Meteorological Magazine.

SIR,—In your magazine for April last, page 41, I stated that "When the total (mean) rainfall of April, May, July, and August, is less than 10·60 inches, but above 8·60 inches, the following winter is partly very severe. Such was the case in 1869-70, 1866-7, 1863-4, 1860-61, 1857-8, 1855-6, 1853-4, and 1852-3." This year the total (mean) rainfall of the aforesaid four months was exactly equal to the average given in the table on page 40—viz., 10·30 inches. Therefore, according to the above-mentioned law, the coming winter will be, at any rate, partly very severe.

GEORGE D. BRUMHAM.

Barnsbury, Nov. 30th, 1874.

REMARKABLE DARKNESS.

To the Editor of the Meteorological Magazine.

SIR,—Lest no one sends you a more correct account, I beg to forward you the following notes of a very remarkable darkness, which occurred in this neighbourhood on November 18th. In the morning the barometer stood at 29·475, and a thermometer which lay on a stone sill outside of a west window, at 41°. Air very misty and calm, but the smoke came from the east. Shortly after 9 o'clock, however, the smoke came slowly from the opposite quarter, and the mist cleared away gradually. About 11.50 I observed an intensely dark and dense-looking cloud, perhaps half-a-mile above ground, coming from the N.N.W. with considerable rapidity, and the westerly current, which was still gentle, curling rapidly up the front of it, like steam from a boiling cauldron, as it pushed onwards. As the cloud passed overhead suddenly all became dark, so dark as to extinguish all color from objects around. I tried to think of something to measure the intensity of the gloom. I took out my watch,—could see its form, but not read its face. I looked up to see if any stars were visible, forgetting for the moment the thickness of the cloudy screen. This state of matters may have lasted fully a minute, when I observed daylight breaking in the north eastern horizon, over the east end of Glasgow; and light returned quickly as the cloud travelled south south eastwardly, followed by a pretty sharp shower of short duration. In some localities farther east, the shower seems to have been heavier, and preceded or accompanied the darkness. The latter, from what I can learn, extended from the west of Glasgow to the east of Motherwell; so would be fully sixteen miles long, from east to west, and where I saw it, it was fully six miles broad: but I fancy I was near the west end of it, as I have not heard of the great darkness occurring more than four or five miles west of Cambuslang, and it seems to have been more intense, and longer continued, more to the east. At Airdrie four minutes of darkness is the length of time mentioned.

Some of our turkeys expressed alarm by sounds and gestures, and made for their roosts; and the ducks came quacking up the paddock. No other animals, wild or tame, were within reach of observation. There was nothing unusual in the quality of the darkness to distinguish it from a cloudy night an hour or so after sunset.

Sunshine and showers occurred afterwards during the day and next morning the rain-gauge registered a fall of 0·30 in.; bar. 29·3, therm. 42°; wind S. At 9.30 there threatened to occur a repetition of the same phenomenon, from the same quarter; but before the intensely dark cloud reached this, it partially dissipated, with lightning, thunder and hail. The latter larger than any I remember ever to have seen; globular of all sizes, from peas to fully five-eighths of an inch in diameter, made up of agglomerated hailstones about an eighth of an inch across, forming a mulberryiform surface. Only a few fell here. Further north they formed a stratum an inch deep.—Yours truly,

HENRY MUIRHEAD, M.D.

Bushy Hill, Cambuslang, Lanarkshire.

RAINFALL IN WENSLEYDALE.

To the Editor of the Meteorological Magazine.

SIR,—I enclose the details of the two great rain storms which we have experienced recently as recorded by my electrical rain gauge, 3 ft. above ground.

The contrast between the two was very marked. The fall of October 20th accompanied a violent W. wind, that of November 28th an E. wind of considerable, and, on the coast, of excessive force. On the former occasion, after 9 or 10 hours of "Scotch mist," the rain fell in irregular and, towards the end, intermittent squalls for about 12 hours, producing an extraordinary flood. On the latter, snow fell for some hours, succeeded (perhaps about 2 or 3 a.m.) by a perfectly steady down-pour of dense rain, continuing without the slightest break or intermission till about 11 a.m. on the 29th. At 9 a.m. the ground was covered with some 3 inches of semi-liquid slush, but at this level it had all melted before evening. The depth of snow on the hills was very great.

F. W. STOW.

P.S.—The record of the snow was obtained by placing a lamp within the box. I append the record of a third fall, partly of snow, but chiefly of rain, ending with a severe N. gale.

Hour ending (a.m.)	1	2	3	4	5	6	7	8	9	10	11	12
Oct. 20	...	...	...	...	...	...	...	...	...	...	...	...
„ 21	...	...	...	...	...	...	...	...	...	...	...	...
Hour ending (p.m.)	1	2	3	4	5	6	7	8	9	10	11	12
Oct. 20	...	...	...	...	...	...	...	...	...	...	...	...
„ 21	...	...	...	...	...	...	...	...	...	...	...	...
Hour ending (a.m.)	1	2	3	4	5	6	7	8	9	10	11	12
Nov. 29	...	...	...	...	...	...	...	...	...	...	...	...
Hour ending (p.m.)	1	2	3	4	5	6	7	8	9	10	11	12
Nov. 28	...	...	...	...	...	...	...	...	...	...	...	...
„ 29	...	...	...	...	...	...	...	...	...	...	...	...
Hour ending (a.m.)	1	2	3	4	5	6	7	8	9	10	11	12
Dec. 8	...	...	...	...	...	...	...	...	...	...	...	...
„ 9	...	...	...	...	...	...	...	...	...	...	...	...
Hour ending (p.m.)	1	2	3	4	5	6	7	8	9	10	11	12
Dec. 8	...	...	...	...	...	...	...	...	...	...	...	...

RED RAINBOW.

To the Editor of the Meteorological Magazine.

SIR,—This morning, at 7.15, I observed a peculiar rainbow: it was entirely red, no other colour being visible. It formed a perfect arch in the N.W.; the sun was just risen, and the sky was fiery red. Was its colour caused by the red rays only reaching the drops?

I am, Sir, yours obediently,

W. C. HUGHES.

Grammar School, Sutton Valence, Staplehurst, Kent, Nov. 25th, 1874.

FINE METEOR.

To the Editor of the Meteorological Magazine.

SIR,—I take the liberty of sending to you a brief description of a most magnificent meteor seen here last evening. The phenomenon being so remarkable, I do not doubt but that it will have been seen by many in various parts of England.

The sky was cloudless, and the air frosty. At 8.35 notice was first drawn to the meteor by the landscape and surrounding objects being illuminated as by a very bright flash of lightning of a peculiarly white and silvery character. Then, and at no very great elevation, a long and broad band of light was observed proceeding from East to West, at the lower end of which was a large and irregularly shaped mass of white flame, which suddenly seemed to explode, emitting a shower of fragments not unlike that produced by a rocket, the whole of a silvery hue, and lasting perhaps 20 seconds from the time of its first appearance.

I am, dear Sir, yours very truly,

EDWD. TUCKER, JUN.

Woodlands, Elterwater, near Ambleside, Dec. 4th, 1874.

RAINFALL AND YIELD OF WELLS.

To the Editor of the Meteorological Magazine.

SIR,—In confirmation of the statement in my letter of October 31st, namely, that "the prospect of water supply this year, or season 1874-5, as compared with 1873-4 is better," I find that the rain of November, from the 25th to the 30th inclusive, viz., 1.33 in. (the total for the month being 2.17 in.) has produced a marked influence on the water level, so that it now stands higher than at this time last year. This is rather due to September and October rains, which so saturated the ground that the November rain, though little above the average, sunk to the water level in the well in question.

Yours obediently,

J. C. CLUTTERBUCK.

Long Wittenham, Dec. 5th, 1874.

A WARM AUTUMN.

To the Editor of the Meteorological Magazine.

SIR,—The remarkable prolongation of mild weather during the present autumn is, I think, worthy of record, and I therefore send you a few notes concerning the night temperatures, which may be interesting to those who have been surprised to find themselves still revelling in kidney beans, and enjoying the unwonted sight of uninjured dahlias and summer-like roses.

Contrary to general experience, October passed away without the occurrence of a single night's frost. The lowest temperature recorded here during the month was 38.3 degrees; so that there were no really cold nights at all—not even a "frost on the grass," which generally occurs, when the temperature of the air at four feet above the soil falls

to about 35 degrees. The following table, showing the date of the first autumn frost (*i.e.*, 32 degrees or below), in each of the last ten years, and the number of frosty nights (*i.e.*, nights below 35 degrees), from October 1st to November 8th, will render very apparent the unusual character of the season up to the present time.

Year.	Date of first frost. (32 deg. or below).		No. of frosty nights on grass. (below 35 deg. in air).	
1865	...	October 6	...	12
1866	...	" 16	...	4
1867	...	" 4	...	4
1868	...	" 2	...	11
1869	...	" 20	...	5
1870	...	" 15	...	8
1871	...	" 10	...	5
1872	...	" 6	...	5
1873	...	" 13	...	12
1874	...	November 8	...	1

The past month is therefore the only October in the last ten years which has brought us no frost whatever, and is in singular contrast to the wintry autumn days of last year.—I am, Sir, yours obediently,

BOSCAWEN T. GRIFFITH.

Trevalyn Hall, Wrexham, Nov. 1874.

P.S.—I should add that my thermometers are by Casella, and that they are placed on a stand (removed from house walls) at a height of 4 feet above the ground, and 61 feet above mean sea level.—B. T. G.

HEAVY FALL OF RAIN IN NORWAY.

(*Translated extract of a letter from Hans Gabrielsen. Liknæs, near Flekkefjord, Norway, 18th October, 1874, to C. O. F. Cator.*)

"I must now tell you of a sad occurrence. There came here on 5—6th October the greatest fall of rain, so that the river went beyond its highest limits: it has not been so high for 100 years. No old man here can remember the river so high, and it did much damage, of which I will tell you: At Orenslø the river swept away my best soil and broke the enclosing fence, and washed it away, so that I cannot make it as good again as it was for 30 dollars (nearly £7), and all my summer earnings are lost by it. Your bridge also has been swept away with the flood, a little bit of it is left, but the greater part has gone to the sea. There is much damage in many places; the river rose to 2 feet above the floor in Hakon Jarl's house, and people could row in boats from Olsen's (the Post Office) and Hans Hoiart's to Carl Tøllaksen's, right over the road.

Your two boats I have kept safely, but many have been lost.

HANS GABRIELSEN."

N.B.—In an ordinary *high* flood the river rises at Liknæs about 6 or 7 feet above its average height; I should estimate from recollection the floor of Hakon Jarl's house about 8 or 10 feet above it, so that the river would appear to have risen about 10 or 12 feet above its average.—C. O. F. C., 19th Nov., 1874.

REVIEWS.

The Diurnal Variations of the Wind and Barometric Pressure at Bombay. By F. CHAMBERS. [Phil. Trans. 1873.]

A VERY good specimen of the class of papers most needed at the present day, and respecting which the only ground for regret is that there are so few persons who are competent to profit by them. It is a very careful, thoughtful paper, not worded perhaps in the most lucid manner, but nevertheless giving all necessary details, and, to a great extent, proving the proposition which the author thus enunciates:—

1.—The object of this paper is to draw attention to a remarkable relation which has been found to exist between the diurnal variation of the wind and the double diurnal oscillation of the barometer at Bombay, and which, it is believed, will be of great interest to all Meteorologists.

The author subsequently discusses some of the British records, especially those from Sandwick Manse, and obtains evidence confirmatory of the relation above-mentioned. The subject may, therefore, be remitted to those who are still working upon that difficult subject, the *cause* of the double diurnal oscillation of the barometer. We have put the word *cause* in italics because there does not appear to be in Mr. Chambers' paper even a hint whether the change of wind direction is a cause or an effect.

Repertorium für Meteorologie herausgegeben von der Kaiserlichen akademie der Wissenschaften, redigirt von Dr. H. Wild. Band III. 4to. St. Petersburg, 1874.

[Continued from *Meteorological Magazine*, page 108.]

ON resuming our notice of this splendid work, we cannot help regretting how few there are in this country competent and willing to profit by its many useful lessons. The time will no doubt come when Englishmen of high mental power will, in increasing numbers, devote themselves to perhaps the most complex of natural phenomena. At present, however, the remarkable dictum, true throughout Europe, is most true in England, now, as when Sir George Airy uttered it, "THE OBSERVING STRENGTH IN METEOROLOGY IS OUT OF ALL PROPORTION TO THE THINKING POWER."

The next memoir which claims our notice is one by Dr. Koppen, on the determination of mean daily temperature, from observations taken at certain pairs, and groups, of hours. And almost on the first page we come upon two most interesting tables, such as we have never seen before: not that there is any special skill in having compiled them, but our own countrymen seem to lack the energy to work up the materials in their possession. If any one demurs to this charge, let him go to work upon the ponderous volumes which have issued from our Indian observatories, upon those of the Colonial Magnetic and Meteorological observatories, and, though last not least, upon the microscopic charts of the Meteorological Committee, and produce from them tables of the mean daily time of minimum and maximum temperature for the British Isles, for India and the Colonies.

Meanwhile we must not pass without briefly indicating the nature of the tables which have led to this process of self-anatomization and self-condemnation of ourselves as Englishmen. The first gives for about 30 stations, ranging from Archangel to Tifis and from Geneva to Pekin, the average time of lowest temperature each day for each month. The second table does the same for the time of maximum. We will give the values for a few stations, in the hope that it may induce others to complete the series, for there are scores of stations which ought to be added to the list.

Hour of Minimum Temperature.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Archangel	4. 0	6.24	6.18	4.12	3.18	1.42	1.48	2.48	5. 6	5.54	3.42	6. 0
St. Petersburg	6. 0	6.42	5.42	4.48	3.42	3.12	3.24	4.24	5.24	6.18	6.42	6.48
Barnaul	7.12	6.24	5.30	4.12	3.36	3.30	3.36	4.12	5. 6	5.42	6.24	6.42
Vienna	6.12	6.24	5.36	4.54	4.18	3.54	4.18	4.42	5. 6	5.36	6.18	6.48
Geneva	6. 0	6. 6	4.18	3.36	3.18	2.42	3.12	3.24	4. 0	4. 6	5.18	6. 6
Gt. St. Bernard	4.24	4.18	3.42	2.54	2.54	3. 0	3. 6	3.18	4. 6	3.18	4.30	5.12

Hour of Maximum Temperature.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Archangel	1.30	2.18	2.36	2.48	2.48	3.36	4.36	2.42	2.12	1.48	1.18	0.18
St. Petersburg	2. 0	2.42	3.36	3.54	3.42	3.42	3.48	3.48	2.48	1.48	1.48	1.48
Barnaul	1.42	2. 0	2.30	2.30	2.48	2.18	2.24	2.48	2.36	2. 6	1.24	1.30
Vienna	2. 6	2.24	2.42	3. 6	3.18	3.30	3.36	3.30	2.36	2.12	2. 0	2. 0
Geneva	2. 0	2.12	2.12	2.12	2.12	2.48	2.48	2.48	2.30	1.42	1.30	1.42
Gt. St. Bernard	0.42	0.42	0.42	0.48	0.48	1.18	1.12	1. 6	1. 6	1. 0	1. 6	1.12

These values alone would afford the basis of much profitable enquiry, but it would be somewhat foreign to the subject of the paper and we, therefore, pass on.

The combinations of hours which are considered are—

$\frac{1}{3}$ (6h.—2h.—10h.)	$\frac{1}{4}$ (7h.—2h.—2h.—9h.)
$\frac{1}{3}$ (7h.—2h.—10h.)	$\frac{1}{3}$ (8h.—8h.)
$\frac{1}{3}$ (7h.—2h.—9h.)	$\frac{1}{3}$ (9h.—9h.)
$\frac{1}{3}$ (7h.—1h.—9h.)	$\frac{1}{2}$ (10h.—10h.)

and these are worked out for every month and for some fifty stations—from Pekin to Nova Zembla (which, by the bye, appears as Nowaja Semlja). As the differences are all given to hundredths of a centigrade degree, our readers will hardly need further details as to the minuteness of the examination. We do not find any final comparison of the results, but on drawing up a short one they appear generally more favourable to the combination of 9 a.m. and 9 p.m. than we could have hoped.

In the last portion of the volume, the “Jahresbericht des Physikalischen Central-observatoriums” for 1872, 1873, we notice with extreme pleasure a new feature, viz., a report by M. Rikatscheff on an inspection tour of Russian meteorological stations in the summer of 1872.

M. Rikatscheff describes with care the testing apparatus which he took with him on his long tour (about 6,000 miles, of which upwards of 1,500 were posting). After a few other pages of introductory matter, he proceeds to report upon each individual station. We rejoice so much over this expedition, and think it so excellent and so useful that we can hardly find it in us to suggest improvements lest, by striving to make the inspection more nearly perfect, we make it so onerous that no one will undertake it. And really what we have here is better than anything ever done before, except as to rain gauges, the inspection of which by Mr. Symons, on behalf of the British Association, has always been exhaustively rigorous. M. Rikatscheff reports upon each station under the following heads: Organization and Observer, Locality, Time (means of ascertaining it), Thermometer and Hygrometer, Thermometer stand, Rain gauge, Barometer, Wind-vane, Resumé. Long may we have such inspectors as M. Rikatscheff, may there be many more like him, willing to devote their time and their physical strength to carrying to the remotest districts the highest meteorological skill, thereby developing the faculties and cheering the hearts of far distant observers, and at the same time giving to those who stay at home confidence in the results forwarded for publication. We have no doubt that, as years roll on, the records of these inspections will become fuller, we shall have plans of the stations, fuller details of the comparisons of the instruments, and perhaps even photographs of them all, but whatever we may have, we must not forget who made the first tour of Russian inspection, and under whose direction it was made.

S. W. Silver & Co.'s Handbook for Australia and New Zealand.

Second edition, post 8vo. viii—449 pages. London: S. W. Silver & Co. 1874.

WHEN a statistical work gets into its second edition in its first year, increases 10 per cent. in size, and 25 per cent. in price, it is not of very much consequence what a reviewer may say about it. As far as we are concerned we have nothing to retract and little to add to what we said in our June number (page 91); we spoke highly of it then, and the rapid appearance of a second edition shows that the public agreed with us. We are glad to find that (though amid some pages of most favourable reviews there is no quotation from our notice) nearly all the suggestions we ventured to offer have been utilised in the present edition, which appears to us to be in every respect a most useful work.

Devonshire Hospital and Buxton Bath Charity. Annual Report, 1873.

Buxton: Bates, 1874. 8vo.

THE meteorological portion of this report is better than usual, and worthy of the hospital, and of the compiler, Mr. E. J. Sykes, who though he has left the hospital, continues his voluntary labours as honorary observer. The mean temperature for 1873 was 45°·2; max., 88°·0 on July 22nd; min., 6°·5 on Feb. 24th. Total rain, 43·27 in. on 212 days.

Lettere Meteorologiche dirette al Sig. Ing. Conte Guido Vimercati in Firenze, dal Prof. D. RAGONA. Florence, 1872. 8vo.

A SERIES of short notes. The firsts treats of "The increase of humidity and the decrease of temperature which produce rain," and is an interesting little note. Prof. Ragona has extracted from the records of the observatory the observations made at the commencement of, and during, rain, and compared them with the normal values. There is, by the bye, one result naturally brought out by this method which, though familiar to those well read in Meteorology, may be new to some of our readers, so we will mention it and leave it for their consideration. When it rains at Modena the average humidity (saturation being 100) is in winter 93·7, spring 86·6, summer 81·7, autumn 89·1, year 87·8. That is to say *while it is raining* the air is 12·2 per cent. short of being saturated. Such conditions we have ourselves observed in England, but they are very far from being usual; we fear our mean value would be nearer 97·8 than 87·8.

Note II. is on "Evaporation from Salt Water," and is a purely theoretical paper based on the difference of the tension of the vapour of pure and of salt water. Its line of argument will be sufficiently gathered from the following table:—

Temperature.	Maximum Tension		Difference	
	of the vapour of Pure Water.	of the vapour of Salt Water.		
Fahr.	in.	in.		in.
32°	0·181	0·146	..	0·035
50	0·361	0·248	...	0·113
68	0·684	0·389	...	0·295
86	1·242	0·559	..	0·683

Note III. refers to an "Optical Atmospheric phenomenon," which appears to us to have been merely a fine solar halo, while Note IV. (and last) is devoted to a discussion of the anemometric conditions which subsist during the prevalence of Auroræ. We think that this problem had better be investigated at Toronto or St. Petersburg than in Italy.

Eighteenth half-yearly Report of the Marlborough College Natural History Society. Marlborough: Perkins, 1874. 8vo.

THIS report is virtually the supplement to the previous one, and gives the detailed meteorological observations from which the data given in the previous one were deduced. There is also a short paper on "Tiger Moths," by E. Meyrick, with a good coloured plate, and there is also a very fair entomological report. We are sorry to call attention to a fault, but by so doing we shall benefit so many, that the one concerned may regard himself as a public benefactor. It was too bad that daily readings of a grass minimum thermometer should be recorded without comment, while 10° of spirit was lodged in the top of the tube. Let all who read this look to their own minimum thermometers.

SUNDRY BAROMETRIC NOTES.

We have been favoured with several sets of observations for Nov. 29th–30th, and Dec. 9th. While, on the one hand, it appears to us undesirable to occupy much space with details of depressions not of exceptional extent, on the other, it seems a pity to bury all the records. We, therefore, adopt the intermediate course of printing a few of the salient features, and offering the M.S. *in extenso* to any one who may be working up the meteorology of either date.

Sea Level Pressures.

November 29th—

	9 a.m.	9.30	10.30	10.40	Noon	0.35 p.m.	1.40
Worthing	28·611	(lowest since 20/1/73, when it was 28·539).					
Crowboro' Beacon	28·684	—	—	—	—	—	—
St. James St., Brighton	28·681	—	—	—	—	—	—
Buckingham Place, „ ..	—	28·691	—	—	—	—	—
Magdalen Coll., Oxford	—	—	28·607	—	—	—	—
Geldeston, Norfolk	28·68	—	—	28·63	28·57	28·54	28·56
Bath	28·588	—	—	—	—	—	—

December 8th–9th—

	8th 9 a.m.	9 p.m.	9th 1 a.m.	2 a.m.	3 a.m.	4 a.m.	9 a.m.
Buckingham Place,							
Brighton	29·819	29·026	28·849	28·785	28·705	28·686	28·957
Merton Villa, Cam-					4.30 a.m.	6 a.m.	
bridge	29·81	—	28·71	28·66	28·63	28·65	—
Camden Square,					3.50 a.m.		
London	29·780	28·950	28·774	28·729	28·622	—	28·976
Osmington Lodge, Weymouth—Fall between 11.30 p.m. on 7th, and 0.10 a.m. on 9th (24 hrs. 40 min.)	1·11 in.						
Bath—Fall between 9 p.m. on 7th, and 11 p.m. on 8th (26 hrs.)	1·104 in.						

SUPPLEMENTARY TABLE OF MONTHLY RAINFALL,
NOVEMBER, 1874.

Div.	County.	Station.	Total Fall.
			in.
II.	Kent	Margate (Acol)	1·41
„	Sussex	Hailsham	2·50
„	Hampshire	Strathfield Turgiss	3·18
III.	Oxford	Oxford (Magdalen College)	2·50
„	Cambridge	Cambridge (Merton Villa)	1·76
IV.	Essex	Harlow (Sheering Rectory)	2·06
„	Norfolk	Swaffham	2·70
V.	Devon	Teignmouth (Brookbank)	3·58
„	„	Torrington (Langtree)	3·05
„	Somerset	Taunton (The Castle)	2·68
VII.	Leicester	Melton Mowbray (Coston)	2·28
„	Lincoln	Horncastle (Bucknall)	2·35
VIII.	Lancashire	Liverpool (Walton-on-the-Hill)	4·36
IX.	York	Wakefield (Stanley Vicarage)	2·64
X.	Durham	Gainford	2·13
„	Westmoreland	Shap	2·94
XVII.	Banff	Keith	3·45
XVIII.	West Ross	Strathconan	7·46
XX.	Cork	Fermoy (Glenville)	5·48
XXI.	Westmeath	Athlone (Twyford)	4·17
XXII.	Galway	Ballinasloe	3·51

BOOKS RECEIVED.

BARBADOS.

- RAWSON, The Hon. R. W. "Rainfall and Meteorological Observations in Barbados," August and September, 1874. Fcap. folio.
 RAWSON, The Hon. R. W. "Map of Daily Rainfall in Barbados," August and September, 1874. Single sheets, folio.
 RAWSON, The Hon. R. W. "Rainfall in Barbados," July and August, 1874. Single sheets, folio.

BELGIUM.

- VAN RYSELBERGHE, Prof. M. F. "Notice sur un Système Météorographique Universel." Brussels, Hayez, 1873. 8vo.

CANADA.

- KINGSTON, Prof. G. T. "Instructions to Meteorological Observers, in correspondence with the Magnetic Observatory, Toronto." 8vo. 1871.
 KINGSTON, Prof. G. T. "Third Report of the Meteorological Office of the Dominion of Canada, for the fiscal year ended 30th June, 1873." 8vo.

CEYLON.

- FYERS, A. B., Lieut.-Col., R.E. "Results of Meteorological Observations at Ceylon for April, May, June, and July, 1874." Single sheets, folio.

DENMARK.

- "Bulletin Météorologique du Nord, publié par les Instituts météorologiques de Norvège de Danemark et de Suède." Oblong 4to. April-October, 1874.

FRANCE.

- "SOCIÉTÉ MÉTÉOROLOGIQUE." Nouvelles, Septième Année, Première livraison, Paris, 1874. 8vo.
 MARIE-DAVY, M. "Bulletin Mensuel de l'Observatoire de Montsouris." Jan.-August, 1874. 4to.

GREAT BRITAIN.

- BIRT, W. R., F.R.A.S. "Selections from the Portfolios of the Editor of the Lunar Map and Catalogue." Part II., second issue. 4to. 1874.
 "Cardiff Naturalist's Society Report and Transactions, for 1873." 8vo. 1874.
 EVERETT, Prof. J. D. "On Underground Temperature." [From Proc: Belfast Nat. Hist. and Philos. Soc.] 8vo. 1874.
 EVERETT, Prof. J. D. "Sixth Report of the British Association Committee on Underground Temperature." 1874. 8vo.
 HOGG, J., and CAMPBELL, D. A. "Microscopical Examination and Chemical Analyses of certain Waters." 8vo. 1874.
 LAWES, J.B., F.R.S., &c., and GILBERT, J. H., Ph.D., &c. "Effects of the Drought of 1870 on the experimental crops at Rothamsted. [From Journal of Royal Agricultural Society.] 8vo. 1871.
 Leicester Literary and Philosophical Society. "Report of the Council." 1874.
 Leicester Town Museum. "1st and 2nd Reports of the Museum Committee to the Town Council." 8vo. 1874.
 "Meteorological Observations at the Royal Engineer Observatory, Chatham, 1873."
 "METEOROLOGICAL COMMITTEE Quarterly Weather Reports," July-Sept., 1873. 4to.
 " " " " Quarterly Weather Reports," Oct.-Dec., 1871. 4to.
 " " " " Charts of Meteorological Data," for square 3. folio.
 " " " " Remarks to accompany Monthly Charts of Meteorological Data," for square 3. 4to. 1874.
 "Report of the Registrar-General of Births, Deaths, and Marriages in Scotland, during the years 1861-70." Supplement, fcap. folio. 1874.
 SILVER, S. W., & Co.'s "Handbook for Australia and New Zealand." Second edition. Small 8vo. 1874.
 "Yorkshire Philosophical Society Annual Report, for 1873." 8vo.

NOVEMBER, 1874.

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 1860-5	Greatest Fall in 24 hours.		Days on which -01 or more fell.	Max.		Min.				
				Dpth	Date.		Deg.	Date.	Deg.	Date.			
											Inches.	in.	
I.	Camden Town	2.21	—	.20	.90	28	15	60.0	6	25.6	22	11	13
II.	Maidstone (Linton Park)	1.98	—	1.21	.66	29	10	66.0	6	19.0	22	13	...
III.	Selborne (The Wakes)	4.02	+	.48	1.43	28	12	57.5	6, 7	17.0	25	13	14
IV.	Hitchen	1.96	—	.18	.80	28	12	53.0	6	22.0	22†	14	...
V.	Banbury	2.52	+	.32	.66	28	14	56.0	4	21.5	24	15	...
VI.	Bury St. Edmunds (Culford).	2.62	+	.23	.64	28	14	57.0	5, 6	19.0	22	15	18
VII.	Bridport	3.13	—	.03	1.50	28	15	60.0	2*	30.0	12§	3	...
VIII.	Barnstaple	3.06	—	1.08	.94	28	14	62.0	10	36.0	12	0	...
IX.	Bodmin	5.01	+	.03	.91	28	19	57.0	8	34.0	12	0	1
X.	Cirencester	2.81	+	.02	.97	28	16	...	...	...	...	...	...
XI.	Shifnal (Haughton Hall)	3.73	+	2.16	.87	28	18	56.0	5	25.0	24	14	14
XII.	Tenbury (Orleton)	3.29	+	.82	1.03	28	19	59.7	9	25.7	22	11	15
XIII.	Leicester (Belmont Villas)	2.42	—	...	.69	29	17	56.8	9	23.5	24	...	...
XIV.	Boston	2.04	—	.10	.72	28	15	57.0	1	27.0	22†	8	...
XV.	Grimsby (Killingholme)	3.24	—	...	.80	29	19	55.5	4	26.0	22†	9	...
XVI.	Derby	2.71	+	1.08	1.12	28	14	57.0	9	22.0	22	12	...
XVII.	Manchester	4.85	+	2.09	.61	29	17	60.8	5	23.5	12	11	16
XVIII.	York	3.22	+	1.24	.84	28	20	57.0	15	22.5	23	12	...
XIX.	Skipton (Arncliffe)	5.13	—	1.32	.85	29	21	48.0	15	20.0	21	15	...
XX.	North Shields	3.30	+	.60	.50	30	22	59.0	9	28.0	23	9	12
XXI.	Borrowdale (Seathwaite)	13.29	—	3.38	2.52	3	18	...	...	...	...	...	...
XXII.	Cardiff (Ely)	3.39	+	.79	1.33	28	13	...	...	...	...	...	...
XXIII.	Haverfordwest	4.32	—	1.35	1.73	28	11	57.0	8	29.5	30	...	5
XXIV.	Rhayader (Cefnfaes)	4.75	+	.17	1.50	29	11	57.0	...	29.0	...	...	...
XXV.	Llandudno	5.64	+	2.48	.95	28	22	67.5	5	34.8	22	0	...
XXVI.	Dunfries (Crichton Asylum)	5.64	+	2.38	.80	5	21	55.6	10	28.0	22	8	10
XXVII.	Hawick (Silverbut Hall)	4.65	—	...	1.21	29	18	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill)	4.14	—	...	.54	29	20	55.4	10	26.0	12	4	10
XXIX.	Castle Toward	6.12	+	1.48	1.12	30	19	54.0	5	...	...	6	...
XXX.	Leven (Nookton)	2.38	—	.66	.85	29	16	58.0	9	22.0	23	12	20
XXXI.	Stirling (Deanston)	...	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Logierait	...	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Braemar	2.56	—	.26	1.00	29	20	55.8	9	20.0	23	14	21
XXXIV.	Aberdeen	3.61	—	...	.98	29	22	58.1	5	27.5	1	6	16
XXXV.	Loch Broom	6.12	—	...	.67	18	28	...	...	...	...	...	...
XXXVI.	Portree	6.29	—	9.34	1.09	9	27	...	...	...	...	...	...
XXXVII.	Inverness (Culloden)	1.71	—	.22	.53	10	12	55.8	4	23.0	23	6	20
XXXVIII.	Helmsdale	2.75	—	...	...	...	...	...	...	...	...	...	...
XXXIX.	Sandwick	4.00	+	0.3	.54	25	25	53.2	8	30.9	22	3	7
XL.	Caherciveen Darrynane Abbey	5.28	—	...	1.42	24	20	...	...	...	...	...	...
XLI.	Cork	3.69	—	...	1.20	1	18	...	...	...	...	...	...
XLII.	Waterford	5.19	+	1.24	.93	28	20	56.0	16	30.0	12	2	...
XLIII.	Killaloe	3.94	—	.95	.67	24	24	62.0	4	27.0	12	5	...
XLIV.	Portarlinton	2.81	—	1.11	.55	29	29	57.0	9	27.5	11	4	...
XLV.	Monkstown, Dublin	3.73	+	.84	1.69	28	19	...	...	...	...	...	...
XLVI.	Galway	4.63	—	...	.58	26	24	58.0	2†	32.0	11**	2	...
XLVII.	Ballyshannon	3.60	—	...	.61	17	23	...	...	...	...	...	...
XLVIII.	Waringstown	3.29	—	...	.65	28	19	58.0	4	28.0	9	3	13
XLIX.	Edenfel (Omagh)	3.19	—	...	.84	28	24	54.0	8	28.0	11	8	...

* And 5, 6, 8.

† 5, 10, 19.

‡ 23.

§ 21.

** 20

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

METEOROLOGICAL NOTES ON NOVEMBER.

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.

LINTON PARK.—High wind and R on night preceding the 29th, and all that day, with L at night, otherwise a fine dry month; the last week frosty, but so dry that the roads were almost dusty. Bar. lower on 29th than on any former occasion since January, 1873, while 1·25 in. of R out of 1·98 in. (the total fall of the month) fell on that and the following day. Fogs frequent in the early part of the month, and the frosts more severe than usual in November.

SELBORNE.—Frequent fogs; very dense on 5th, 21st, and 28th; followed on the 28th by R in the evening, and all night, bar. falling 0·70 in., from noon on this day till 9 a.m. on the 29th, and standing lower than it has since the 20th of January, 1873. Average min. ther. of the week, 22nd to 28th inclusive, 22·9°; frequent white frosts. Intensely cold on the 22nd.

BANBURY.—On the morning of the 22nd the ther. fell to 23°, and had been low all night, but owing to the fog and the great calm, the ground was but slightly frozen. Lowest bar. at 10.30 a.m. on 29th, 28·25 in., followed in the afternoon by a very high wind. S 2½ in. deep on 26th.

CULFORD.—Stormy, with very low bar. on 29th. The last three weeks of this month have been unusually cold, the mean temp. of the month being only 39°. S to the depth of 2 or 3 in. fell on the 11th. Dense fog on the 21st, and two following days. Easterly winds on 6 days, and westerly on 24 days.

BRIDPORT.—Bar. began to fall rapidly on 27th; on the 28th it fell from 29·50 to 28·85 during the night, at which time the greater portion of the R fell, accompanied by a heavy gale from the S.W. Heavy floods.

BODMIN.—A strong gale from S. to N.W. on the 29th, the bar. fell to 28·75, the lowest since January, 1873. The past month has been remarkable for its mildness.

HAUGHTON HALL, SHIFNAL.—A great variety of weather, with sudden changes throughout the month. After the first two days of R and mist, it was beautifully fine and open till the night of the 7th, when at length a frost cut down the dahlias and tender plants. On the 11th R set in, and fell copiously daily, with one exception (13th) till the 20th. Dense fogs through the 21st and 22nd. Sleet, with heavy R (·81) on 25th, on which night 4 in. of S came from S.S.E., damaging the cedars, &c., greatly; this was carried off on the night of 28th by heavy R (·87). Although the rainfall (3·73) has only been exceeded twice in 40 years, viz., 3·81 in 1839, and 6·59 in 1852, there were 14 frosty nights; the wind for the first five days came from S. and S.W., changed to N.W. on 6th, and so continued till 25th, when it brought the S from the S.S.E., very high on the 17th.

ORLETON.—A variable month, with a temp. rather above the average. On the 1st the sun was seen at noon, the first time for nine days. The weather was generally warm, with a few frosty mornings, till the 21st, when frost set in, with a dense fog. On the 12th, the Cleve hills were covered with S. On the 25th heavy R set in about 6 p.m., changing to S, which covered the land regularly from four to five inches deep, and the air was so still that it remained on the trees till the 28th, when a great fall of R and rapid thaw set in, which filled the river to overflowing on 29th. On the 29th the bar. fell to 28·38 (uncorrected) and remained at that point nearly three hours.

BOSTON.—No water has yet passed through the sluice of the Witham, but it is gradually rising. On the 1st of October the water stood at 6 ft. 9 in. at the sluice door; on the 1st of November it had risen to 7 ft. 9 in.; on the 21st, after a fall of ·92 in. of R, it rose to 8 ft. 6 in.; and on the 30th, after a further fall of ·93 in.; on the 28th and 29th it rose to 11 ft. 3 in. On 28th the bar. fell during the night from 29·60 to 28·66. Wind from S.E.

GRIMSBY.—First ten days very fine, afterwards cold, with very little intermission. Heavy R on 28th and 29th at night; bar. low on 29th, i.e. 28·55 uncorrected. Several kinds of roses in bloom on 17th. Three inches of S on the ground on the 11th. Fieldfares seen on the 16th. Lunar corona on the 20th.

One inch of S on the ground on the 26th. North Sea roaring very loudly at night on 28th. High wind early on 29th.

MANCHESTER.—H on 19th. S on 25th and 27th.

ARNCLIFFE.—S on 11th, and heavy S on 25th.

NORTH SHIELDS.—S on 12th and 25th. Fog on 2nd, 7th, 8th, 18th, and 23rd.

SEATHWAITE.—Although there were two days (3rd and 29th) on which the fall reached $2\frac{1}{2}$ in. and the total for the month was 13·29 in., it was still 3·38 below the average.

WALES.

HAVERFORDWEST.—On the whole a fine month, marked by an absence of frost. S on the Precilly hills on the morning of the 12th, succeeded by two or three cold days; from the 18th to the end of the month, more or less stormy and wet. Very stormy on 26th, and on night of the 28th, it blew a violent gale, accompanied by a very heavy fall of R (1·73), and great depression of the bar., the readings of which were, 27th, 9 a.m., bar. (corrected) 29·38 in.; 9 p.m., 28th, 28·91 in., 4.30 a.m. bar. 28·580 in.; 9 a.m. 28·766; 9 a.m. following day 28·945 in.; and at 9 p.m. 29·08 in. The storm raged with terrible violence from 5 a.m. on Sunday until noon, when it abated, but continued very stormy to the end of the month.

CEFNFAES.—S on 26th and 27th.

LLANDUDNO.—Altogether a wet month, but for the first nine days warm and fine; no frost, the lowest temp. being 34°·8. The copper beech, plane and common poplar, divested of leaves on the 5th; the wych elm and hawthorn on the 7th; apple trees and mountain ash on 10th. S on the distant hills on 11th, 12th, and 13th.

SCOTLAND.

HAWICK.—A very mild month; hills white with S on the 26th, 27th, and 30th. Heavy R, with high wind on 29th; the total fall of R in the 24 hours was 1·21 in. Frost on nights of 10th, 11th, 12th, and 27th.

CASTLE TOWARD.—This November has been cloudy and dull throughout, scarce a gleam of sunshine, and the temp. low; but little done in either farm or garden, the wet state of the ground preventing it. Cattle and sheep in this locality healthy, but grass being scanty, turnip feeding has commenced. On 29th the Arran hills were again covered with S.

NOOKTON.—29th, high wind and heavy R (·85).

BRAEMAR.—S on 11th, 23rd, and 28th. A very severe month, with prevailing low temperature.

ABERDEEN.—A month of dull, damp, but rather mild weather. S on 10th and 11th; L on 15th and 16th. Bar. on 29th 28·83 (at 32° sea level); a terrible gale S.S.E.-E.N.E. on this day; bar. below the average; rainfall and temp. above it. Winds from N.W. and S.W. more frequent than usual, and the estimated pressure greater than the average.

LOCHBROOM.—Except two days of severe frost, we have had R every day; the hills are covered with deep S, and the valley for days was covered, except when alternate sleet and R would uncover the stunted verdure, which prognosticates a critical season; the cold for days has been intense, and the winter has very rarely been known to commence so early.

IRELAND.

DARRYNANE.—On the whole a fine month, with moderate winds and calms. Fresh N.W. breezes on 2nd and 16th, and N.W. gale on night of 28th and 29th. Trace of S on the mountains on morning of 30th.

MONKSTOWN.—Month very wet, more from the frequency than the quantity of the R.

BALLYSHANNON.—The first part of the month fine and mild, the latter part stormy and constantly wet.

WARINGSTOWN.—Very mild; scarce any frost as yet; many bedding plants still uninjured.

EDENFEL, OMAGH.—With the exception of a short interval in the second week, the weather of the month has been remarkable for continuous damp.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CVIII.]

JANUARY, 1875.

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

THE LATE FROST.

THE cold period in December was noteworthy rather on account of its duration, and the very fine specimen of a silver thaw with which it terminated, than for individual cases of extreme cold. But so many of our correspondents have favoured us with accounts that it would be as ungracious as it would be unwise to omit them all, because in some previous years lower temperatures have occurred.

The data have been arranged in the following order:—

I.—Letters printed *in extenso*.

II.—Table of max. and min. temperatures for 12 days at seven widely spread stations.

III.—List of lowest temperatures in the late frost.

IV.—List of lowest temperatures in the frosts of 1860, 1867, 1869, 1870 and 1874.

V.—A few words about the silver thaw.

SIR,—The following are abstracts for December, 1874:—Temperature—max. 51° on 8th, min. 15° on 23rd; frost on 22 nights, on grass on 29. The min. temp. was below 20° on 5 nights, on the grass on 10. The min. on the grass (snow) was 6° on 23rd, 7° on 31st, 9° on 22nd and 30th, 11° on 20th, 12° on 3rd, 14° on 28th, and 17° on 2nd and 26th. The frost, although it lasted from the 14th, has not been remarkably severe in this locality, the only day on which the 9 a.m. reading was below 20° was the 23rd, on which day it was 16°, and on several days the reading ranged from 20° to 32°; the max. on 31st was only 25°·1, and on 23rd 26°·5.

Snow fell heavily on 11th, 16th (11 in.), 18th, 19th and 24th, and slightly on 2nd, 13th, 14th, 17th, 21st, 22nd, 26th, 28th and 31st.

Heavy snow fell last night, from 5.30 to 7 p.m., followed by heavy rain, which produced a silver thaw, and freezing on the hardened snow made travelling almost impossible; it is, however, thawing rapidly to-night.—Yours truly, THOS. PAULIN.

Enfield Chase, Enfield, 2nd Jan. 1875.

SIR,—The long frost of the past month has now completely broken up, the rise of temp. from the 1st to the 3rd inst. having been very great.

The min. on the night of Dec. 31st-Jan. 1st, was only $17^{\circ}2$ in the air, and $15^{\circ}8$ on the grass, the max. in the air on the 3rd was $50^{\circ}9$ about 9 a.m. Small globules of frozen rain fell in showers from 4 to 7 p.m. on the 1st, followed by rain, which froze upon the surface of the ground and snow till 11.30 p.m., when the temp. rose to 34° in the air, and the thaw became general. At 9 p.m. the air temp. was, dry bulb $32^{\circ}3$, wet $31^{\circ}7$, and on grass $31^{\circ}8$, all objects out of doors being covered with a sheet of ice one-tenth of an inch thick, and extremely slippery. At 9 a.m. on 2nd I registered 0.31 in. of rain, and the temp. had risen to 40° , and most of the snow had disappeared.—Yours very truly, EDWIN E. GLYDE.

Forest Hill, S.E.

SIR,—The past month, Dec. 1874, was the coldest one for 14 years. The mean temp. was $31^{\circ}5$, or $7^{\circ}6$ below the average. Frost occurred on grass on every day except the 9th. The mean of min. on grass was $23^{\circ}7$.

The greatest cold commenced on 22nd, and I herewith give the readings, which require little comment :—

		IN SHADE.		ON GRASS.	
		Max.	Min.		Min.
1874—Dec.	22	27 [°] 8	24 [°] 2	.....	21 [°] 3
	23	33 [°] 7	17 [°] 0	.....	15 [°] 0
	24	33 [°] 8	19 [°] 2	.....	16 [°] 3
	25	33 [°] 8	31 [°] 5	.....	30 [°] 8
	26	32 [°] 6	18 [°] 0	.....	16 [°] 0
	27	33 [°] 3	22 [°] 7	.....	20 [°] 2
	28	27 [°] 5	16 [°] 5	.....	14 [°] 5
	29	26 [°] 0	14 [°] 0	.. ..	14 [°] 4
	30	26 [°] 0	14 [°] 5	.....	13 [°] 0
	31	26 [°] 7	18 [°] 2	.....	16 [°] 0
1875—Jan.	1	35 [°] 0	11 [°] 8	.....	12 [°] 0
	2	39 [°] 8	27 [°] 2	.....	26 [°] 0

The lowest readings of the dry and wet bulbs at 9 a.m. occurred on 30th Dec. viz., $16^{\circ}1$, $16^{\circ}0$.—Very truly yours, SAM'L. H. MILLER.

Wisbeach, 8th January, 1875.

SIR,—I omitted to give you a remarkable depression of the thermometer on the night of December 30. At 11 p.m. it stood at 24° with cloudy sky ; the three or four previous nights having been similar in all respects ; the sky, however, cleared for a short time—how long I do not know, and the minimum proved to be $2^{\circ}25$, and at 9 a.m. it stood at 12° and then rose rapidly to 32° . I could not believe in the reality of such a fall until I found it was confirmed by two thermometers in Hereford, one of which fell to $3^{\circ}5$, and another to about 5° .

My thermometer is a good one, tested at Kew, and stands in a proper thermometer stand at about 4 ft. from the ground.—Faithfully yours, HENRY COOPER KEY.

Stretton Rectory, Hereford, Jan. 4th, 1875.

SIR,—Mr. Brumham's prophecy that the winter of 1874–5 "will

be, at any rate, partly very severe," is likely to prove correct, as the cold continues.

The frost in this part set in on December 14th, and has lasted as yet to the month's end with but little intermission. Snow fell here during the night of the 15th and morning of the 16th, and covered the ground to a depth of about seven inches on the level, and on the 18th we experienced a very severe frost, which appears to have been rather local, as I did not see anything like so low a temperature noted at 8 a.m. at the different places given in the meteorological reports, published in some of the London daily newspapers. On the 18th, at 8 a.m., my thermometer, (one of Negretti and Zambra's), placed 4 ft. from the ground, with a north aspect, read as low as $+8\cdot5$ deg., or $23\cdot5$ deg. below freezing. It was a calm morning, with a few clouds about and haze around the horizon. During the day the temperature rose considerably; at 9.30 a.m. it was 14 deg., and at 5.30 p.m. it was $25\cdot5$ deg.; at 7 p.m. 30 deg., and by 8 p.m. had risen to 32 deg., when some freezing rain fell, and the wind blew lightly from the S.W., and a thaw occurred during the night, and the next morning, the 19th, the temperature at 8 a.m. was $38\cdot5$ deg., being a rise of 30 deg. during the 24 hours. The frost last night was again very severe; the thermometer this morning at 8 a.m. was 21 deg.—I am, yours faithfully, ARCHDALL E. BUTTERMER.

Staunton, near Gloucester, Dec. 31st, 1874.

SIR,—We had a fine example of a "silver thaw" here, as elsewhere, on the 1st. Snow began at 3 p.m., when the thermometer had risen to 27° , (on the previous night it had fallen to 10° , the lowest point attained here during the frost); at 4 p.m. the snow very suddenly changed to hard rain, mixed with ice crystals. The rain continued to pour down until after midnight. At 11.45 $\cdot40$ in. had fallen, as far as I could measure it, but the state of the gauge precluded accuracy. The thermometer stood at 30° till 10 p.m. and rose to freezing point at midnight, when everything had become a sheet of smooth, glassy ice. During the night the thermometer rose to 41° .

The 1st was remarkable for the great difference of direction in currents of only slightly differing altitudes. Cirrus moved from W.N.W., but low clouds travelled very fast from S.S.W., while on the earth's surface the E.S.E. wind held all day, and blew roughly (about force 6) in the evening, scarcely veering to S.E. till midnight.—Yours sincerely, W. CLEMENT LEY.

Ashby Parva Rectory, Lutterworth, Leicestershire, Jan. 6th, 1875.

SIR,—Perhaps a note of the severity of the frost here may be useful for purposes of comparison.

The values of the dew-point below 10° are calculated on the supposition that Glaisher's factor would $8^{\circ}\cdot8$, the tables not extending so low. But I doubt the accuracy of the tables. M. August's formula gives higher values. I had my little pocket dry and wet thermometers (which are good instruments) out: the dry agreed with the other dry, and I com-

pared the two wet bulbs together at about 5°, taking the higher value as most probable—cold work too!

	9 a.m.		9 p.m.		Read at 9 p.m.		
	Dry bulb.	Dew point.	Dry bulb.	Dew point.	Max.	Min.	Min. on grass.
December 22	18°·3	15°·8	12°·2	10°·4	30°·6	11°·4	+ 3°·0
„ 23	23°·8	16°·9	22°·6	15°·3	28°·6	10°·7	+ 1°·2
„ 28	...	...	5°·3	— 5°·2	26°·2	5°·3	+ 2°·0
„ 29	23°·3	21°·9	15°·8	+ 4°·4	24°·8	5°·5	+ 2°·0
„ 30	6°·8	— 9°·0	19°·0	+13°·3	20°·8	5°·2	+ 3°·0
„ 31	5°·8	— 1°·2	4°·7	— 2°·3	22°·3	3°·3	— 6°·0
January 1	15°·0	+15°·0	..	...	...	1°·9	— 6°·0

The mean for December is 28°·25—the coldest *calendar* month I have ever registered. The “storm” has now continued with two brief intermissions since November 25th, and the farmers are at their wits’ end to fodder their sheep.

At the time of writing everything is frozen that can be. The waterfalls present a most extraordinary appearance, being covered with ice apparently yards in thickness, and only a small channel in the middle remaining for the water, which is scarcely to be seen at all.—F. W. Stow.

Hestholm, Bedale, Jan 1st.

P.S.—Near Bedale,—3° is said to have been registered at 4 ft. This is probably correct. Also,—8° in Swaledale, below Richmond, but I do not know on what authority. At Penrith +2° was the min. on 29th, and +4° on Jan. 1st, and the ther. fell 7 times below 10° in Dec., the mean being 28°·0. Ullswater was a magnificent sheet of ice a foot thick. (Thermometer in a Stevenson).

Extract from Meteorological Register at Mellington Hall, Churchstoke, Montgomery.

		Dry Bulb.	Wet Bulb.	Min. 4ft. above gd.	Grass Min.	Max.	Solar Rad.
1874.							
December	28	31°·0	31°·0	28°·5	27°·0	35°·0	77°·0
„	29	27°·5	27°·0	21°·5	21°·5	30°·5	33°·0
„	30	24°·0	24°·0	21°·5	23°·0	31°·0	55°·5
„	31	18°·0	18°·0	1°·5	4°·0	25°·0	55°·0
1875.							
January	1	30°·0	30°·0	16°·0	11°·0		
„	2	42°·0	42°·0	34°·0	30°·5		

Instrument stand 4 ft. above ground, and on level open ground.

Observations taken at 9 a.m. and 4 p.m.

Thermometers verified at Kew.

PHILIP WRIGHT, F.C.S.

To the Editor of the Meteorological Magazine.

SIR,—The cold has been so intense in this district during the month of December (just passed) and the first two days of January, 1875, that I thought a brief account might not be uninteresting to you and the readers of the *Meteorological Magazine*. The frost gradually increased in severity towards the end of the month, until the mean temp. of the last week was not higher than 20°·02. Snow fell frequently and remained on the ground for several weeks, and the ice on the lakes has been from eight to ten inches in thickness.—I remain, yours faithfully, EDWD. TUCKER, junr.

Woodlands, Elterwater, Ambleside, Jan. 4th, 1875.

Date.	Air min. in shade.	Grass min.	Temp. at 8 a.m.	Max. temp. in shade.
1874.				
Dec. 21	30°	...	24°	...
„ 22	20	...	16	...
„ 23	11	...	9	...
„ 24	17	...	15	...
„ 25	25	...	20	...
„ 26	14	...	11	...
„ 27	15	...	11	...
„ 28	14	...	9	...
„ 29	10	...	5	...
„ 30	6	...	3	...
„ 31	7	...	4	...
1875.				
Jan. 1	7	...	*4	...
„ 2	29	...	26	...

Height above Sea Level at which observations were taken, 290 feet.

* A thermometer placed about 80 ft. lower down in the valley indicated 2° below zero the same night.

Extremes of Air Temperature Dec. 21, 1874, to Jan. 1, 1875.

Date.	London, Camden Sq.		Worthing.		Wolverhampton.		Bucknall, Horncastle.		Brinkburn.		Elliston, St. Boswell's.		Cargen.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Dec. 21	deg. 34·1	deg. 28·4	deg. 35·3	deg. 27·5	deg. 36·7	deg. 22·5	deg. 32·0	deg. 23·0	deg. 33·0	deg. 18·0	deg. 35·0	deg. 26·0	deg. 37·5	deg. 26·7
22	31·8	22·7	31·0	22·4	30·0	18·2	31·0	19·0	24·0	14·0	35·0	16·0	36·7	23·5
23	28·2	18·4	33·0	21·0	33·8	20·1	28·0	12·0	25·0	12·0	32·0	17·0	27·5	14·7
24	36·2	19·5	41·9	21·4	35·2	21·0	34·0	14·0	35·0	22·0	31·0	22·0	35·9	26·9
25	36·2	33·3	37·0	32·3	36·7	31·8	32·5	31·0	30·0	11·0	28·0	15·0	34·1	24·5
26	33·1	24·8	35·0	29·5	36·4	25·4	29·5	12·0	30·0	14·0	32·0	17·0	29·1	17·7
27	34·1	27·6	35·3	29·2	31·8	25·3	29·0	21·0	28·0	14·0	33·0	18·0	23·5	10·5
28	33·8	27·2	37·9	28·0	32·1	26·8	29·5	7·0	25·0	2·0	27·0	12·0	20·5	9·5
29	32·4	25·4	34·2	27·7	28·0	25·0	28·0	18·0	25·0	0·0	16·0	4·0	25·1	11·5
30	30·1	19·1	35·0	24·9	27·5	20·5	23·0	4·0	20·0	8·0	20·0	4·0	25·5	9·5
31	24·3	19·0	30·2	26·4	28·0	15·7	27·0	15·0	20·0	—4·0	24·0	11·0	29·5	17·5
Jan. 1	33·0	20·7	...	...	39·4	17·4	29·0	14·0	...	...	27·0	4·0	...	...

Minimum Temperatures, December 1874, and January 1875.

[Not quoted elsewhere in this article. Others will be found in the preceding letters and tables, in the following comparison, and also in the tables and remarks on pp. 189-192.]

Cranbrook.....	9·0	1st.	Leeds	4·0	30th & 1st.
Eltham	15·1	30th.	Barnard Castle	2·0	1st.
Ticehurst	12·8	30th.	Gainford, Darlington	3·0	30th & 1st.
Cambridge ...	15·0	30th.	Eastwood Hill, Glas-		
Tean, Cheadle.	5·0	31st.	gow	—3·0	26th.
Nottingham...	12·1	30th.	Ostend	15·4	29th.

Comparison of Minimum Temperatures in several Frosts.

	1860		1867		1869		1870		1874
Camden Square	6·7	...	6·7	...	20·8	...	14·0	...	18·4
Greenwich Observatory	8·0	...	6·6	...	21·3	...	9·8	...	18·2
Selborne	—1·5	...	—2·0	...	17·5	...	5·0	...	5·0
Bodmin	14·0	.	11·0	...	18·0	...	15·0	...	30·0
Orleton	3·0	...	1·6	...	10·7	...	4·5	...	8·3
Bromsgrove	0·3	.	2·3	...	7·8	...	5·8	...	4·8
Derby	2·0	...	13·6	...	15·0	...	9·0	...	16·0
Old Trafford, Manchester	—3·0	...	8·7	...	13·5	...	—	...	13·2
York	—	...	10·0	...	15·0	...	11·0	...	—
Malton	—6·0	...	6·0	...	—	...	3·0	...	1·0
Aberdeen	—11·0	...	10·2	...	17·8	...	11·2	...	12·1

Full information respecting these frosts, and some previous ones, will be found in the *Meteorological Magazine*, Vol. II., pp. 3, 11, 18, 94; Vol. IV. p. 185; and Vol. V. pp. 6, 20, 201.

A word or two respecting the "Silver Thaw" of Friday evening, January 1st. The day had, in London (and, we believe, it was similar throughout much of Western Europe), been very dull and cold; about 3 p.m. a few "ice needles"—delicate, but very sharp spiculæ of ice—fell. These changed, about 5 p.m., to clear hard crystals of ice, brilliantly refractive, but of no regular shape, and seldom more than 0·03 in. in any direction. This changed to rain about 6 p.m., though the air temperature remained below 32°, and the ground was, of course, much colder. The result was that every exposed surface and object was coated with clear ice, about 0·15 in. thick—the effect of this upon the roads, &c., may be imagined. One curious instance of the effect of the low air temperature may be worthy of record:—The bow of a bonnet was brought to us, coated with ice, and perfectly rigid therewith, the rain which fell upon it was, in spite of the warmth of the wearer, frozen into ice by the coldness of the air.

How serious were the effects in Paris may be gathered from the following translation from *L'Echo de l'Ostende*:—

"The number of accidents produced by the state of the Paris streets on Friday night is not yet accurately known, but there are already 2,023 reported at the Préfecture de Police. Many are only bruises, more or less serious; but, unfortunately, a great many falls have caused broken limbs, and there are a large number of deaths."

A MAGNIFICENT METEOR.

To the Editor of the Meteorological Magazine.

SIR,—Possibly you may be interested with the following notice of a splendid meteor which I saw last night, at 9h. 15m., while crossing the Roman Road in this road. I stood still and exclaimed aloud, "What a magnificent meteor!" and, I should think, it was visible several seconds, as I seemed to stand gazing at it for some time. The head, or nucleus, was a bright pale blue, much larger than any star, the tail a bright fiery crimson, and yellowish in the interior portion. Its shape was that of a very elongated pear, the eye in front and the stalk behind. Its first appearance was about S.E. by S., at an altitude of about 45°, and it travelled eastward, disappearing about E.S.E. at an altitude of 30°; the stars were shining brightly. You may possibly get some other notices of this meteor, and my account may serve for comparison with them.

Yours faithfully,

R. STRACHAN.

11, Offord Road, N., 15th Dec. 1874.

RAINFALL AND YIELD OF WELLS.

To the Editor of the Meteorological Magazine.

SIR,—The facts that have come under my observation up to the end of 1874, have confirmed in a remarkable manner the statements made in the letters you did me the favour to insert in the August, November and December numbers of the *Meteorological Magazine*, in which I wished to show that it was rather the condition under which rain falls, than the yearly amount, by which the subterranean water supply is ruled. The total rainfall registered by me is 21.58 in., or, in round numbers, 4.00 below the average of the last 10 or 20 years, or taking the exact figures for the 10 years, 25.81 against 21.58 in 1874. Then again the rainfall for the last three months (deducting the snow not melted) is as nearly as possible the average depth of the last ten years, whereas the well under my observation stands now 3 feet higher than at this time last year, the average alternation being 8 feet. If the thaw should be rapid, the effect on the water level will be considerable; should this be attended with heavy rain, the stock of water in the earth will, notwithstanding the short quantity of annual rainfall, be in excess of the average. This will be chiefly due to the conditions of the fall in the months of October, November, and December of the year just closed, and not to the yearly quantity.

I am, yours faithfully,

J. C. CLUTTERBUCK.

Long Wittenham, January 1, 1875.

THE ZODIACAL LIGHT, &c.

To the Editor of the Meteorological Magazine.

SIR,—Perhaps the subjoined notes will interest some of your readers. Solar halos have been looked out for every day; the northern sky has been nightly scanned for auroræ. The look-out for the zodiacal light was begun on the 10th of March, and was continued through the spring and early summer; and observations again began in the mornings on the 1st of September. So that as regards solar halos, auroræ and the zodiacal light, these observations may be safely regarded as a fair account of the number of times such phenomena have been visible here.

I may also remark that I was led to watch for the zodiacal light, not like Mr. Plummer (see monthly notices of Royal Astronomical Society, November, 1874), who has been led to suspect maxima and minima, but simply to ascertain whether in this latitude the phenomenon was frequently visible in the early mornings of autumn and winter. I never saw it very distinctly on these mornings owing to the presence of thin clouds, but portions of it were sometimes quite as bright as in the March twilight.

Parhelia were seen on May 1st.

	Halos.	Auroræ.	Lunar Bows.	Zodl. Light.
January	1 ...	4 ...	1 ...	—
February ...	2 ...	3 ...	— ...	—
March	6 ...	— ...	— ...	4
April	13 ...	— ...	— ...	—
May	7 ...	2 ...	— ...	—
June	13 ...	6 ...	— ...	—
July	3 ...	2 ...	— ...	—
August	1 ...	— ...	— ...	—
September ..	2 ...	— ...	1 ...	2
October	— ...	2 ...	— ...	6
November...	5 ...	— ...	— ...	3
December ...	— ...	— ...	— ...	—
	<hr/> 53 <hr/>	<hr/> 19 <hr/>	<hr/> 2 <hr/>	<hr/> 15 <hr/>

I am, Sir, yours truly,

JOSEPH GLEDHILL, F.R.A.S., F.G.S., &c.

Mr. Edward Crossley's Observatory, Halifax,
Dec. 17th, 1874.

REVIEWS.

Charts of Meteorological Data for Square 3, Lat. 0°—10° N., Long. 20°—30° W.

Remarks to accompany the same. Published by authority of the Meteorological Committee. London: E. Stanford. Folio and quarto.

CAPTAIN TOYNBEE has had a difficult task before him in preparing these handsome works, because he has had to please two classes of readers distinct in their wishes, ideas and modes of life, and yet two classes one of which often merges into the other; for a steadily

increasing number of our naval men are claiming a position as men of science.

We are by no means sure that anyone would have steered a middle course more judiciously than Capt. Toynbee has done, and we think that on the whole the course adopted is the best. It is quite true that for the purposes of navigation a large proportion of the information given is superfluous, but on the other hand it must not be forgotten that these very data are essential to meteorological work, and if that portion which may be described as navigational had been issued separately, many captains might have jumped to the false conclusion that that class of data was alone essential, and have grown careless in keeping their records of other phenomena. Now, however, that the complete work has been issued, we think it might be well to prepare an epitome of those portions which partake of the nature of sailing directions, taking care in the preface to call attention to the desirability of captains filling in their logs as fully as possible, and to the fact that the completeness of the larger work, and the consequent accuracy of the smaller, had been greatly increased by records of many data not mentioned in the lesser one.

We must, however, pass on to the charts. We do not attempt to tell our readers what they contain, for they are crammed so full of facts that without reprinting them in fac-simile it would be impossible to explain them. Moreover, to those who have copies such description is useless, and to those who have not, it would be little better. They appear to us very good, but we are sorry to see that the very simple plan of feathering the arrows to indicate the maximum strength of wind recorded from each point has not been adopted; to a thoughtful mind the present arrow heads express nothing more than if they were all removed, and thus an important item might have been added without much trouble, and with good effect. The shape of many of the isobars is very remarkable, and we think it would have been well had the twelve monthly diagrams been reimposed on a single page of the remarks, in order to facilitate tracing the sequence of monthly changes. It is, however, a bold step to draw isobars for hundredths of an inch from ship observations, and some eccentricity in the curves was to be expected rather than wondered at.

On comparing the data now published with some of the best previously accessible we find very satisfactory agreement. This is the case as to the surface temperatures, as given in Keith Johnston's *Physical Atlas*, except perhaps that his "Oceanic Warmth Equator" of 82° is slightly too high. The remarkable skill of Dove in drawing accurate conclusions from slight data is shewn by the remarkable agreement between the curves in his *Die verbreitung der wärme auf der oberfläche der Erde*, published in 1852, and those now deduced. The same may be said of the January barometric curves in Buchan's *Handy-book of Meteorology*, 2nd edition; but his July curves will require considerable alteration, and herein is a proof of the utility of the present publication.

It is too bad of Captain Toynbee, after the long discussion in our pages,* to spell Equatorial on the very first page of his remarks with two e's; it may be only a slip, but it almost looks like a direct intimation of his views on the orthographical question; but, if so, he might have put a foot note to explain why he holds that the termination should (unlike that of almost all words) be "oreal."

There are, of course, a few useless things in the remarks, such as the table of "Falling Stars" on p. 66, but very few, and we know few more thorough pieces of work. There are also a few statements scattered at wide intervals which make us wish that by a reference number we could ascertain who vouched for their truth—*e.g.*, in January, between 5° and 6° N. and 20° and 21°, someone reports "Heavy chain lightning; impossible to see anything for at least *ten minutes* after each flash." But there are fifty statements for which we should like to thank the observers for one which is open to adverse criticism. Here, for instance, is a capital account of a waterspout:—

10 a.m. 11th February, 1871.

A waterspout had suddenly formed within 20 yards of the ship's stern, though its formation was not noticed. It reached the water at an angle of about 30° from the perpendicular, inclining with the wind, though it seemed almost stationary. There was a clear, well-defined, inside space, like the bore of a cannon about 18 inches in diameter, very smooth and, apparently, even. Within it the water revolved rapidly, having an upward, spiral motion, and looking very much like dark smoke. The revolution was contrary to that of the hands of a watch. Its diameter seemed to be about 4 feet. There was but little commotion on the surface of the water, but much in the cloud where the spout joined it. It became disconnected near the water, and rapidly receding upwards into the cloud it soon vanished, but for some time after its disappearance much commotion and disturbance could be seen in the cloud.

Owing to the variable number of observations in different parts of the square it is only possible to determine the area in which exceptional phenomena occur most frequently by noticing the percentage of their frequency to the total number of observations; judged by this test waterspouts appear to prevail nearly equally in all *parts*, but it is not so for all months, their frequency in winter being thrice that in summer. The total number of sub-squares in which they have been reported is 40, and they are thus distributed over the year:—

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
6	3	4	1	1	2	4	1	0	5	8	5
31			9						31		

We are sorry to find in the Appendix another instance which seems likely to lend strength to the prevalent belief that it is a theory of the Meteorological Office, that whatever poor Admiral FitzRoy did was useless. Seventeen pages are devoted to a discussion of the Diurnal Range of Atmospheric Pressure, and yet the only recognition of the Admiral's work on the subject is one line and a half, *viz.*:—"The investigation is a continuation (on a larger scale) of the work undertaken in the year 1861 by Admiral FitzRoy (Seventh number of Meteorological papers)."

* Met. Mag. vol. viii. pp. 164, 167, 182, Vol. ix. pp. 8, 27.

Considering the number of years this memoir has been in preparation, and the enormously greater pecuniary resources of the office now than in FitzRoy's time, to say nothing of the progress of Meteorology during the interval, it is somewhat superfluous to state that the present discussion is "on a larger scale." On the other hand, a few words of graceful recognition of the fact, that with his far inferior resources Admiral FitzRoy and his assistant, Mr. Harvey Simmonds, had in many respects been wonderfully near the truth, would have been more worthy of both parties.

We have, however, no desire to conclude our notice in a tone of censure; it is a good work, well and thoroughly done, and, as far as we have observed, very free from misprints, and creditable to the office and its marine superintendent.

Nederlandsch Meteorologisch jaarboek voor 1870. Tweede Deel.
Oblong 4to. Utrecht: Kemink en Zoon.

OUR readers must not conclude that because the above work has only just been issued, Dr. Buys Ballot is far behind with his work. That is not the case, his completed volume for 1873 was on our table early last year, and we hope to see that for 1874 very shortly. The work before us is, in fact, a sort of appendix, and, for all that we can see, might just as well have been called Vol. II. of 1873 as of 1870. However, the title is a very trivial matter, and we gladly pass to the introduction and contents. The former is very clear and to the point; the latter, or rather 145 pages thereof, consists of a very extensive collection of mean monthly barometric values for long series of years at places mostly in Europe, but including a few outsiders such as Funchal in Madeira, and Barnoul in Siberia. As Dr. Ballot is very anxious that any errors which may exist in these tables should be detected, he has printed the monthly means and the decennial average monthly means in the scales employed by the observers, but given also the decennial average monthly means in their metric equivalents. Although at first the jumble of Paris lines, English inches, millimetres and Russian lines, and many of these with different constants thrown off, looked very unpromising, we are inclined to think that Dr. Ballot has adopted the right course, and that if he had converted all the values into any one scale, few observers would have taken the trouble to re-convert his values in order to test their accuracy. On the present plan, they must be hopelessly idle who neglect to verify the printed tables of their own observations.

The work is such a mass of figures that it requires almost as much care in revision as a table of logarithms, and among the hundreds of thousands of figures a few are sure to be wrong; we hope, however, that in page 36 (which we chose hap-hazard as a test) we have fallen on a bad specimen, for, truth to tell, there are three misprints, 1788, August, 30.04 should be 30.00; 1797, May, 29.99 should be 29.93; and 1799, February, 29.81 should be 29.80. There are some very

wide differences between the values given by Dr. Ballot for Sandwich on p. 70, and those given in Dr. Clouston's paper (page 90) in FitzRoy's *Fifth Number of Meteorological Papers*. We do not know which are correct, but both cannot be.

We are painfully aware of the difficulty of doing that perfectly which Dr. Ballot has attempted; he has our best wishes for his success, but we doubt if he has realized the necessity which increasingly exists for keeping down the quantity and improving the quality of meteorological work. Dr. Ballot is very frank in his acknowledgment of the sources of his information, and is well known to be most liberal with his publications; may we suggest that as probably nearly all the contributors of data have received copies of the work before us, it would be well to send a circular to each, informing him that the tables were undergoing final revision, and that any corrections he might forward within two months would be duly noted, and that for all errors not so reported the observers must be held responsible.

We hope that further examination may prove that our selection was exceptionally unfortunate, and that nothing more than a short table of errata is necessary; but, if otherwise, we should very much like to see the decennial averages 1861-70 corrected for altitude, and thrown into a single series. Of course, for Dr. Ballot's special purpose this is not necessary, but he has collected so fine a series of records that we desire to see them utilized in every possible way.

The latter portion of the volume contains the elaborate rain tables, well known to all readers of the *Jaarboek*, and also a reprint of the table of Scotch rainfall, given by Mr. Buchan, in the *Quarterly Journal of the Scottish Meteorological Society*, vol. iii. p. 254, but converted into metric equivalents.

BOOKS RECEIVED.

GREAT BRITAIN.

CAMPBELL, MAJOR W. R. E. A Suggestion for the Flood Relief of the Shannon, *via* Belhaven. Fcap. folio. Dublin, 1874.

Cardiff Naturalists' Society Report and Transactions. Vol. v. 1873. 8vo. Cardiff, 1874.

DONCASTER, D. Mean Monthly Temperature at Sheffield for 1874, as compared with the average of 20 years, 1852-1871, inclusive. Single sheet.

DONCASTER, D. Mean Atmospheric Pressure for 1874 at Broomhall Park, Sheffield, compared with the average of 20 years, 1852-1871. Single sheet.

DONCASTER, D. Total Monthly Rainfall at Broomhall Park, Sheffield, for 1874, compared with the average of 20 years, 1852-1871. Single sheet.

Kew Committee Report for the Year ending October 31, 1874. 8vo.

FRANCE.

BORIUS, M. LE DR. A. Recherches sur le Climat du Sénégal. Ouvrage accompagné de tableaux Météorologiques, de 14 planches dans le texte et d'une Carte du Climat et de l'état sanitaire du Sénégal suivant les Saisons. 8vo. Paris: Gauthier-Villars. 1875

BORIUS, M. LE DR. A. Gorée (Sénégal) Observations Météorologiques faites pendant dix années 1856-1865, par Mm. les Pharmaciens de la Marine. [From *Annuaire Soc. Mët. de France*.]

MARIE-DAVY, M. Bulletin Mensuel de l'Observatoire de Montsouris, Sept. to Nov. 1874. 4to.

DECEMBER, 1874.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which ≥ 1 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.				Deg.	Date.	Deg.	Date.	
													inches	inches.	in.
I.	Camden Town	1.58	+ .08	.52	8	14	53.8	6	18.4	23	21	26	
II.	Maidstone (Linton Park).....	2.95	+ 1.12	.64	17	15	52.0	6, 7	12.0	31	27	...	
III.	Selborne (The Wakes).....	3.32	+ .57	1.04	8	14	56.0	11	5.0	31	25	27	
IV.	Hitchin	2.07	+ .76	.62	8	18	48.0	6	13.0	29	28	...	
V.	Banbury	1.81	+ .14	.47	8	15	50.0	6	13.3	30	27	...	
VI.	Bury St. Edmunds (Culford).....	2.17	+ .68	.61	6	14	51.0	6	6.0	31	26	30	
VII.	Bridport	4.07	+ .70	.86	23	15	55.0	6	20.0	3, 23	23	...	
VIII.	Barnstaple	7.10	+ 3.98	.76	29	22	54.0	6, 7	24.0	23	...	...
IX.	Bodmin	7.26	+ 2.02	.90	10	26	52.0	6	30.0	3	9	13	
X.	Cirencester	2.78	+ .49	1.00	8	7	...	...	...	...	...	...
XI.	Shifnal (Haughton Hall)	2.43	+ .75	.64	15	14	49.0	6	14.0	31	26	28	
XII.	Tenbury (Orleton)	2.83	+ .37	.85	15	16	53.5	6	8.3	31	23	27	
XIII.	Leicester (Belmont Villas)	1.72	...	.36	8	14	50.5	8	12.8	29	26	...
XIV.	Boston	2.71	+ 1.22	.56	7	16	50.0	8	8.0	30	24	...	
XV.	Grimsby (Killingholme)	2.65	...	.56	8	22	49.0	8	11.0	30	22	...
XVI.	Derby	1.90	+ .35	.30	8	13	50.0	8	16.0	23	24	...	
XVII.	Manchester	3.64	+ 1.31	.59	5	19	49.5	8	13.2	...	...	...
XVIII.	York	3.35	+ 1.55	...	...	...	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	5.71	+ 1.16	1.57	8	13	...	...	2.0	31	20	...
XX.	North Shields	3.79	+ 1.59	.90	8	23	50.0	4, 5	6.8	30	23	30	
XXI.	Borrowdale (Seathwaite).....	7.34	+ 9.61	1.26	4	12	...	...	...	...	...	...
XXII.	Cardiff (Ely)	5.66	+ 3.06	1.05	8	14	...	...	...	...	...	...
XXIII.	Haverfordwest	8.09	+ 3.26	1.65	8	20	51.0	4, 5	11.3	30	22	24	
XXIV.	Rhayader (Cefnfaes).....	3.17	+ .12	.90	11	...	...	...	10.0	30	...	...
XXV.	Llandudno	4.43	+ 2.23	.95	5	19	54.2	8	21.6	31	10	...	
XXVI.	Dumfries (Crichton Asylum) .....	...	...	...	...	...	...	...	...	...	...	...
XXVII.	Hawick (Silverbut Hall).....	2.81	...	1.04	8	15	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill).....	1.84	...	.44	5	10	48.6	5	18.0	24	26	29
XXIX.	Castle Toward	2.28	+ 3.07	.40	12	12	50.0	4, 5	...	25	...	...
XXX.	Leven (Nookton)	2.02	+ .76	.39	8	15	49.0	4	8.0	29	29	30	
XXXI.	Stirling (Deanston) .....	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Grandtully	1.09	...	.14	9	13	...	...	...	...	...	...
XXXIII.	Braemar	1.42	+ 2.35	.25	11	18	42.8	5	5.0	29	29	31	
XXXIV.	Aberdeen	2.76	...	.42	21	22	47.5	4	12.1	23	28	30
XXXV.	Loch Broom	4.35	...	.73	10	18	...	...	...	...	...	...
XXXVI.	Portree	4.51	+ 11.12	.61	17	23	...	...	...	...	...	...
XXXVII.	Inverness (Culloden)	1.02	+ .91	...	...	20	50.0	4	14.1	31	28	31
XXXVIII.	Helmsdale	3.79	...	.62	2	23	...	...	...	...	...	...
XXXIX.	Sandwick	3.44	+ .53	.58	3	22	49.8	4	22.4	31	15	22	
XL.	Caherciveen Darrynane Abbey	8.17	...	1.15	23	21	...	...	...	...	...	...
XLI.	Cork	5.15	...	1.10	31	21	...	...	...	...	...	...
XLII.	Waterford	4.68	+ .26	.90	28	19	50.0	4, 5*	27.0	15	19	...	
XLIII.	Killaloe	7.99	+ 4.30	.95	5	23	...	...	...	...	...	...
XLIV.	Portarlinton	3.41	+ .22	.49	6	22	51.0	8	23.0	16	24	...	
XLV.	Monkstown, Dublin .....	...	...	...	...	...	...	...	...	...	...	...
XLVI.	Galway	5.83	...	1.14	10	24	53.0	8	25.0	27	18	...	
XLVII.	Ballyshannon	4.55	...	.67	5	17	...	...	...	...	...	...
XLVIII.	Waringstown	3.24	...	.64	8	16	51.0	4	19.0	22	27	29
XLIX.	Edenfel (Omagh)	4.28	...	.74	8	18	46.0	8	17.0	30	27	...

* And 7, 8. + 31. ± 30. § 27. ** 20
 + Shews that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON DECEMBER.

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.

LINTON PARK.—A very wintry month; frost on every day, except 1st, 6th, 9th, and 12th, and the ground deeply covered with S on the 16th, and to the end of the month, with severe frosts on the 3rd, 20th, 23rd, 30th, and 31st, the last two days especially; the ther. fell to 12° which is lower than on any previous occasion here for 25 years, excepting Feb. the 10th, 1855, and Jan. 1867.

SELBORNE.—A most inclement month; the death-rate very high, even for Dec. The min. ther. lower than I have recorded it in December for 12 years. The max. also lower, than in any Dec. but 1870. The average min. during the last 10 days of the month was only $19^{\circ}03$. The S has lain deep on the ground from the 16th to the end of the month; prevailing winds from 14th to 22nd, N. and N.E., before that date S. and S.W. On the 31st the ther. fell to 5° , at 5 p.m., at this station; at E. Tisted, four miles distant, it fell to 1° . Frequent fogs and white frosts during the month.

BANBURY.—On the 23rd the rime on the trees very beautiful, resembling pure white coral.

CULFORD.—An exceedingly cold month; mean temp. being only $30^{\circ}5$. Gale of wind, with R, on 6th; and very stormy on 8th and 9th. Bar. very low about the 11th. S on eight days. Heavy fog on the 28th, and the trees, &c., festooned with hoar frost to an unusual degree on the last two days. The temp. fell to 7° on the 29th, and to 6° on the 31st.

BRIDPORT.—The fall of S on the 30th is almost unprecedented; it was universally 1 ft. deep, and in many places, on the hills, 5 or 6 ft. deep. A thaw set in on new year's day, accompanied by heavy R, which caused the highest floods known for years, and doing some damage to property.

BODMIN.—The mean temp. $38^{\circ}0$, being $4^{\circ}3$ below the average, and the rainfall of the month 2.28 above the average of 25 years. No S has fallen in Bodmin, and the frost as compared with other parts of the kingdom has been slight; the temp. falling only as low as $30^{\circ}0$ on one day, the 3rd.

HAUGHTON HALL.—This has been the most severe Dec., both for frost and S, that we have had for 40 years (the period of my registration); the nearest approach was in that of 1844, when the average min. temp. was 29° (against $26^{\circ}5$ this month); the S then was only 4 in. deep, whereas now it has been 9 in., on the night of 15th, followed by 3 in. on 23rd, and 1 in. on 27th. The ice on Christmas day was 6 in. thick. R daily, except on 2nd and 9th, till the 13th. The bar. fell suddenly from 29.47 to 28.34, on the 8th, followed by a storm on that night; it then rose to 29.34, falling again on the 11th to 28.32, with no result till the 15th, when 9 in. of S fell in that night (melting into '64). From that day the frost was intense daily till the close, when at night the ther. stood at 14° . Only one day with sunshine; from the 21st, mist and fog.

ORLETON.—The temperature variable, with severe frost occasionally till the 14th, when winter set in; on the night of the 15th a great fall of S covered the ground 10 or 11 in. deep where it was not drifted, and remained without any steady thaw till after the end of the month. Another heavy fall of S and R occurred on the night of the 23rd. From the 15th to the end of the month the sky was generally cloudy, and the frost severe and steady. The mean temp. of the month was about $7^{\circ}5$ below the average, and lower than that of any Dec. (except 1870), for the last 18 years. The bar. was very low (28.40 uncorrected) on the 11th. The downfall was chiefly S.

LEICESTER.—Very severe weather, especially during the latter part of the month. Mean temp. $31^{\circ}6$. Bar. (reduced) 28.654 on 11th. Max. temp. on 29th 27.2 ; min. 12.8 ; mean 20° . Max. temp. on 30th 25.5 ; min. 14.5 ; mean 20° . Max. temp. on 31st 25.0 ; min. 13.2 ; mean $19^{\circ}1$.

BOSTON.—Mean temp. of month $8^{\circ}0$ below the average of previous 10 years.

A sharp frost set in at the beginning of the month, followed by a few days of higher temp. The cold weather set in again on the 18th, and continued to the end of the month; the temp. falling to 8° on the 30th. The river Witham commenced running again on the 4th, after several months' cessation. Rainfall for the year 4.16 below the average.

GRIMSBY.—A month of real winter weather, which was very severe at times, especially at the end of the month, but we had no high winds. Many birds starved to death. The temp. on the 1st of Jan., 1875, was as low as at the remarkable Christmas day, 1860, viz., 6.5; but the min. of this Dec. was 11° 0 on the 30th. The highest temp. on the day preceding was only 24° 5. Several redwings found starved to death on the 26th. Wild swans in the Humber on the 29th.

MANCHESTER.—Frequent R and S. Dense fog on 10th and 30th, and less dense on 23rd, 25th, and 26th.

ARNcliffe.—A very severe month; the longest continuance of frost ever registered here; deep S ever since Nov. 11th; a very wild night on the 8th, with 1.57 of R, the max. of the month.

WALES.

HAVERFORDWEST.—The month was cold from beginning to end, and very wet; much S fell; first fall about the 14th, which never melted from the high lands till the end of the month. Heavy snowstorm commenced at 3 a.m. on 29th, and lasted through the next day and night, followed by intense frost, and a gale from E.S.E., during which the S drifted to the depth of several feet; the frost was not severe till the last week of the month. A terrible gale occurred on the 8th and 9th, with great depression of the bar.; it fell from 30.019, 9 p.m., on 7th, to 28.651, at 9 p.m., on 8th. Great floods; heavy gale on the night of the 31st. Min. temp. 11.3 on 30th.

LLANDUDNO.—A cold month; mean temp. 37° 7, being 7° 8 below the corresponding month of last year, and 5° 7 below the average, 1861 to 1873, both inclusive; during these 13 years the mean temp. of Dec. never fell so low, except on one occasion (1870), when it reached 36° 5. No frost the first half of the month, and never more than a sprinkling of S, except on the distant hills.

SCOTLAND.

HAWICK.—A month of S, H, fog, frost and stormy winds. Hills white from the first to the last of the month; farmers at their wits' ends for food for their stock.

ANNANHILL.—A month characterized by a specially low temp.; a frost which for severity has not been equalled since 1860; a deficient rainfall. Winds light, except a severe gale on the 7th, and chiefly E. and N.E. But little S here; the hoar frost very beautiful, forming into unusually large ice crystals which glittered on the ground. Number of deaths this year 762, the highest number since the Registration Act came into force.

CASTLE TOWARD.—But little R or sun; S on the 11th, about 3 in. deep near the sea, and very deep on the hills. On the 15th and 16th another fall, about 2 in. deep, followed by very hard frost; lowest temp. 17°. Ice 4 in. thick from the 22nd to end; frequent fog on land, and still more dense on the water. River steamers delayed with the mails.

ABERDEEN.—A month of bitterly cold weather, the ground round Aberdeen white with S on 25 days. Rain, bar. and temp. all below the average, the latter being 6° 1 below the mean of 18 years.

PORTREE.—The month has been the most severe ever experienced here; the frost is most intense, everything is frozen up into a sheet of ice. The sheep are ill off, they cannot scrape any food for themselves.

SANDWICK.—With the exception of four partial thaws, we have had frost and S during the whole of December, which is unprecedented in our insular climate, and caused by the absence of W. wind. The roads are like glass; several severe accidents have occurred from falls. The strongest gale was on the 4th—68 miles an hour. T and L on the 5th.

IRELAND.

DARRYNANE.—1st and 2nd, fine and frosty, with N.E. winds ; 3rd to 12th, N.W. winds and showery, except on 10th, when the wind was S.E. ; fresh gale and heavy sea on 11th and 12th ; 13th to 31st, winds moderate and variable, chiefly N. S on mountains on 13th, 17th and 31st, a good deal on the last day ; H on 6th, 9th (heavy) and 16th ; frost on 1st, 2nd, 14th, 17th, 26th, 27th and 28th.

WATERFORD.—Great storm on the 8th.

BALLYSHANNON.—The month has been an unusually severe one. Falls of S, frequent frost, storms and E alternating, and the temp. throughout considerably below the average. Gale from N.N.W., T and L and showers of sleet on 6th, and a strong gale from E.N.E. on 31st.

WARINGSTOWN.—Early part of the month wet ; frost set in on 13th, and, with occasional intermission, lasted to the end, but was never very intense ; little or no S lay here.

EDENFEL, OMAGH.—Weather to 10th very wet, and inclement the remainder of the month ; chiefly hard frost with S except during frequent short intervals, when rapid variations in temp. occasioned heavy E, to be again immediately followed by frost.

SUPPLEMENTARY TABLE OF MONTHLY RAINFALL,
DECEMBER, 1874.

Div.	County.	Station.	Total Fall.
			in.
II.	Kent	Margate (Acol)	2·45
"	Sussex	Hailsham	2·40
"	Hampshire	Strathfield Turgiss	1·68
III.	Oxford	Oxford (Magdalen College)	1·88
"	Cambridge	Cambridge (Merton Villa).....	1·89
IV.	Essex	Harlow (Sheering Rectory)	1·73
"	Norfolk	Swaffham	2·23
V.	Devon	Teignmouth (Brookbank)	5·17
"	"	Torrington (Langtree)	6·29
"	Somerset	Taunton (Haines Hill)	3·35
VII.	Leicester	Melton Mowbray (Coston).....	1·89
"	Lincoln	Horncastle (Bucknall)	2·34
VIII.	Lancashire	Liverpool (Walton-on-the-Hill) ...	2·70
IX.	York	Wakefield (Stanley Vicarage)	2·30
X.	Durham	Gainford	3·70
"	Westmoreland	Shap	3·48
XVII.	Banff	Keith	2·78
XVIII.	West Ross	Strathconan	4·21
XX.	Cork	Fermoy (Glenville)	7·31
XXI.	Westmeath	Athlone (Twyford) ..	4·44
XXII.	Galway	Ballinasloe	4·17

NOTE. *Gainford*, Observer reports that his return for September should have been 2·56, and for October 1·96.