

SYMONS'S

MONTHLY

METEOROLOGICAL
MAGAZINE.

VOLUME THE FOURTH.

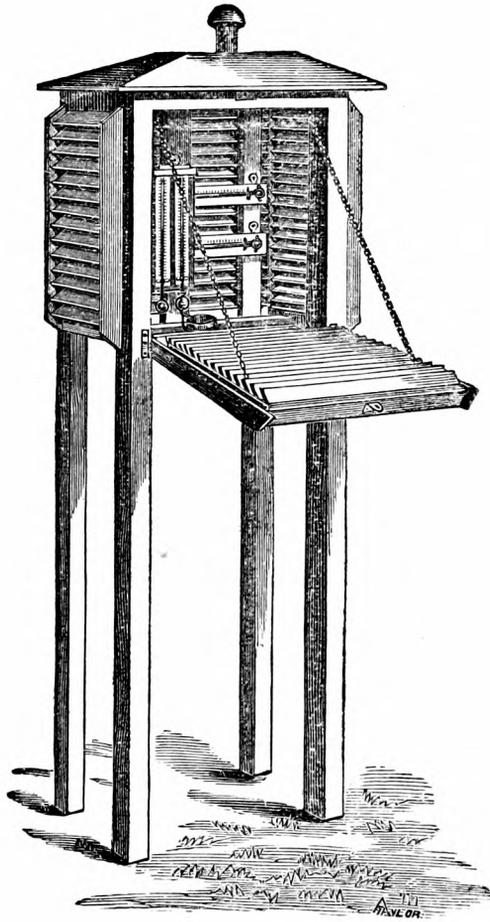
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1869.  
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AND ALL BOOKSELLERS.

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STEVENSON'S THERMOMETER STAND.
[See page 2.]

SYMONS'S
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XXXVII.]

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INTRODUCTORY.

It has been our practice, in each preceding volume, to prefix a few words, by way of introduction, greeting, or prospectus. The plan may be unusual, may be open to some objections, but to us it seems more worthy of retention than abandonment. It calls upon us to review the volume completed, and to gird ourselves for new efforts in the forthcoming one. It calls upon our readers to remember that the progress of any branch of science depends in part upon the publications devoted to it—that if they are independent and progressive, the science is far more likely to advance, than if they are lethargic or dead. We rejoice to know that the *Meteorological Magazine* commences its fourth volume with an increased staff of correspondents, with a steadily increasing circulation, double its original size, and copiously illustrated. We never made promises of the grand things we would do, and we leave our past to indicate our future. In conclusion, we would remind our readers that the progress of a scientific periodical very much depends upon themselves; if they are prompt in supplying local information, and in pointing out any errors, editorial or otherwise, it will tend to keep the whole staff up to their work; and if they, by their recommendation, still further increase the circulation, they will soon find a corresponding increase in the quality and quantity of its contents.

THERMOMETER STANDS.

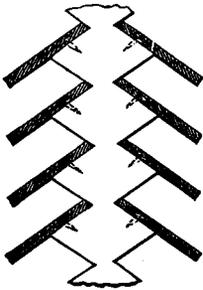
At last we are approaching the termination of our long series of descriptive articles. The entire set at Strathfield Turgiss includes varieties of mounting briefly designated by the following names, which may be grouped in three columns—

Already described.	Described in this Number.	To be described.
Lawson's Glaisher's Martin's James's Morris's	Stevenson's Stow's Griffith's	Welsh's = Kew. Pastorelli's 13 feet, <i>i.e.</i> elevated Aspirated.

We therefore hope to conclude the individual descriptions in our next, and to proceed to details of the very important experiments now in progress.

STEVENSON'S STAND

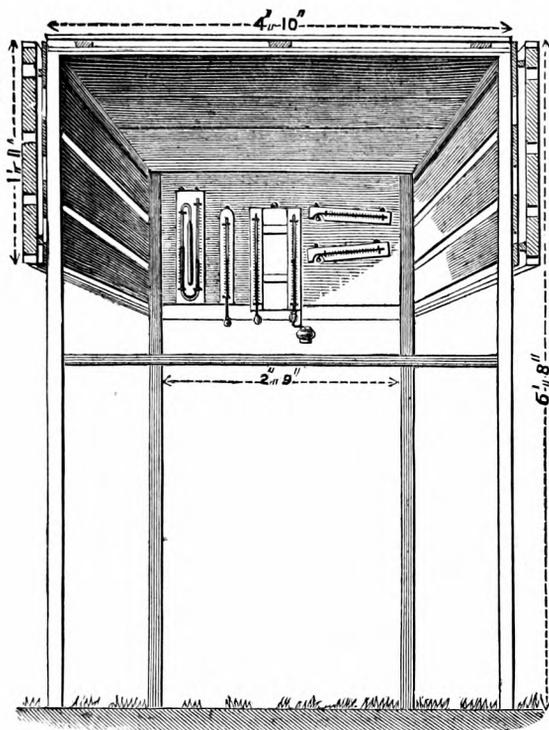
Is represented on the frontispiece, the northern side being shown as let down when observations have to be taken—ordinarily the north side is up like the other three, and the thermometers are thus protected most infallibly from any possible solar rays; the top of the box is solid, to keep out the rain; the small capped chimney prevents the accumulation of heated air, and the bottom is perfectly open; the venetians are fitted by the ingenious plan shown in the annexed figure, and the thermometers hung as shown in the frontispiece.



Refraining as we have hitherto done from forming any opinion on the merits of any of the stands, we cannot help most heartily approving the arrangements connected with this pattern, namely, that the manufacture is in the hands of one firm, that the dimensions are all settled, the materials, construction, and price, uniform in every respect, so that there is no room for doubt or uncertainty. It may be a good pattern, it may be a bad one, but this much is certain, that wherever a Stevenson's stand is used, we must always have the same corrections, if any, to apply.

GRIFFITH'S STAND.

Mr. Griffith desires to explain that his stand was not intended for competition; it was like scores of others, an original design, because at the time of its erection no other pattern was known to him. It is brought into the competition by the fact of the other stands being all congregated in the rectory grounds, and because the extreme simplicity of its shape renders it one of the cheapest forms of stand, and one which any village carpenter could readily construct. It consists, as will be seen, of double boards with intervening spaces, and at the back



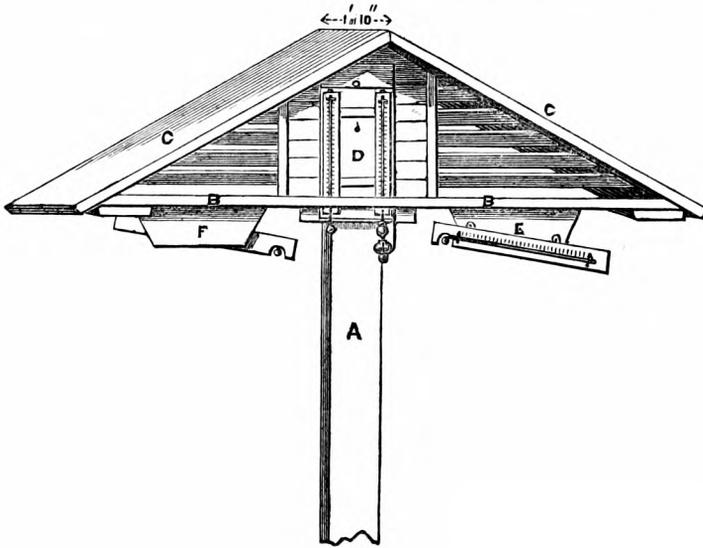
A. V. O. R.

of triple boards, also separated by air spaces ; the sides are brought so far forward as to prevent either morning or evening sun ever reaching the thermometers.

The stand also has a flat board, one inch thick, painted white below, fixed a few inches below the bulbs of the thermometers, indicated in the sketch by a shaded line drawn across from the one outer post to the other, to prevent heat being radiated or reflected from the ground to the bulbs of the instruments ; this board covers the whole space enclosed by the four outer posts. The two thermometers on the right of the stand are not in immediate contact with the wood, large holes being bored in their rear to admit freely the air after it has passed the two outer sheltering screens. The board to which the thermometers are affixed is set back about two feet from the outer front and wings.

STOW'S STAND.

This stand may be considered a modification of that invented by Mr. Glaisher, the thermometers being placed in the same positions relatively to each other, and exposed, as in the Glaisher stand, to a perfectly free circulation of air. It was contrived about two years ago by the Rev. F. W. Stow, M.A., F.M.S., and has been in constant use since. It is generally expedient that the designers of new things should themselves describe them ; we have therefore prevailed on Mr. Stow to favour us with the following :—



Referring to the engraving, A is a stout post, firmly fixed in the ground, and steadied by lateral supports. It is narrowed to a circular rod of $2\frac{1}{2}$ inches diameter from the point where it passes through the horizontal board (B), and its upper end, on which the weight of the stand principally rests, is inserted in a block of wood placed in the angle of the boards (c c). The whole frame turns upon the post (A), but though a convenient arrangement, it is not absolutely necessary that it should turn at all. (B) is a board of full half-inch deal, 4 ft. long and 1 ft. 10 in. or 2 ft. wide, through the centre of which the post (A) passes. It is 4 ft. 3 in. above the grass. Upon (B) are fastened the boards (c, c) of ordinary half-inch deal and of the same width as B, at an angle of 30° , so as to meet at a point 1 ft. above B. At the back, which is the sunny side, wide laths are placed across from one of the boards (c) to the other, sloped at an angle just sufficient to throw the rain outwards, and to prevent the sun's rays from falling on the board (B), while the breeze is allowed to pass freely through. At the front similar venetians are placed, but space is left open in the centre, to allow the scales of the dry and wet bulb thermometers (D) to be seen. These instruments are either screwed at the top to the block in the angle of the boards (c, c), or fastened on a frame which is suspended from the block. Their scales are above the horizontal board, but the lower part of their stems passes through it, and the bulbs are 3 inches or nearly so, below it. They are arranged on either side of the post (A) and at least 2 inches in front of it. (E) is a piece of wood screwed to the bottom of the board (B), and carrying the maximum thermometer; (F) is a similar piece of wood carrying the minimum thermometer. These thermometers are hung upon brass screws, and their bulbs project, as will be seen, considerably beyond the pieces of wood. (E) and

(F) are not placed at the front of the stand, but at half the width of the board (B) from it. Thus the maximum and minimum thermometers have their bulbs as nearly as may be under the centre of the board (B), and 3 inches below it. It is not necessary, as in the Glaisher stand, that one of them should be made with the bulb at the reverse end. In the engraving the minimum thermometer is represented as placed on the other side of (F), and is read with facility from the back of the stand. It may be desirable, in a very open situation, to extend the venetians a little below (B), or to fasten a strip of deal to it, as in the Glaisher stand, projecting downwards a couple of inches (but so as not to interfere with the easy reading of the instruments), in order to shut off the rays of the sun at sunrise and sunset. But it will generally be sufficient to turn one end of the stand towards the sun.

Thus placed under the centre of a horizontal board, which is itself screened from the direct rays of the sun, the thermometers are supposed to be well protected from solar heat, while at the same time they are exposed to a free circulation of air.

The peculiar advantages claimed for this kind of stand, besides those mentioned, are :—

1. Complete protection from rain, as well as from radiation at night.
2. It is not necessary to turn the stand, which is a boon at least to those who have other occupations.
3. Ozone papers may be hung from the under surface of the horizontal board, without the use of a cage.
4. It is perhaps less unsightly than some stands, looking in a garden no worse, at all events, than a huge mushroom !

To the Editor of the Meteorological Magazine.

SIR,—Your correspondents, Mr. Smith of Hampstead, and Mr. Freeman, have done good service in directing attention to what one may call the weak point of nearly all the thermometer stands now in general use—viz., the tendency, when solar radiation is very powerful, to show a temperature much above that of any ordinary shade.

Mr. Smith, in the magazine for December, tells us that “on comparing his weekly maxima with those of Greenwich during the hot dry weather of last summer, he found that if the maximum fell on a bright sunny day, the Greenwich temperature was several degrees above his, while if the sun was less powerful, they were much more nearly together,” and, in further corroboration of this view, points out similar discrepancies between the maxima recorded at Greenwich and those at Kew.

I may perhaps be allowed to state that I observed precisely the same thing last summer on comparing my own observations with those of my neighbour, Mr. Lowe, of Beeston. You will of course understand that I am not for one moment putting my observations into competition with those of Mr. Lowe as regards accuracy, but merely

pointing out discrepancies arising from differences in the position of the instruments. Nor am I one of those who allow myself to be prejudiced against the existing forms of thermometer stands from a preference for a so-called natural standard of shade, as distinguished from an artificial and arbitrary one. I am aware that natural shade may admit of almost any amount of variety, and that any standard that may be adopted, if it is to be a uniform one, must be more or less arbitrary. And if the Glaisher or any other stand should eventually receive the deliberate sanction of those most competent to pronounce an authoritative decision, I for one would bow to that decision, as an alternative at any rate preferable to the present state of anarchy, as some one has well termed it.

At the same time, I think it is only right, while the matter is still *sub judice*, to point out what seems to me an obvious defect in nearly all the stands now in general use. I see that your correspondent Mr. Smith is disposed to attribute the extreme temperatures registered in these stands to reflection from the ground, but I believe they will be found to be due to that accumulation of heat which must necessarily take place in and around any small structure of wood exposed to the full blaze of a powerful sun, even though the instruments themselves may be carefully shielded from its rays. Might not this be remedied by some combination of the Glaisher with the Martin stand, described in your December number?

I only throw out this as a suggestion, and am quite willing to wait for Mr. Griffith's report, from which I look for much interesting and valuable information on this point.—Yours truly,

G. T. RYVES.

Nuthall, Nottingham, February 3rd, 1869.

MEAN TEMPERATURE.

To the Editor of the Meteorological Magazine.

SIR,—The following results are deduced from “Meteorological Observations made at the Private Observatory of J. Tebbutt, jun., for the Peninsula, Windsor, New South Wales, for 1863, 4, 5, and 6,” recently published at Sydney:—

Mean of Maxima and Minima	63°
Mean of daily observations at 9 a.m. (62°·5), 3 p.m. (72°·5), and 9 p.m. (58°·4)	64°·5
Mean ditto 9 a.m., and 9 p.m.	60°·5

Will any of your contributors oblige me by saying what he considers the most approved and correct method of deducing the mean temperature of Windsor from those data?

If the formula applicable to three daily observations, given in Mr. Glaisher's “Diurnal Tables,” be adopted—viz., $\frac{64^{\circ}\cdot 5 \times 3 + 63 \times 2}{5}$ the result would be 64°, or the mean at 9 a.m. and 9 p.m. + 3°·5.

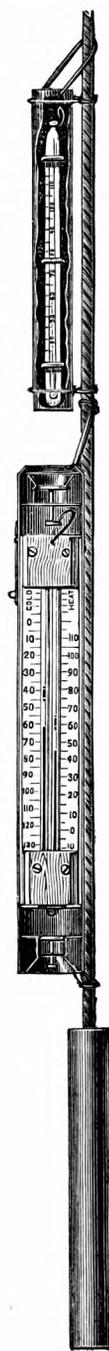
Your obedient servant,

D. A. FREEMAN.

Upper Tooting, S. W., Jan. 13th, 1869.

TEMPERATURE OF THE EARTH AT GREAT DEPTHS.

THE thermometers employed at Kentish Town are shown in the annexed engraving. They are all (as indeed was the whole of the apparatus) constructed by Mr. Casella, and their performance is perfectly satisfactory. Inasmuch as the temperature rises gradually downwards, it had been rightly decided that the most suitable thermometer would be one registering the maximum reading, and accordingly the committee of the British Association recommend the form of instrument shewn at the top of the engraving. It is a small and very delicate maximum mercurial thermometer, on Professor Phillips' principle, hermetically enclosed in a glass tube, containing a small quantity of alcohol, and protected from jarring against the tube by collars of cork. The tube itself is enclosed in a tin or copper case, and protected from fracture by india rubber collars. The lower thermometer is of the pattern invented in 1780 by Six, of Canterbury, and registers both maximum and minimum, as well as showing present temperature; it is provided with a copper case, having valves opening upwards top and bottom, so that on being lowered into water a stream passes upwards through it, and directly the thermometer is arrested in its descent the valves close, and the water then in it is raised to the surface. This is the pattern of instrument used for deep sea observations in the Royal Navy, and Mr. Symons added it to that recommended by the British Association committee, to compare their relative merits. He finds, as might have been foreseen, that the Six's is much more sluggish in its action, but that if time is given they agree perfectly. The great difficulty with registering instruments which have to be raised and lowered any considerable depth is in the slipping of the indices. In the Six's thermometer we have two tubes side by side, each containing an index, both of which, as tested by a magnet, are held by the springs with equal firmness; if then the indices be set, say the minimum at $46^{\circ}2$, and the maximum at $46^{\circ}3$, (there is generally a difference of 0.1 or 0.2 of index error between the columns), and the instrument be sent down into a temperature of $58^{\circ}0$, the indices after lowering and raising



should show, minimum $46^{\circ}2$, and maximum $58^{\circ}0$; if one has not slipped, *probably* the other has not. And if we further find that the Phillips', attached within four inches of the Six's, comes up also showing $58^{\circ}0$, the probability becomes a certainty, and within a range of $0^{\circ}2$ this agreement has always been found at Kentish Town, whence we conclude that the values thus obtained in duplicate must be correct. An iron sash weight is attached below the thermometers to ensure the tautness of the lowering line.

The mode of observing adopted at present is weekly; for instance, on January 22nd, the thermometers were set at the following temperatures:—

Phillips' max.	$39^{\circ}8$
Six's max.	$41^{\circ}9$
,, min.	$41^{\circ}9$

And they were lowered to a depth of 200 ft.; on the 29th they were raised and read—

Phillips' max.	$53^{\circ}6$
Six's max.	$53^{\circ}3$
,, min.	$42^{\circ}0$

There is a constant difference of $0\cdot3$ between the temperature registered by the two thermometers, due to index error, which being allowed for, they never differ more than $0\cdot1$. After reading on the 29th, they were cooled down to about 48° , and then lowered to 250 ft.—a week being allowed to take up the true temperature at each successive lowering, which is increased weekly by 50 ft. Subsequently observations will be taken on one or two days at various depths and short intervals of time.

In the observing room there are also a pair of standard thermometers, to afford some guide as to the probable influence of cold air descending the tube and well—a source of error not readily overcome and hitherto, so far as we know, neglected, though clearly pointed out in the note on terrestrial temperature, given by Professor Bravais in that marvellous treasury of information, “*Patria*.”* Supposing the tube hermetically closed and free from water throughout, there would still be continuous currents, for a cubic foot of air near the top—say at 51° —would weigh 525 grains and one near the bottom—say at 61° —would weigh only 514 grains, a difference of 11 grains; this is assuming the air saturated with moisture; the difference would be the same whatever its hygrometric condition. Therefore the upper air, by reason of its greater specific gravity, must fall to the bottom, be warmed, and so being rendered lighter, must in its turn ascend, to be again cooled, and so on *ad infinitum*. The same holds good of such part of the tube as is filled with water—stagnant water we may term it, as distinguished from a running stream, but decidedly not stagnant

* *Patria—La France Ancienne et Moderne, Moral et Materielle, ou Collection Encyclopédique et Statistique de tous les faits relatif a l'Histoire Physique et Intellectuelle de la France et ses Colonies.* 2 vols. Paris, 1847.

in the ordinary acceptation of the term, because liable to exactly the same influences as the air. In that part of the tube occupied by air the influence of varying temperature will be partially reversed by the pressure of the superincumbent column of air.

These effects must complicate the results obtained, but it is quite probable their elimination is possible ; if the known laws of fluid motion are not adequate to their solution, there are several means by which the velocity of these currents might be examined, some of them very inexpensive.

The following letter so well describes the arrangement Mr. Symons had adopted for noting the varying depth of water, that it may stand in lieu thereof, with the exception that inasmuch as the diameter (8ft.) and depth (600 ft.) of the Kentish Town Well are so large, it is crossed at various depths by beams, which support the tube, and these are very much in the way of the line from the float, which cannot have an unimpeded path in any part of the well, hence of course friction is entailed.

To the Editor of the Meteorological Magazine.

SIR,—In reading your interesting article on the operations you are carrying on at Kentish Town, it struck me that you might perhaps like to have a description of a very simple plan I have had in operation for the last two years and a half, for ascertaining the daily rise or fall of water in wells. Observations on this subject being required during the last visitation of the cholera, it occurred to me that the simple application of an organ tell-tale would be the readiest mode. Accordingly, having ascertained the depth of the well, and the height of the water in it, I let down an empty bottle, well corked, as a float, (a champagne bottle is best, because it is heavy and large at the bottom), by means of some copper bell-wire. This wire was brought to the surface through three feet of common lead gas-piping, and joined to a small brass chain, which was made to pass over a pulley fastened to a wall, pump, or post, over the well, the other end of the chain having attached to it a leaden weight, nearly equivalent to the bottle. This weight playing on a scale of measurement, tells at a glance the exact depth of water in the well. We have three wells which are thus daily gauged ; their several depths (all in new red sandstone), are $22\frac{1}{2}$, 21, 18 feet. On November 7th, 1866, they severally contained 6 ft., 7 ft. 3 in., and 3 ft. of water. On the 5th of last November the third well was quite dry, the second contained only a few inches of water, and the first 18 inches. On the following day there were symptoms of a change, and since then the water has steadily increased at an average rate of two inches daily. I shall take care to note down the highest point reached between this and the next dry season.

I am, Sir, yours faithfully,

FREDERICK SILVER, F.G.S.

Norton-in-Hales, Salop, January 27th, 1869.

CHRONICLE OF THE MONTH—JANUARY.

1st.—At 0h. 30m. p.m., a meteor burst with a loud explosion, near Upsala, in Sweden, and many fragments were picked up.

2nd.—Snow in many parts, especially in Yorkshire.

3rd.—A south-westerly gale swept away all the snow, and produced slight floods in some places.

4th.—Earthquake shock reported from Weston-super-Mare (Somerset), and Alton (Hants); time about 9.7 a.m.

5th.—The Severn, the (Derbyshire) Derwent, and many other rivers very much flooded and many lives lost.

9th.—Smart shock of earthquake at 11.17 a.m., felt only in a district about 15 miles in diameter, whose centre is Elmswell, near Bury St. Edmunds.

10th.—Serious earthquake in Silchar and Cachar, in Bengal, extending also to Assam and Darjeeling.

13th.—Brighton, 1.20 a.m., "H. C. M." saw the light of a meteor slightly W. of North; three minutes afterwards he and four others heard two reports like two pieces of artillery fired within a second or two of each other. "B. P. E." saw the light at 1.5 a.m. in Bushey Park, but heard no noise. A celebrated cliff in Denmark, known as "Queen's Cliff," about 400 feet high, fell into the sea, "from a shock of earthquake." Considering the character of the season, and the fact that the cliff was a mass of chalk, it is not improbable that rain had as much influence as an earthquake.

21st.—At More, near Bishop's Castle, Salop, the nest of a blue titmouse was found with nine eggs.

22nd.—Fresh strawberries in Paris markets in abundance.

23rd.—Severe frost and heavy snow at Naples.

26th.—The tower of the parish church of St. Issey, Cornwall, fell with a tremendous crash; the roof of the church was broken in and the organ smashed. The heavy gales have gradually brought about this destruction.

27th.—Mr. Angwin, of Mousehole, Cornwall, gathered above 50 good apples from one tree; this was a second crop. In the same garden there is a pear tree in full bloom.

28th.—At Tramore (co. Waterford) the sea broke over the embankment, and shattered the sea wall in several places; large stones, 10 to 20 tons, were rolled about like pebbles.—Part of Glenbrook Pier, Cork, swept away.—Thunderstorm at Bromsgrove; also in Lancashire and Cumberland.—(See p. 16.)

30th.—Severe gale in Ireland; several persons drowned in the floods. Terrific hurricane at Queenstown; two piers, parts of the railway, and Dunkettle and Youghal stations destroyed. The damage to the embankments of the Suir and Barrow is estimated at £50,000. Extraordinarily high tides on the western and southern coasts, with heavy gales, thunder, and lightning. Great destruction of property.

31st.—Unprecedentedly high tides, and serious floods, in all parts

of Ireland, Belfast, Galway, and Cork.—At Worthing, about 150 yards of road and a row of cottages were washed away.

“HIGH TIDES AND HEAVY GALES.—Last year the Thames rose to an unusual height, flooding the densely-inhabited district of Westminster which lies near the river, and overflowing the lowlands of Battersea and Chelsea as far as Kew. On Sunday last, 31st, the river overflowed its banks to such an extent that boys in tubs and even boats were paddling along Millbank as far as Little College Street. On Wednesday next, February 10th, a greater rising of the river is expected, and every conceivable plan has been resorted to, by the construction of embankments and otherwise, in order that the water may not enter the lower rooms of the houses. Every high tide is waited for with much excitement by the people who inhabit the low-lying parts of Westminster. The highest tides known for 20 years in the Channel Islands occurred on Saturday, 30th, Sunday, and Monday, and were accompanied by a heavy gale from the south-west. Considerable damage was done on the Jersey coasts. The water rolled over the top of Albert Pier, and flooded some of the streets of St. Helier's nearest the harbour; about 60 yards of the esplanade wall was knocked down, and the guardhouse at the opening of Elizabeth Castle causeway rendered untenable. The walls of shipbuilding yards have been carried away, timber floated off, boats on the beach sacrificed, and fishermen thereby reduced to distress; cellars flooded, portions of houses carried away, and strongly-built granite landing-slips destroyed. The inhabitants of the coasts generally dwelt in a state of alarm during the prevalence of the gale, which greatly assisted the height of the tide. Several persons narrowly escaped drowning, but no loss of life is reported. The gales and high tides have been much more serious on the Welsh coast than was anticipated. A large building now in course of conversion into the University of Wales has been seriously damaged. Three cottages have been washed away by the high tides at Borth, the inmates narrowly escaping with their lives. A portion of the Welsh Coast Railway which skirts the estuary of the Dovey on each side has been materially injured, and traffic has been entirely suspended as far as Dolgelly, Port Madoc, and Carnarvon are concerned. A pile bridge, about 180 yards in length, crossing the estuary of the Penrhyn river near Port Madoc, has been washed away, and many of the smaller bridges are reported to be insecure. For nearly a mile on each side of Towyn station, near the Dyoynni river, the surface has been washed away to a depth of 10 ft., and similar gaps have been made by the tides near Aberdovey, Glandovey, and Borth, and the mails have to be conveyed by road.

“On Sunday night, 31st, about 50 yards of the granite coping of the sea wall at Dawlish, Devonshire, was washed away by the sea, in addition to the wall and railway carried away by the morning tide. On Monday morning the tide, though it did not rise so high as the previous day, washed away more of the cliff. During the day a strong body of men set to work to erect a temporary wall, but, on the return of the tide, it was again demolished. On Tuesday renewed efforts were made to erect the wall, and it is hoped the efforts will be successful.

“On Sunday, 31st, the tide was so high at Whitehaven that it overflowed the market-place. Between Whitehaven and Parton the water swept in heavy showers over the railway; near to Harrington a portion of the wall which protects the railway from the sea was damaged, a breakwater running out from the wall was broken, and at Messrs. Bain, Blair, and Patterson's ironworks, an embankment and line of rails were partially destroyed. At Harrington harbour on Sunday the sea damaged the breakwater on the north side; while between Workington and Flimby the sea overflowed, and so seriously injured about 100 yards of the railway as to put a stop to the traffic. The passengers from Whitehaven for Maryport and Carlisle, and other stations east of Maryport, had to travel on Tuesday by the Cocker mouth and Workington line to Brigham, and thence along the Derwent Valley branch to Bullgill, to reach their respective destinations.

“On Saturday night, 30th, and Sunday, 31st, Cornwall was visited by a terrific gale, and the highest spring tides which have been seen in the county for 40 years. A large number of people had a hair-breadth escape on the West Cornwall railway on Sunday morning. The up-passenger train had moved slowly out of the

Penzance station, and was about to enter on the long wooden viaduct at Ponsandane, which was at times buried in sea, when a loud crash caused the driver to promptly pull up. Two hundred yards of massive uprights, driven a great depth into the beach, and the whole system of wooden supports, began to shake, and in a few minutes went down with a fearful noise. Immense iron bars were twisted, gigantic bolts of the same metal snapped, and in a very short time the wreck was twirled seaward. The telegraph wires were also carried away. Sand and shingle covered the railway from Penzance to Marazion, the depth in many parts being from 2 ft. to 3 ft. The Penzance promenade, quay, pier, and other places were under water for many hours, and scores of houses were flooded. At Truro the houses and thoroughfares in the lower parts of the town were flooded to a considerable height, and many poor people have suffered great loss by damage done to their furniture. In scores of instances, chairs, tables, &c., were afloat, and many articles were washed away. A boat, laden with coal, went down in the Truro river, and a man named Davey was drowned. At Falmouth a youth named Tregenza was washed overboard and drowned. A large portion of the town of Fowey was covered by from 2 ft. to 4 ft. of water nearly all Sunday, and at Helston, Padstow, and Saltash there was a similar state of things. Many people had to turn out of their houses in their night-clothes and seek refuge elsewhere. Several hundreds of acres of land were under water on Monday, and the continuance of heavy rains was causing serious alarm. House property has suffered considerably.

"The floods have risen very rapidly in the neighbourhood of Reading, and on Tuesday were higher and more extensive than had been known for several years. An immense body of water has come down the Thames, which has overflowed its banks for many miles, and laid a great quantity of land under water to the depth of several feet. For a considerable distance east and west of this town the immediate course of the river is scarcely perceptible, the floods being on a level. There has been a great fall of rain during the last few days, and the water continues to rush on with much force, interfering seriously with the construction of the new bridge across the Thames at Caversham. The whole of the meadows on which the races are held are submerged, and, consequently, the public bathing-houses, as also the building belonging to the Reading Cricket Club, are quite insulated. A house occupied by a family named Knight may be said to stand in the midst of a vast lake. The water rushes completely over the foot-bridge and the road which form the means of communication between the town and Lower Caversham, while the path leading to Sonning is likewise under water. The timber yard of Messrs. Talbot and Sons is partly inundated, and the floods wash over a portion of the Caversham Road itself, and have reached the boundary walls of the Great Western Iron Works, and the casting foundry of Mr. Hood. The Kennet and Avon Canal has flooded the valley between Devizes and Reading; navigation is entirely stopped, and work at several flour mills suspended. Between Coley, Mortimer, and Theale the country presents a perfect sea. The canal has almost reached the level of the coal wharves in Bridge Street, and the road leading to the corn stores and dwelling-houses in rear of the King's Road is quite impassable. The river Loddon has inundated a large breadth of land. Fortunately no loss of life has resulted from the floods, but the gales have caused much damage."

FROST IN YORKSHIRE.

To the Editor of the Meteorological Magazine.

SIR,—The severity of the frost experienced at Ripon on January 1st seems to have been so local that it may be worth a corner in your magazine. A heavy fall of snow, 4 or 5 inches deep, and gauging 0·78 in., took place on the 29th and 30th December. The heat from the earth being thus cut off, the thermometer at 4 ft. fell to 9°·5 on Jan. 1st, and on the surface of the snow to 6°. The ice was strong enough for skating both on the 1st and on the 2nd.

I am, Sir, your obedient servant,
Trunbridge Wells, Jan. 28th, 1869,

F. W. STOW.

JANUARY, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which ≥ 1 or more fell.	Max.		Min.		
				Dpth	Date.		Deg.	Date.	Deg.	Date.	
		inches	inches.	in.							
I.	Camden Town	2.76	+ .81	.58	28	15	56.3	31	25.0	24	6
II.	Staplehurst (Linton Park)	3.04	+ .98	.52	31	12	54.0	31	22.0	25	11
III.	Selborne (The Wakes)	4.53	+ 1.26	.59	28	19	...	...	19.0	25	9
IV.	Hitchin	2.58	+ .44	.45	28	19	54.0	31	25.0	24	6
V.	Banbury	4.31	+ 2.22	.84	28	17	54.0	31	23.0	25	11
VI.	Bury St. Edmunds (Culford)	2.08	+ .21	.47	6	15	55.1	31	21.0	21	9
VII.	Bridport	4.59	+ 1.40	.83	28	17	55.5	17*	26.0	25	4
VIII.	Barnstaple	4.69	+ 1.17	.70	28	20	56.0	29	30.0	25	2
IX.	Bodmin	7.36	+ 2.17	1.54	28	22	55.0	7	32.0	22†	...
X.	Cirencester	5.60	+ 2.60	1.00	29	13	51.0	31	30.0	28	3
XI.	Shifnal (Haughton Hall)	2.91	+ 1.01	.49	28	17	54.0	31	22.0	25	7
XII.	Tenbury (Orleton)	4.52	+ 1.99	.71	28	20	55.5	5	23.3	25	8
XIII.	Leicester (Wigston)	2.82	+ .84	.42	28	17	53.0	31	19.0	24	6
XIV.	Boston	2.52	+ .81	.49	1	20	55.2	31	25.2	25	3
XV.	Derby	2.96	+ 1.17	.48	1	21	54.0	17†	24.0	25	7
XVI.	Manchester	2.69	+ .17	.33	21	21	54.0	31	26.0	1	7
XVII.	York	2.94	+ 1.36	.65	16	19	52.0	5	25.0	1¶	9
XVIII.	Skipton (Arneliffe)	7.89	+ 2.25	1.05	31	22	...	...	...	...	...
XIX.	North Shields	2.28	+ .17	.57	16	16	55.5	31	26.6	...	6
XX.	Borrowdale (Seathwaite)	17.43	+ 1.07	3.64	17	24	...	...	...	...	...
XXI.	Cardiff (Town Hall)	5.29	...	.91	4	18	...	...	...	...	...
XXII.	Haverfordwest	9.05	+ 4.00	1.34	16	19	53.0	31	26.5	23	...
XXIII.	Rhayader (Cefnfaes)	5.56	+ 1.04	1.00	2	19	52.0	...	23.0	...	4
XXIV.	Llandudno	4.12	+ 1.58	.74	31	19	54.6	16§	32.4	25	...
XXV.	Dumfries	5.16	+ .56	1.30	16	23	52.0	31	24.5	1	4
XXVI.	Hawick (Silverbut Hall)	3.79	...	.66	16	20	...	...	...	...	...
XXVII.	Ayr (Auchdrane House)	4.60	+ .08	.78	16	18	54.0	5	24.0	1	9
XXVIII.	Castle Toward	6.24	— .05	.93	16	22	52.0	9	26.0	25	9
XXIX.	Leven (Nookton)	3.61	+ .74	.80	16	18	50.0	5	21.0	1	5
XXX.	Stirling (Deanston)	6.51	+ 1.79	.84	16	26	52.2	5	19.2	1	9
XXXI.	Logierait	5.48	...	.92	17	19	...	...	...	...	...
XXXII.	Ballater	4.93	...	1.05	1	20	50.0	8	16.0	1	9
XXXIII.	Aberdeen	3.98	...	.77	16	19	49.4	31	25.2	1	14
XXXIV.	Inverness (Culloden)	...	...	...	...	...	...	...	...	...	...
XXXV.	Fort William	12.27	...	1.74	4	26	...	...	...	...	...
XXXVI.	Portree	12.46	— .63	2.16	31	18	...	...	...	...	...
XXXVII.	Loch Broom	5.25	...	.82	31	19	...	...	...	...	...
XXXVIII.	Helmsdale	2.29	...	.55	31	17	...	...	...	...	...
XXXIX.	Sandwick	3.83	+ .54	.60	5	21	50.0	9	31.8	24	1
XL.	Cork	8.59	...	.93	30	28	...	...	...	...	...
XLI.	Waterford	8.42	+ 3.56	.78	20	27	52.0	9, 11	34.0	1	0
XLII.	Killaloe	5.02	+ .16	.48	16	24	53.5	12	28.0	1	6
XLIII.	Portarlington	4.53	+ .52	.61	17	28	53.5	16	31.0	25	2
XLIV.	Monkstown	4.63	+ 1.24	.75	28	21	55.5	16	28.0	1	4
XLV.	Galway	4.27	...	.47	1	22	54.0	13¶	32.0	6**	...
XLVI.	Bunninadden (Doo Castle)	4.68	...	.49	28	19	51.0	19	25.0	7	3
XLVII.	Bawnboy (Owendoon)	4.06	...	.52	4	22	52.0	16	27.0	6††	4
XLVIII.	Waringstown	3.23	...	.70	16	17	53.0	16	27.0	25	6
XLIX.	Strabane (Leckpatrick)	3.53	...	.48	4	22	52.0	16	27.0	22†††	9

* And 28th & 31st. † And 31st. § And 30th. ¶ And 17th. ‡ And 23rd & 24th.

¶ And 2nd and 25th. ** And 21st & 25th. †† And 25th. ††† And 26th.

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

METEOROLOGICAL NOTES ON THE MONTH.

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 mild month; no S, and the frosts from 20th to 27th did not produce ice more than an inch thick. T on 30th; fogs frequent; winds, which were sometimes high, were S. or its compounds. Bar. 28·70 on 29th.

SELBORNE.—On the whole a tempestuous month, and unprecedentedly mild, the wind, though high, being S.W. to S.E., T on 1st at 10 p.m., 3rd in morn., and 28th at 11 p.m., and with L at 5 a.m. on 3rd, and at the same hour on 31st; frequent fogs from 8th to 18th.

HITCHEN.—T on 5th; bar. very low on 29th.

BANBURY.—High wind on 4th, and from 28th to end of the month; fogs on 7th, 18th, 21st, and 28th; TS on 29th.

CULFORD.—A slight but distinct shock of earthquake was felt here and throughout the eastern counties on Saturday, the 9th, about 11.20 a.m. High wind on 2nd, 29th, and 31st. The weather throughout the month has been (for the season) remarkably mild; no S, and frost but of short duration; mean temp. of month, 39°·9. Vegetation remarkably forward: gooseberry bushes almost in leaf, and apricot blooms nearly open; the yellow crocus on 20th in full bloom.

BRIDPORT.—Very mild month; very heavy gale from S. to W.S.W. sprang up on the morning of the 28th, and continued to the end of the month; on the afternoon of the 29th much H with vivid flashes of L; nearly 2 in. of rain fell during the last four days. Bar. 29·05 at 9 a.m. on 29th; very rough sea and high tide on 31st, water flowing over the quay and inundating the houses.

BODMIN.—Very heavy gales on 28th and 31st.

CIRENCESTER.—The S.W. gales, which generally bring rain, continued until the 9th, from which time till the 28th we had serene weather, with a few black frosts. On the 28th the weather became very windy and wet, the total fall being nearly twice the average.

HAUGHTON HALL.—Snowdrops up on 7th; seven-spot ladybird out on 10th; throats singing all the month; crocus in flower on 31st. The new year came in clear and frosty, and good hope of change from the excessive rain of last month, but on the 3rd rain returned with L at night, and such, with slight intermission, it continued to the end; wind southerly throughout; max. ther. seldom below 45°·0; T with heavy R at midday on 29th; violent wind on 31st. We shall suffer for this mild January, if the old adage holds good—

“When January calends are summery, say
’Twill be winterly weather till calends of May.”

WIGSTON.—Our experience of the temperature and rainfall of this month was the same as that of the country generally, both being above the average; vegetation in many of the fruit and other trees being more forward than I ever remember.

BOSTON.—Remarkably mild weather, dull with little sunshine and much mist. Influenza epidemic in this district. Heavy gales on 4th, 28th, 30th, and 31st. Mezereon in flower on 30th.

DERBY.—The exceptionally high temp. which prevailed during the greater part of 1868, still continues; the excess over the average on the last seven years being no less than 5°·2. Vegetation, as may be supposed, is forced forward, the fields and gardens having more the appearance of April than January; the proximate cause of the warmth of the season arises, no doubt, from the prevalence of southerly winds, but why they should prevail at this season is a mystery; the heat of the past summer may to some extent influence the present temp. The thorns were never fuller of fruit, and the country folk even to the present prophesy bad weather.

ARNCLIFFE.—The whole month unusually gloomy, but very mild.

NORTH SHIELDS.—Cloudy or rainy nearly all the month; S on 24th; L on 29th.

W A L E S.

HAVERFORDWEST.—January commenced with a continuance of the same wet, tempestuous weather which had characterized December; very mild; from the

8th to the 13th, the weather was better ; again an exceedingly wet period occurred ; less rain but constant drizzle and fog from the 19th to 22nd ; the wind changed to the E., and two or three fine days with sharp frost occurred. From the 26th to the end of month very wet and unusually stormy ; great storm on the night of the 28th. On the evening of the 31st an awful storm, the floods from the hills coming down the valley of the river Cleddy in great volume, and meeting the spring tide impelled by the hurricane violence of the S. E. wind, caused such an inundation as had not been remembered for 40 years.

CEFNEAES.—A stormy and wet month, wind generally S. E., frequent T and L, with storms of hail, &c. Vegetation forward.

SCOTLAND.

DUMFRIES.—The month with the exception of the second week has been very wet, and throughout has been unusually mild ; S on the 3rd ; T on 3rd and 29th ; both temp. and rainfall above the average ; vegetation very forward, fields quite green, snowdrops in flower on the 7th, and hepatica in bloom on 12th.

HAWICK.—Keen frost on 1st, but taken as a whole the mildest January ever remembered here. Daisies have been in bloom all the month, gooseberries in flower on the 16th, and the blossoms of the *ribes sanguinem* all but expanded. Pastures look more green than they do generally in April. The hills were white with a thin covering of snow on the 23rd, 24th, and 25th. Boisterous westerly winds from 28th to the end of month.

AUCHENDRANE.—Very boisterous weather on 2nd, 5th, and 18th, from equatorial gales, but on the 14th the gale was a polar one ; from 27th to the end of the month the equatorial gales never ceased.

CASTLE TOWARD.—The month has been mild, too mild for the season. Bar. comparatively high (although only nine dry days) until the last few days ; it fell to 28.64 on 30th, but soon rose again. Thirty head of dairy stock have been quite comfortable on the grass during the month. The winter garden quite gay with rhododendrons, heaths, laurestinas, &c. The tide rose very high on the 31st, overflowing the banks and doing much damage.

NOOKTON.—First fortnight fine, second wet, the last three days stormy.

DEANSTON.—The month generally very dull, dark, wet, and occasionally hazy ; some frost on 1st, 18th, 22nd and 26th, but no ice more than a quarter of an inch thick ; S only once, half an inch on 24th ; gales on the night of the 28th, and during the day of the 31st.

LOGIERAIT.—Heavy rainfall, high temp. ; severe gales of wind ; no frosts yet, and flowers, &c., progressing as if it was spring.

BALLATER.—A very mild and open month ; prevailing winds westerly, increasing occasionally to a gale ; a very heavy gale on 30th ; rainfall above the average ; snowdrops in flower on the 22nd ; a very bright meteor seen on the evening of 11th.

ABERDEEN.—A very brilliant meteor, one-third the size of the moon, seen at 7.35 p.m. on the 11th. A remarkably mild month ; no S, except a few flakes on the 25th ; no severe frosts, and hoar frosts on 6 or 7 days only ; dull, dark weather, scarce two hours' sunshine a day on an average. Grass growing as if in March or April ; whin in bloom all the month ; *Eranthis*, *hiemalis*, and *Petasites vulgaris* in bloom in the middle of the month.

ROSSE PARSONAGE.—With the exception of frost on the 21st and 22nd, and night of 25th, the month has been wet and mild throughout ; very stormy on the night of 29th, with T and L ; on three days, the 4th, 29th, and 31st, more than inch of R was registered.

SANDWICK.—Heavy gales on 1st, 2nd, 14th, and 16th ; auroræ on 4th, 5th, 12th, 16th, 17th, and 24th ; lunar halos on the 27th and 28th.

IRELAND.

GALWAY.—There was a severe storm on the night of the 28th, continuing on the 29th, and accompanied by an unusually high tide, which did much injury, and exactly the same took place on the morning of the 31st, about 6.30 a.m., great damage being done along the sea coast.

DOO CASTLE.—The high temp. of this month was something extraordinary, spring operations going on all through the month.

WARINGSTOWN.—Heavy gales at the beginning, and again at the end of the month ; weather variable, wind and R, interspersed with some unusually fine warm days ; temp. much above the average.

LECKPATRICK.—Very mild month ; ribes and laurel coming into flower, primrose and hepatica in flower. Bar. fell to 28.425 (corrected) at 10 p.m. on 28th.

EFFECT OF LIGHTNING AT BRAYSTONES.

To the Editor of the Meteorological Magazine.

SIR,—On the 29th of last month (January), the sky became very dark in the north, between twelve and one at noon, and after a few peals of distant thunder being heard in that direction, there was here, during a heavy storm of hail, at five minutes before one, a very vivid flash of lightning, immediately followed by a loud peal of thunder ; after which there were several other peals of thunder not so loud, accompanied by lightning less vivid. At the time of the most vivid flash, a large ash tree in the Mill Lane, Beckermont (distant about a mile and a quarter from Braystones), growing in a corner of the fence of Mr. Atkinson's meadow, was struck by the electric fluid. The fluid struck the tree near the top, stripping bark off in a continuous line to the bottom of the trunk, throwing the soil off two of the large roots (which in their ordinary position grew extending from the tree in contrary directions), and tearing one of them away. The fences into which the roots of the tree extended were considerably thrown down, and a number of large stones, of which one of the fences was partly formed, were scattered about the lane, eight of them being hurled into a field over a hedge (6 ft. in height), on the opposite side of the lane, which is 20 ft. wide. The largest of the stones thus hurled into the field was found to weigh 47½ lbs., and the smallest weighed 6 lbs. 6 oz. The largest of these stones was hurled the greatest distance, namely, 63 ft. from where it had formed a portion of the fence. The line where the bark was stripped off the tree was only about an inch wide at the top, but the width of it gradually increased as it extended downwards, till at the bottom of the trunk it was about eight inches. The substance of the trunk of the tree was not split or damaged. Is not this fact curious, and one worthy of observation ? so little damage done to the top of the tree, where the electric fluid struck it, while where the fluid became diffused and left the tree, at the bottom, the results to be seen are indications of immense violence. Windows in several houses about 200 yards from the tree were broken by the concussion made by the thunder.

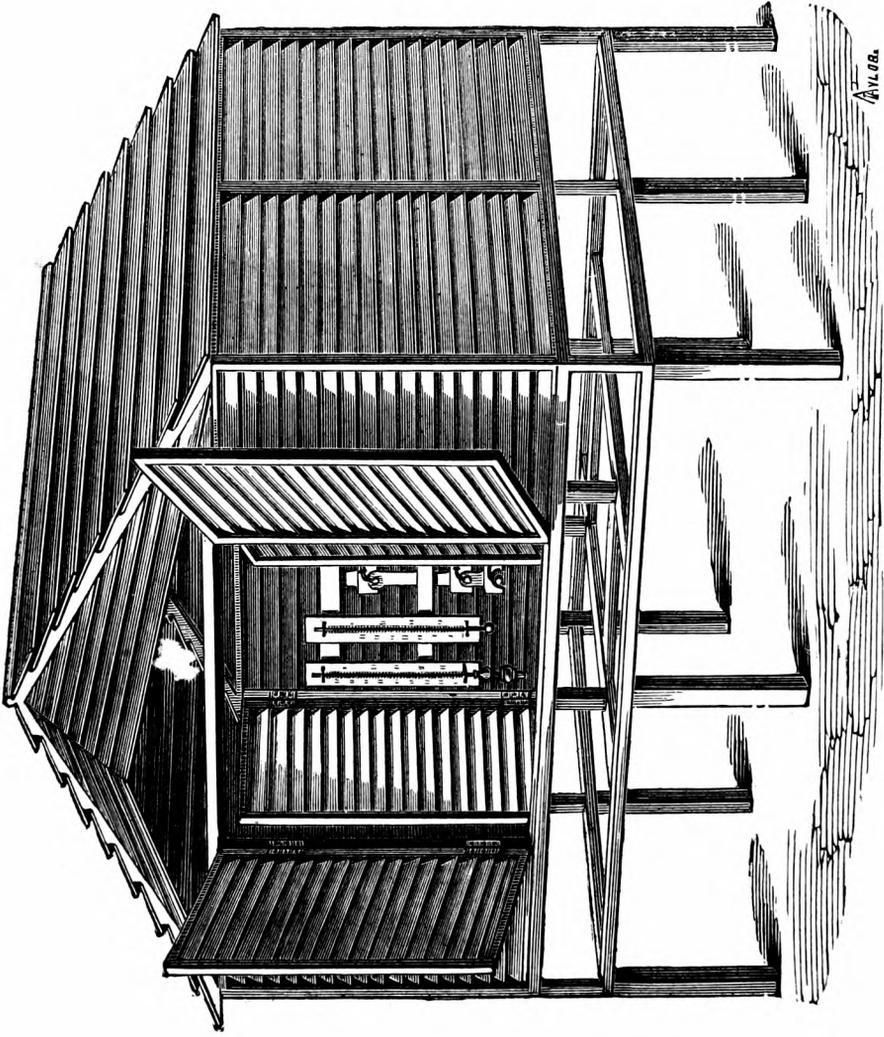
The storm passed on in a southerly direction, the newspapers reporting it as being at Bolton-le-Moors at half-past one, and at Manchester at a little before two, the electric fluid having struck a factory chimney at Bolton, "breaking a large stone at the summit and displacing another"—a contrast between the chimney and the tree.

WILLIAM HENRY WATSON.

Braystones, Cumberland, February 3rd, 1869.

[Was it not an up-stroke at Braystones ?—ED.]

Several articles unavoidably postponed—"Magnetic Variation," "Meteorological Society," &c.



WELSH'S KEW THERMOMETER STAND.—(See page 18.)

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

XXXVIII.]

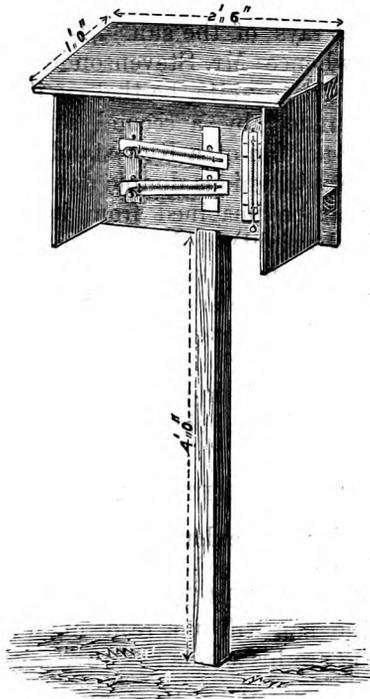
MARCH, 1869.

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

THERMOMETER STANDS.

As we are desirous of concluding our details of individual stands and modes of mounting, we proceed without further preface to describe

PASTORELLI'S STAND.



A very simple arrangement, being virtually a Morris's stand with double back, and mounted on a post in lieu of being nailed to a wall. The accompanying engraving represents it so completely that little further explanation is necessary. It does not revolve, but is provided with wings, projecting six inches, and therefore cutting off the sun's

rays even at rising and setting in eleven months out of twelve. The layer of air between the two vertical boards is about two inches in thickness.

KEW STAND.

This very important stand is last noticed, because last erected at Strathfield Turgiss. The fact was, the cost being reported to be about £12, we hesitated before spending as much over one stand as over any other three. The difficulty was most considerably removed by the Kew Committee of the British Association, who have kindly lent us the original Kew stand, which for so many years stood against the stone steps forming the northern entrance of Kew Observatory, and with the thermometers some 10 ft. above the surrounding ground. As will be seen from the frontispiece, and indeed as has already been stated in these pages, it is a very large, (6 ft. × 6 ft. × 5 ft.) nearly cubical, louvre boarded, double box, with louvre boarded folding doors to each box; the bottom, with the exception of the beams necessary to support the inner box, is quite open. It is not, therefore, easy to see how a more thorough exposure to air currents could be obtained, with perfect security from the direct rays of the sun. In a word, this stand may have been the type whence Mr. Stevenson designed his, which we engraved last month. At any rate, be that as it may, the Kew stand is a Stevenson surrounded by a second series of louvres, and a Stevenson is the inner portion of a Kew stand with several improvements—notably the very ingenious double louvres, the ventilator, &c. The Kew stand, as may be imagined from its size and cost, is very heavy (several hundred-weight), and the louvres of half inch wood, while those of the Stevenson are very light, like venetian blinds. We do not yet know which is preferable—thick or thin. In order to maintain perfect uniformity among all the stands, the Kew one is not now at the same height above the ground that it was at Kew, but, as represented in the engraving, so much of the posts is cut off as to bring the thermometers to the uniform height of 4 ft. above the turf.

THERMOMETER AT 13 FT.

IN one of the best and most exhaustive papers on meteorology ever written,* Mr. Glaisher announced the singular, and to some people incomprehensible fact, that at 13 ft. above the ground a thermometer in the full blaze of the sun will not read higher than one in perfect shade. The following are his words:—

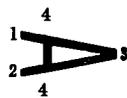
“The thermometers for ascertaining the temperature of the air at distances from one inch to twelve feet from the earth, were placed with their stems passing through a piece of wood planted firmly in the ground, and whose thickness was two inches and breadth three inches, with the bulbs at least nine inches from the wood.

* *Phil. Trans.*, 1847, pp. 124 and 142.

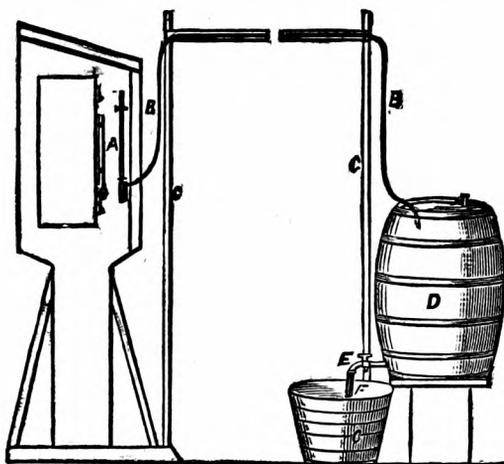
The several thermometers at the different distances from the earth, were for some time read at short intervals during the night and day, and it was found that, except after noon, the reading of the thermometer at 12 feet from the earth was very nearly identical with the true temperature of the air. The bulb of the thermometer thus exposed to the full rays of the sun was situated nine inches west of the plank which carried it, and whose width was three inches, and the cause of its readings being about 1° too high during the afternoon was owing to the heat reflected from the plank to it.

During the summer of 1844 and the year 1845, the readings of this thermometer were frequently examined, and found always thus to agree. Hence there is no doubt that if a thermometer be freely suspended in the air, with its bulb at the height of 13 feet above the soil and far from any object to reflect heat to it, its readings will represent the true temperature of the air at the time, and much more truly than those of any one placed near the ground or within a few feet of walls or buildings."

Herein, therefore, we seem to have that which some have thought so difficult of attainment, namely, a standard of true temperature in shade. We have consequently devoted some care to so mounting a thermometer that the supports should have no possible influence upon it. The arrangement adopted will be best shown in the general view of the thermometric enclosure which we intend to give in our next, but in the interim we may state that two posts, 14 ft. high, are placed 3 ft. apart on the north side of the enclosure, and one post of the same height, at the south side, there being 20 ft. between the two posts and the one post. To make the matter quite clear, let us take a very homely illustration—let 1 and 2 at the feet of the accompanying letter A represent the two northern posts; let 3 represent the southern one. Then 1 and 2 are coupled with cross bars for about 6 ft. above the ground, to afford means of reading the thermometer; but though 10 ft. distant, even these bars are not allowed any higher. From the top of post 1 a thin rope passes almost to post 3, but before reaching it is bent round and comes back to post 2; a similar rope passes from 1 ft. lower on post 1, and returns to a similarly lower position on post 2. The bends of these ropes unite near post 3, and one rope passes from this junction over a pulley on post 3, and then downwards, with a 7lb. sash weight attached, thus keeping the ropes constantly taut, and yet preventing alterations in their hygrometric condition from loosening the posts. Midway between the posts, say at 4, there is a bridge of iron wire, not so thick as a pencil, and from the middle of this the thermometer is suspended. It is therefore 10 ft. from everything but this frame and the cords, the total section of which is considerably under an inch, and none of which is within eleven inches of the bulb. From this description, especially when further elucidated by the engraving now in hand, we trust it will be evident that the mode of mounting fulfils as nearly as may be the requisite condition of free suspension, none of the tackling being of anything like the influence of the thermometer tube itself, with which of course we cannot dispense,



ASPIRATED THERMOMETER.



Everybody knows that it feels warmer when the thermometer shows 30° and the wind is calm, than if the temperature is much higher but a brisk wind is blowing; the reason being that the surface of the body being at (say) 60° , if the air is calm that in contact with the skin rises in temperature, and a partially warmed envelope surrounds the body. If however, the air is put in motion, and becomes wind, fresh layers of air are continually brought in contact with the skin, and its temperature is thereby reduced more nearly to that of the air. In the balloon ascents by Mr. Welsh in 1852, and in the recent ones by Mr. Glaisher, thermometers have always been employed, with a current of air drawn past them by a bellows-like apparatus worked by hand or foot. At Strathfield Turgiss our aspirator is self-acting, as shown by the annexed engraving, where (A) is a very delicate thermometer mounted in a shady corner of Lawson's stand; this thermometer has its bulb surrounded by a polished platinum tube which is open at the bottom, closed at the top round the stem of the thermometer, and with a small lateral tube, to which is attached a flexible tube (B), which is supported by (C), and led into the butt (D) through an airtight joint. At the bottom of (D) is a tap (E), with a short length of tube (F) leading to the bottom of the tub (G) which is always partly filled with water. If (D) be assumed to be say half full of water, and the tap (E) be opened, water will pass from (D) into (G), but as this will create a partial vacuum in the upper portion of (D), a stream of air will therefore be drawn past the bulb of the thermometer, along the tube (B) as long as the water continues running out of (D) into (G). It would, therefore, seem that this thermometer is independent of wind; it certainly is well shaded, and it seems free from the objection indicated in Mr. Ryves' letter in our last, where he suggested that

some of the high readings at times recorded were "due to that accumulation of heat which must necessarily take place in and around any small structure of wood exposed to the full blaze of a powerful sun, even though the instruments themselves may be carefully shielded from its rays."

THE REMARKABLE STORM OF FEBRUARY 12TH, 1869.

HAVING understood that Mr. Glaisher, F.R.S., is likely to communicate the results of an examination of the above to the Meteorological Society at the meeting on March 17th, we think it will be most expedient to insert the following notes without comment, and in our next to report somewhat fully the paper to be read at the above-mentioned meeting.

To the Editor of the Meteorological Magazine.

SIR,—I have been surprised to find so little notice taken in the papers of a violent cyclone which passed over this part of England on the 12th inst. I have been collecting information from other parts of the country, and judging from the reports I have received, and from my own observations, I believe that the centre of the storm passed immediately over this county. At 7 a.m. on the 12th the wind was E. and light; rain was falling fast, as it had been during the last twelve hours; the thermometer stood then at 50°, but at 10 a.m. it had fallen to 41°. The wind then rose rapidly, blowing heavily from the S.E. at 11 a.m., and a gale from the S. at 1 p.m. The thermometer had now risen to 50°. At 3 p.m. it was nearly calm, the wind blowing lightly from the S.W.; the sun came out; the thermometer stood at 51°, and the weather looked like clearing up. At 4 p.m. the wind changed to N.W., with heavy rain; at 4.30 p.m. to N.; at 5 p.m. it was blowing a hurricane from N.N.E., with snow; the thermometer had now fallen to 33°; the change of temperature was so rapid that the windows were instantly covered with steam on the inside. By 7 p.m. the wind was moderate from the N.W.; the sky clear; thermometer 35°. The rainfall from 7 p.m. of 11th till 7 p.m. of 12th amounted to 1.25 in. The barometer at 9 a.m. on the 12th stood at 29.92; at 3.30, 29.49; at 10 p.m., 29.93.

I find that at Chelmsford the change to a violent N.E. wind, with snow, took place at 5.10. At Castle Hedingham, in Essex, at 4.45 p.m.; at the latter place 1.50 in. of rain fell during the storm. At Lowestoft, I see from the reports in the newspapers that a strong gale blew from the E. in the evening. I should imagine, therefore, this to be the northern limit of the storm. A friend, writing from the neighbourhood of Canterbury, gives the following account of the weather on the 12th: "The wind here blew fiercely all day, from S. to S.W., and at about 6.30 p.m. it veered suddenly to N.W., and blew a hurricane for half-an-hour, and then all was calm. . . . The rainfall was 0.82. . . . Our N.W. squall did all the damage here, snapping off a large elm in my

garden, tearing up by the roots a large cedar, and rooting up and snapping off an occasional oak, thorn and fir. The 'lie' of every tree told that the N.W. wind did the mischief." Canterbury was, therefore, probably not far from the southern limit of the cyclone.

I have been induced to give you rather a full account of this storm, for I felt that from its true cyclonic nature, it must possess many points of interest for meteorologists.—I am, Sir, yours faithfully,

W. CLINTON BAKER.

Bayfordbury, Hertford, Feb. 27th, 1869.

WEYMOUTH.—*E. E. Glyde, Esq.*—Bar. at 9 a.m., 29·95; wind S.W., fresh and raining till 1 p.m., when bar. was only 29·55; tremendous gale from W. to N.W. from 2 to 4 p.m. on 12th; bar. at 6 p.m., 29·97; calm after 10 p.m.

ORLETON, TENBURY.—*T. H. Davis, Esq.*—Snowstorm noon to 3 p.m. on 12th; wind changed from W. to E., and then to S.

NORTHWICK HOUSE, HARROW.—*H. St. John Joyner, Esq.*—Rain commenced about 4 p.m. on February 11th, continued all night, and at 9 a.m. on 12th I measured ·45 in.; at noon (that was during 3 hours) I measured again ·31 in.; it did rain in earnest for that time, wind shifting from W. to N.E., S.E., S.S.W., to W. again in 24 hours, and at 4 p.m. it rose from that, with rain, hail, and sleet, into a most terrific hurricane, and blew most tremendously for nearly four hours; getting northward the sky cleared, stars were bright, and it froze. Barometer, which was 29·85 when the rain began, went down to 29·60 at noon, and then began rapidly rising: at 8 p.m., 29·74, and this morning 29·97. Thermometer lowest in night, 28°; 32° at 8 a.m. Rainfall, ·42 in. at 9 a.m., which includes the ·31 measured at noon yesterday, so the fall during the 24 hours, from 4 p.m. on 11th, was ·87.

	Time.		Bar.	Ther.	Wind.
11th	8	Fair, dry, fine	29·80	51°	W.
"	12	Fine	...	52°	...
"	5	Clouds, rain	29·85	48°	W.
Night		Rain	...	40°	...
Rainfall, 0·45.					
12th	8	Thoroughly wet	29·83	40°	N.E.
"	10	Much rain	...	...	S.E.
"	12	Rain	29·60	48°	S.S.W.
"	5	Hurricane, hail	...	37°	W.
"	8	Calm, clear	29·74	...	N.W.
Night		Frosty	...	28°	N.
Rainfall, 0·42.					
13th	8	White frost, clear	...	32°	N.W.

WESTMINSTER.—*H. S. Eaton, Esq., M.A., F.M.S.*—

	Bar. red. to sea level. in.	Dry Bulb Ther.	Rate of Bar. change per hour.	Remarks.
10 a.m.	29·857	...	...
4.30 p.m.	29·341	49°	·080	
4.35 "	—	...	...	Wind changed from S.W. to N.N.W.
5.0 "	29·466	37°	·250	
5.15 "	·557	...	·364	
5.30 "	29·617	...	·240	Rise in 1 hour = ·276.

CAMDEN SQUARE.—*G. J. Symons, Esq., F.M.S.*—At 9 a.m. the bar. read 29·880, and was falling rather rapidly; wind N.E.; towards noon the bar. fell faster, the wind became S.W., and so continued, with a continuous and very rapid fall of the barometer, and rise of temperature to 50°, until 4.40, when all at once the wind veered to N.E., and blew with great force; the barometer ran up, the thermometer went down almost to freezing point, every window in the house was streaming with moisture condensed on the inside of the glass by the external cold, the rain ceased, and the evening was cold and almost frosty. The following are the readings of the barometer reduced to sea level:—9 a.m., 29·880; 0.30 p.m., 29·672; 3.5 p.m., 29·427; 3.25 p.m., 29·390; 3.30 p.m., 29·372; 4.15 p.m., 29·318, after which it rose rapidly, and was 29·915 at 9 p.m.—the most rapid fall was therefore at the rate of ·216 in. per hour, and the lowest point was reached nearly half-an-hour before the sudden increase of wind force.

BECKENHAM, PARKSIDE.—*C. O. F. Cator, Esq., M.A., F.M.S.*—February 11th, 9 p.m., after 113 hours continuous blow became calm; February 12th, 6 a.m., by this time had backed to E.N.E., and remained till 10 a.m. E.N.E., and became by forward motion at 10.45 a.m. S.S.W., up to which time it remained calm. 11 a.m., began to blow; 2.20 p.m., 10 lbs. on square foot; 4 p.m. to 4.40 p.m., only 3 lbs. to 5 lbs., and during these 40 minutes changed from S.W. to W.; at 4.40 the sudden shift began, and also increase of strength; 4.45, 9lbs.; 4.50, 11½ lbs.; 4.55, 13 lbs. N.W.; 5 p.m., 17·6 lbs., max. gust, N.W.; 5.10, 14 lbs. N.W.; 5.30, 8 lbs. to 10 lbs. N.W.; 6.10, 16 lbs. N.W.; 6.40, 11 lbs. N.W.; 9, 1 lb. N.W.; 11, W.S.W.; by midnight became calm.

TUNBRIDGE WELLS.—*Rev. F. W. Stow, M.A., F.M.S.*—Wind veered to N.W. at 5.25, and at 5.30 burst in the window; bar. at 5 p.m., 29·060, at 6 p.m. 29·246; rise in one hour, ·186.

HIGH RODING RECTORY, DUNMOW, ESSEX.—*Rev. Edward Maxwell.* I observed, soon after 7 a.m. the 12th, that the wind had changed during the night from S.W. to N.E. It was raining, and had been doing so, I believe, most of the night. The quantity measured at 9 a.m. was 0·49 in. The rain continued; the wind was gentle, but gradually shifted to S.E., then to S. about the middle of the day, when it also began to blow stronger. The barometer fell between 9 a.m. and 12.30 (noon) from 29·83 in. to 29·30 in., or more than half-an-inch in 3½ hours. But by 10 p.m. it had risen again to 29·80.

About 4 p.m. I thought the sky betokened a cessation of the rain, and I started for a walk, hoping to see the flood in the river Roding, but I could not get beyond the shelter of my own shrubbery. The air was then mild, about 47° or 48°, and the wind from the S.W. Soon after this the wind shifted to the W. and N.W., rising considerably, and between 5 and 6 blew from the N. a furious gale, bringing down with it first hail, or rather small flat pieces of ice, followed by snow for a short time.

The external thermometer fell to 33°, or 15° in about an hour's

time. The wind continued high for some time afterwards from the N. By the next morning it had fallen considerably, and gone back to S.W. On the morning of the 13th I measured rain to the depth of 0.66 in., making, with the previous 0.49, a total in two days of 1.15 inches. There has not been such a flood as that of Friday evening for some years.

The peculiarities of the above are of course the shifting of the wind almost round the compass from N.E. by S. to N. in the space of (say) 9 hours, and the rapid fall of the temperature.—Yours truly,

CAMBRIDGE, BEECH HOUSE.—*J. Nutter, Esq.*—Very heavy rain here on 12th, amounting to 1.39 in., and at Granchester Mill to 1.47 in.

CAMBRIDGE, MERTON VILLA.—*G. Warren, Esq.*—February 11th, 8.30 p.m., steady rain began, light wind from S. February 12th, 9 a.m., incessant heavy rain, wind light from E., rainfall, 0.29 in.; 9 a.m. to 4 p.m., heavy rain; 4 to 7 p.m., snow storm, with violent squalls from N.; total rainfall in 22 hours, 1.62 inches. Barometer, corrected and reduced: 9 a.m., 29.94 in.; 5 p.m., 29.54; 10.30 p.m., 29.89.

PICKENHAM HALL, NORFOLK.—*E. A. Applehwaite, Esq.*—On 12th, at 8.30 a.m., bar. was 30 inches, at 5 p.m., it was down to 29.20, rain fell all the morning from the N.E., and at 2 p.m. snow in enormous quantities, the flakes as large as crown pieces, and blowing very hard. The ther. fell to 33° at 3 p.m., and at 7 p.m. rose to 36°, the wind having dropped and a gentle rain recommenced; the total fall was 1.26 in. On 13th, hot sun melted all the snow, and caused considerable floods.

BOYLAND HALL, LONG STRATTON, NORFOLK.—*F. Irby, Esq.*—Wind S.S.W. in the morning, with rain; from 1 to 4 p.m. an aneroid bar. fell 0.25; it then became stationary till about 6 p.m., after which it rose rapidly; a very heavy gale, with snow and hail, blew from 4 till 7 p.m. A large elm tree went down about 5 p.m., but it blew hardest from N.N.E. at 5.45 p.m.

GELDESTON, BECCLES.—*E. T. Dowson, Esq.*—Aneroid at 9 a.m. 12th, 30.04; at 4.15 p.m., 29.51; at 9 p.m., 29.86; at 10 p.m., 29.93. Rain from 5 a.m. continuing all day, with sleet in the afternoon and an easterly gale in the evening. Rain from 9 a.m. 12th, to 9 a.m. 13th, 1.05 in.

PERIODIC SNOW BALLS ON MARCH 8TH.

WE have so often referred to the above subject in these pages* that we shall dismiss it with a very few lines. From Strathfield Turgiss Mr. Griffith writes:—"Hail balls fell here from 8.30 to 8.35 a.m." From Winchmore Hill Mr. Paulin writes:—"A rather heavy fall of the periodical soft hail or snow balls occurred here this morning (8th); it commenced at 7.45, and continued till 9 a.m., when it changed to

* Vol. I., p. 17; Vol. II., p. 30; Vol. III., p. 48.

snow crystals, and snowed very heavily till 9.30." At Camden Square snow fell up to 8 a.m.; at 8.20 there was a smart shower of very small balls, larger than sleet, but not to be compared with the remarkable ones of 1857. After 8.45 the fall was large snow flakes, and many very fine crystals.

FINE SHOWER OF SNOW-CRYSTALS ON MARCH 10TH.

"Yesterday morning (March 10th) a remarkably fine fall of snow-stars took place over many parts of London. The crystals were larger and more perfectly formed than is generally the case in our latitudes, where the conditions requisite for the formation of these beautiful objects are less perfectly fulfilled than in more northerly regions. Many forms were to be noticed which the researches of Scoresby, Glaisher, and Lowe have shown to be somewhat uncommon.

"Many of our readers will perhaps be surprised to learn that no less than 1,000 different kinds of snow-crystals have been noticed by the observers named above, and that a large proportion of them have been figured and described. The patterns are of wonderful beauty. A strange circumstance connected with these objects is the fact that for the most part they are found, on a close examination, to be formed of minute coloured crystals—some red, some green, others blue, or purple.* In fact all the colours of the rainbow are to be seen in the delicate tracery of these fine hexagonal stars. So that in the perfect whiteness of the driven snow we have an illustration of the well-known fact that the colours of the rainbow combine to form the purest white, for the common snow-flake is formed of a large number of such tiny crystals as were falling yesterday, though their beauty is destroyed in the snow-flakes through the effects of collision and partial melting. It may not be very commonly known that ordinary ice, also, is composed of a combination of crystals, presenting all the regularity of formation seen in the snow-crystals. This would scarcely be believed by anyone who examined a rough mass of ice taken from the surface of a frozen lake, yet, if a slice be cut from the mass and placed in the sun's light, or before a fire, the beautiful phenomena called ice-flowers make their appearance—'A fairy seems to have breathed upon the ice, and caused transparent flowers of exquisite beauty suddenly to blossom in myriads within the ice.'

"When we remember that the enormous ice-bergs of the Arctic and Antarctic seas, the snow-caps which crown the Alps, and Andes, and Himalayas, and the glaciers which urge their way with resistless force down the mountain valleys, are all made up of these delicate and beautiful snow-flowers, we are struck with the force of the strange contrasts which nature presents to our contemplation. We may say of the snow-crystals what Tennyson said of the small sea-shell. Each snow-star is

'Frail, but a work divine,
Made so fairly well,
So exquisitely minute,
A miracle of design.'

Yet massed together with all the prodigality of nature's unsparing hand they crown the everlasting hills; or, falling in avalanche and glacier, overwhelm the stoutest works of man, or in vast islands of floating ice show themselves to be

'Of force to withstand, year upon year, the shock
Of cataract seas that snap the three-deckers oaken spine.'"

—*Daily News.*

* Of course these colours are not real, simply the effect of refraction in these fairy prisms.—ED.

MAGNETIC VARIATION.

[ONE great advantage of a small periodical like this is, that circulating almost exclusively among those conversant with the topics of which it treats, any erroneous statement is almost sure of prompt detection and correction. Long may it be so. Correspondents, reviewers, readers, and editor are all benefitted by the most rigorous criticism, and most heartily do we detest the absurd dogma of editorial infallibility. An instance illustrating this promptitude has just occurred. On Dec. 24th, 1868, Mr. Mitchell asked us to give the present magnetic declination. In our January issue we did so, basing our calculations on General Sabine's Magnetic Survey, and stating that—"We believe no data of the kind have been collected or published by the Greenwich authorities, whose observations are exclusively made at the Royal Observatory." Immediately after the publication of that number, we were favoured by Mr. Davis, of Derby, with the paper which we print *in extenso*. Of course if we had been previously aware of its publication, we should have referred to it, but in justification of what we did say, it is only fair to remark, that the paper is apparently not an official one, but simply a communication from the Astronomer Royal to some periodical. It is satisfactory to find that, with the exception of the line for 23° (which Mr. Airy puts to the west of ours), the positions of the several lines as given last month, and those deducible from Mr. Airy's paper are almost identical.—ED.]

VARIATION OF MAGNETIC NEEDLE AT GREENWICH.

1863.—January, West declination	-	-	-	20° 50'
„ July, „ „	-	-	-	20° 47'
1864.—Interrupted.				
1865.—February „ „	-	-	-	20° 31'
„ July „ „	-	-	-	20° 31'
„ December „ „	-	-	-	20° 33'
1866.—July „ „	-	-	-	20° 26'
„ December „ „	-	-	-	20° 22'

(I give them to the nearest minute.)

Generally, it may be understood that the western declination is now diminishing at the rate of 1° in 8 years.

A magnetic survey of an entire kingdom is an operation so troublesome that it is impossible that it can be made very frequently, and we are in practice compelled to adapt the results of a survey made in one year to form, by application of a constant difference, results equivalent to those which would be obtained by survey in another year.

From Dungeness to North Foreland, magnetic westerly declination is 40' *less* than at Greenwich.

From Shanklin (Isle of Wight) to the middle of the Wash, 20' *more* than at Greenwich.

From the Start Point, by Bristol, to Whitby, 1° 20' *more*.

From the Land's End, by Liverpool, to Holy Isle, 2° 20' *more*.

From Douglas (Isle of Man), by Kirkcudbright, to Leith, 3° 20' *more*.

From Youghal (Ireland), by Newry, Belfast, and Bute, to Inverness, 4° 20' *more*.

From Tralee, by Galway and Londonderry, to Cape Wrath, 5° 20' *more*.

From Achil Head to the western part of the Lewis, 6° 20' *more*.

If these differences are applied to the declination at Greenwich, the declination on each of those lines will be obtained with great accuracy. And with the assistance of a map, any of your correspondents will be able to find the declination for his own locality.

(Signed,)

G. B. AIRY.

Royal Observatory, Greenwich,
London, S.E., September 19th, 1868.

RAINFALL AT MALTA.

Comparative Statement of the Rainfall during the last Six years, according to Indications of the Pluviometer on the Terrace of the Public Library.

	1863	1864	1865	1866	1867	1868
	in.	in.	in.	in.	in.	in.
January	1·04	6·29	1·48	0·55	0·56	3·08
February	3·00	2·15	1·73	2·02	0·09	0·48
March	3·76	0·14	0·05	0·45	0·72	5·83
April	1·90	0·65	0·00	0·02	0·29	2·04
May	0·13	0·38	0·00	0·04*	0·00	0·07
June.....	0·00	0·00	0·03	0·10	0·00	0·28
July.....	0·00	0·00	0·00	0·00	0·00	0·00
August	0·00	0·00	0·00	0·00	1·08	0·00
September ..	1·34	0·38	3·58	0·00	1·30	0·44
October	2·70	3·99	1·99	3·20	1·01	5·17
November ..	5·18	2·77	2·48	2·23	3·03	4·40
December ...	5·96	3·93	4·62	0·39	3·16	1·57
	<u>25·00</u>	<u>20·68</u>	<u>15·96</u>	<u>9·36</u>	<u>11·24</u>	<u>23·36</u>

The mean annual fall has therefore been 17·60 in.—*Malta Times*.

* This should probably be 0·40 in. ; if not, the total is 9·00.—ED.

FEBRUARY, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		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	inches.	in.							
I.	Camden Town	2.48	+ 1.26	.52	11	17	60.8	5	31.3	24	4
II.	Staplehurst (Linton Park) ...	3.15	+ 1.64	.75	12	14	56.0	6	28.0	24	6
III.	Selborne (The Wakes).....	3.33	+ 1.62	.74	11	18	51.0	17*	29.5	24	8
IV.	Hitchin	2.02	+ .76	.93	12	14	56.0	4, 5	32.0	19§	...
V.	Banbury	2.20	+ .77	.75	12	16	56.0	5	28.0	24	5
VI.	Bury St. Edmunds (Culford)...	2.49	+ 1.07	1.11	12	12	56.0	4†	25.0	19¶	7
VII.	Bridport	3.07	+ 1.01	.74	11	17	57.5	3	27.5	23	4
VIII.	Barnstaple	4.35	+ 2.27	.77	12	21	62.0	6, 7	34.0	20	...
IX.	Bodmin	4.56	+ 1.77	.92	11	22	58.0	5	34.0	19‡	...
X.	Cirencester	3.37	+ 1.76	1.35	12	13	53.0	8	36.0	20	...
XI.	Shifnall (Haughton Hall)	2.00	+ 1.11	.50	12	17	55.0	8	27.0	23	4
XII.	Tenbury (Orleton)	2.91	+ 1.34	.75	12	19	59.8	5	27.0	23	4
XIII.	Leicester (Wigston)	1.91	+ .57	.92	12	10	57.0	5	29.0	12¶	4
XIV.	Boston	1.89	+ .68	.71	12	16	58.5	8	32.0	23	...
XV.	Killingholme (Lincoln)	1.56	+ .31	.2	13	13	56.0	8	32.0	13**	...
XVI.	Derby	1.89	+ .41	.35	12	19	57.0	5, 8	30.0	20	2
XVII.	Manchester	4.44	+ 2.49	.73	8	21	61.8	5	32.0	18	...
XVIII.	York	1.72	+ .34	.28	24	16	58.0	10	31.0	13**	2
XIX.	Skipton (Arncliffe)	9.08	+ 5.41	2.14	8	20	54.0	6	30.0	28	1
XX.	North Shields	1.32	- .21	.47	10	12	59.0	5	30.0	28	1
XXI.	Borrowdale (Seathwaite) .....	...	...	...	...	...	...	...	...	...	...
XXII.	Cardiff (Town Hall).....	4.80	...	.93	12	21	...	...	...	...	...
XXIII.	Haverfordwest	6.11	+ 3.25	1.08	11	17	54.0	6	30.0	21	2
XXIV.	Rhayader (Cefnfaes).....	5.49	+ 2.51	.90	16	20	59.0	13	30.0	22	...
XXV.	Llandudno	3.43	+ 2.08	.87	7	19	58.0	4	34.0	28	...
XXVI.	Dumfries	4.45	+ 1.90	.67	8	21	55.0	5	30.5	28	1
XXVII.	Hawick (Silverbut Hall)	3.54	...	.83	7	25	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	5.48	+ 2.12	.70	24	25	57.0	5	30.0	28	4
XXIX.	Castle Toward	5.66	+ 1.92	.59	7	24	54.0	4	25.0	27	10
XXX.	Leven (Nookton)	2.46	+ .76	.54	13	16	57.0	5	29.0	28	4
XXXI.	Stirling (Deanston)	5.87	+ 2.87	.94	13	26	56.5	5	26.1	28	8
XXXII.	Logierait	3.38	...	.64	13	17	...	...	...	...	...
XXXIII.	Ballater	1.82	...	.36	8	13	55.5	5	27.0	3, 28	8
XXXIV.	Aberdeen	1.27	...	.46	8	18	57.6	5	28.5	28	7
XXXV.	Inverness (Culloden)	2.76	...	.45	15**	17	54.4	5	28.7	28	2
XXXVI.	Fort William	12.22	...	1.38	13	28	...	...	...	...	...
XXXVII.	Portree	11.40	+ 1.17	1.25	13	24	...	...	...	...	...
XXXVIII.	Loch Broom	6.89	...	1.25	14	22	...	...	...	...	...
XXXIX.	Helmsdale	4.90	...	.66	26	21	...	...	...	...	...
XL.	Sandwick	4.04	+ 1.56	.53	3	22	51.0	6	28.4	28	4
XLI.	Cork	2.96	...	.83	7	17	...	...	...	...	...
XLII.	Waterford	2.34	+ .31	.69	7	21	54.0	3, 25	32.0	28	...
XLIII.	Killaloe	5.96	+ 3.05	1.40	7	28	57.0	14	32.0	18	...
XLIV.	Portarlinton	2.24	+ .21	.44	8	22	56.0	5	33.0	28	...
XLV.	Monkstown	1.50	- .14	.26	7	16	61.0	5	31.0	28	1
XLVI.	Galway	6.12	...	1.25	7	26	56.0	23	32.0	1	...
XLVII.	Bunninadden (Doo Castle) ...	5.21	...	1.08	9	25	54.0	5	29.0	2	1
XLVIII.	Bawnboy (Owendoon)	6.50	...	1.29	7	24	56.0	5	29.0	1	2
XLIX.	Waringstown	4.30	...	.65	9	22	57.0	4	29.0	27	2
L.	Strabane (Leckpatrick)	4.22	...	.73	9	24	55.0	5, 6	27.0	28	5

* And 27th. † And 5th, 6th & 8th. § And 20th. || And 23rd. ‡ And 22nd.
¶ And 19th & 23rd. ** And 28th.

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

METEOROLOGICAL NOTES ON THE MONTH.

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.

CAMDEN TOWN.—Gales on 8th, 9th, 11th, and 28th; S on 22nd and 28th; almond in flower on 13th, pear in bud on 24th.

LINTON PARK.—A very mild month; vegetation forward; winds mostly S.W. and W.; very slight frosts, but a heavy fall of S on the 22nd, which soon melted; bar. very unsteady, sometimes fluctuating nearly an inch in 24 hours; R much above the average. Although it has been a wet month, dust was flying about on the 23th, an unusual thing for February.

SELBORNE.—Violent wind, with H and storm of R, at noon on 9th; the min. temp., 29.5 on 24th, had risen to 41° at 8 a.m. on 25th, with change of wind from N.E. to S.W., and back to N.E. in evening. Vegetation about six weeks earlier than the average; yew and box in flower early in the month.

BANBURY.—S on 12th and 22nd; high winds on 6th, 7th, 8th, 9th, 16th, and 27th; violets in bloom on 20th.

CULFORD.—Stormy on 1st and 2nd, high wind on 7th and 8th, a little S on 12th, which soon changed to R, which continued all day; a considerable amount of S fell on the last day of the month which soon melted; altogether this was the most wintery day we have had this winter.

BRIDPORT.—Heavy south-westerly gale with very high tide on the 1st. A mild month, and vegetation very forward.

BODMIN.—Mean temp. of the month 4°.6 above the average of 20 years.

CIRENCESTER.—Double the usual quantity of R this month, with much wind and several gales; S from 2.30 to 3.30 p.m. on 13th, and S shower on 28th. Many spring flowers and much grass; not one hoar frost.

HAUGHTON HALL, SHIFFNAL.—Another wet and windy month, with high temp. Nettles several inches high on the 5th; willow blossoming, apricots in flower and hawthorn budding on the 16th; wild daffodil in flower on 20th; rooks began to build on 28th; the lower grounds flooded all the earlier part of the month; pastures green as in May; stormy on 7th, 14th, 27th and 28th.

ORLETON.—5th and 6th very fine and pleasant, but high winds on 7th and 8th; S storm at noon on 12th, and again on 28th from 11 a.m. to noon; high winds on 13th, 14th and 27th; the rivers frequently full. A warm rainy month with changeable sky; the temp. more than 5° above the average; vegetation very forward; apricots in bloom on the 12th. TS in S.E. on 18th.

WIGSTON.—Mean temp. 5° higher than the mean of same month for 15 years; rainfall also in excess. Apricot trees in full bloom in the middle of the month, and vegetation more forward than I have ever recorded.

BOSTON.—Temp. very high during first part of the month; vegetation very prematurely advanced, limes, elms, and other forest trees being in full bud; gnats flying on the 10th. Rainfall above the average, but not excessive.

KILLINGHOLME.—Much high wind during the month; vegetation earlier than I ever knew it, even in 1859; scarcely any E. wind; great titmouse and thrush singing on 4th; several bats out in the evening of 6th; ringdove cooing, and blackbird whistling on 12th; frogs spawning on the 23rd; crocus and hepatica began to flower on 4th, wild primroses on 6th; pyrus japonica in flower, and yews shedding pollen on 10th; gossamer across rain gauge on 11th; elms flowering, bees busy at the blossom, on 15th; apricots began to flower; queen wasp out on 16th; hawthorn buds green on 19th; peach began flowering on 20th; had lawn mown on 24th; sleet on 28th, which was the coldest day in the month.

DERBY.—The temp. of the month was 5°.2 above the average of the last seven years; vegetation is considered to be six weeks in advance of the average, and fears are entertained as to the result. Snowstorm on 28th.

NORTH SHIELDS.—Yellow and purple crocus in flower in the first week. S on 2nd, 23rd, 27th and 28th. Lunar halo on 24th.

W A L E S.

Haverfordwest.—A mild month, generally stormy and wet, the wettest February during the last 20 years; only two nights frost; spring flowers in full blossom; the Precelly hills white with S on the morning of the 28th; heavy gale from the N. W. on 27th and 28th.

Cefnfaes.—A stormy, tempestuous month; winds strong and frequent, generally N. W. or S. E.; vegetation forward, and all spring flowers both fine and abundant.

Llandudno.— S on the distant hills on 12th, 18th, 23rd, and 27th; severe H storm at 3.15 p.m. on 24th; lunar rainbow at 9.30 p.m. on 26th. Peach, apricot, and pear in bloom on 4th; sprig of hawthorn in full leaf on 6th; black-thorn, palm and primroses in bloom in the lanes on the 13th; red flowering currant in full bloom on 16th; mezereon in flower on 20th; horse chesnut and elder in full leaf in sheltered situations on 21st.

S C O T L A N D.

Dumfries.—Month wet but mild; vegetation unusually forward; fruit trees expending their blossoms; the gloire de Dijon rose with large buds; pastures very green and beautiful. On the night of the 27th a S storm, and on the morning of the 28th the S was from 3 to 4 inches deep over the country, but deeper on the hills.

Silverbut Hall.—Heavy gales on 1st, 5th, 6th, 7th, 13th, 16th, and 17th. hurricane from W. on 4th; tremendous wind on 25th; keen frost on 27th and 28th, which checked the growth of grass, disfigured bays, laurels, &c., and injured the prematurely developed buds of trees and shrubs. S about three inches deep at the end of the month.

Castle Toward.—A mild, dull, cloudy month, until the last few days, when it was cold and stormy, with S , sleet, and heavy H showers; a yucca gloriosa began to throw up a flower shoot about the 1st, and is now 15 inches long, having grown half an inch every day since; I never saw it start so early before.

Nookton.—Gales on 5th, 7th, 13th, and 25th; S on 27th and 28th.

Deanston.—Very wet month; gales on 6th, 13th, 14th, 26th, and 27th, the latter accompanied by heavy falls of S .

Logierait.—Frequent gales of wind with R , but no frost till the 28th, when much S fell, the first of the season.

Ballater.—Up to the last week vegetation was making alarming progress for the season; the last week, however, was stormy, with strong gales of wind, and the ground covered with S , which remained to the end of the month. Pink hepatica in flower on the 4th, blue hepatica and crocus on the 20th. Lark singing on 16th. Aurora on 9th; lunar halo on 19th and 23rd.

Aberdeen.—A month of fine, mild, dry weather, except the last four days, which were stormy; S on the last three; S. W. and W. winds more than usually prevalent. Temp. $4^{\circ}6$ higher than the average of last 12 years, and bar. lower. Auroræ on 1st, 3rd, 4th, 9th, 10th, 11th, 14th, 16th and 17th.

Rosse Parsonage.— R has been registered every day, but in smaller quantities than last February, when the total was 20.13, this year it is but 12.22; we have had 8 in. of S ; no frosts, but very stormy on 13th, 25th and 26th.

Portree.—This month has been very stormy and squally throughout; a continuous W. S. W. gale from 9.30 a.m. on the 25th to 3 a.m. on 1st March. A heavy fall of S commenced on the evening of the 26th, and continued to the 1st of March, being blown in some places 18 inches deep; on each of three days more than 1 in. of R was measured.

Lochbroom.—Upon the whole, this has been a beautiful and favorable month for the agriculturist and grazier; trees and bushes never seemed so green and so far advanced at this season, but a sudden change took place by the end of the month: on the night of the 26th and morning of 27th we had one of the most terrific storms from the S. W. that we ever remember, doing great damage to ships, houses, and other exposed property.

Sandwick.—February has been wetter and warmer than the average, but very

stormy, especially the latter half; there were six gales, and the last of these, on the 27th, was fully equal to any yet recorded here since the anemometer was erected (8 years ago), being 75 miles an hour from 3 to 5 a. m.; a continued gale travelling 1276 miles between 10 a. m. on 25th and 10 a. m. on 26th. Auroræ on 2nd, 4th, 6th, 9th, 10th, 11th, 12th, 17th, and 27th.

I R E L A N D.

WATERFORD.—The rainfall of the *six* months ending February 1st was 40 in., being almost exactly the average fall in *twelve* months.

KILLALOE.—The wettest February in 24 years, except in 1848, when 7·76 in. fell, being 1·80 in. more than now.

DOO CASTLE.—Very inclement month, almost constant rain; no frost; S on the last day.

OWENDOON.—Rainfall and floods very high this month, particularly on 7th, 8th, and 9th, when 3·00 in. fell almost within 48 hours; S lay on the 27th (nearly an inch deep) for the first time this season, though it was seen on the mountains on the 12th; a very forward spring.

WARINGSTOWN.—Wet and stormy but mild; spring flowers from a month to five weeks earlier than usual; S on 27th and 28th.

 THE METEOROLOGICAL SOCIETY.

THE ordinary meeting of this Society was held at the rooms of the Civil Engineers, 25, Great George Street, on Wednesday Evening, the 20th January, James Glaisher, Esq., President, in the chair.

Two Fellows were admitted into the society, and one was elected. An excellent paper by F. W. Doggett, Esq., was read, "On the Weather in connection with the Hop Crops in the year 1868." The paper appeared to have been composed after much personal experience and labour by the author, and pointed to a probable connection between severe blights and the non-prevalence of thunder and lightning at the time of the perfecting of the hops. The fly, and its young in the form of a louse, were described as differing from that which produces the ordinary *black* blight (the *aphis*) in size, colour, and activity, and in producing a *brown* blight (called by continental hop-growers "copper-burnt.") The communication led to a discussion respecting the prevalence of different kinds of vermin with different temperatures. Mr. Glaisher remarked that the ordinary white butterfly, while it could thrive in temperatures as high as 80° forsook the inland counties for the coast when the temperature rose to 90° and more, as it did in the past summer.

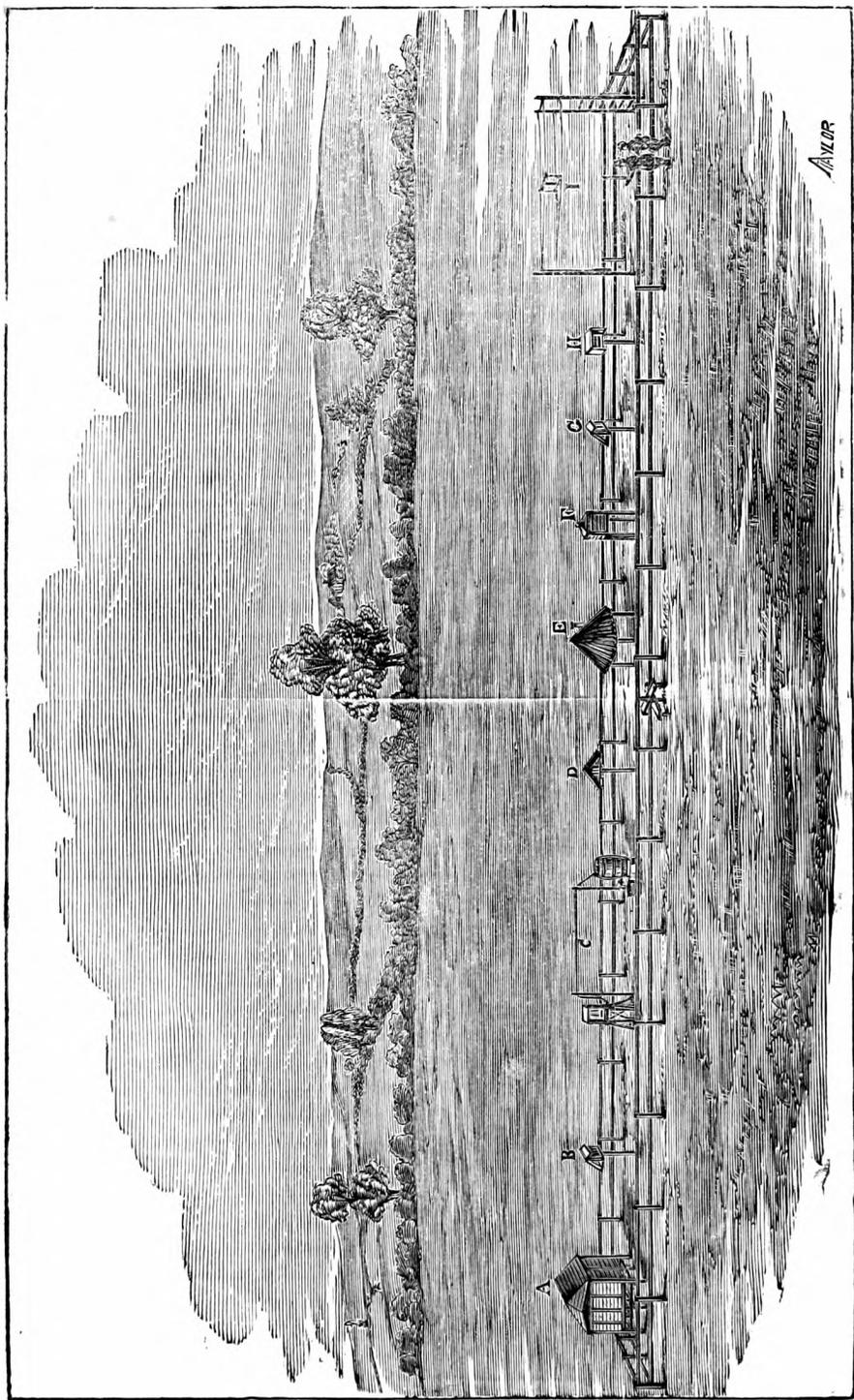
A valuable communication by Mr. Pastorelli, on the "Graduation of Spirit Minimum Thermometers," offered an opportunity for some remarks on the great improvements lately effected in these instruments. Then followed a good paper by the Rev. W. Pravita on "Reducing Barometer Readings to the sea level;" but being purely a mathematical work, it will be better read in the Society's *Proceedings* than in this review. Some observations on the Sombrero Hurricane of October, 1867, by R. H. Twigg, Esq., C.E., were read, and these were followed by a brief paper from the President on the Meteorology

of 1868. In July the extraordinary shade temperature of $96^{\circ}6$ was registered at Greenwich, which, when compared with the minimum of $22^{\circ}8$ noted in January, gives a range of $73^{\circ}8$ for the year. The unusual rainfall and warmth of December last were dwelt on at considerable length. Mr. Glaisher was requested, before the close of the meeting, to present the Society with a still more detailed paper on the subject for future publication.

The meeting closed at about 9 p.m. in the usual manner.

THE ordinary meeting for February was held at 7 p.m. on Wednesday, the 17th, in the rooms of the Institute of Civil Engineers. James Glaisher, Esq., F.R.S., President, in the chair. Five gentlemen were balloted for and elected Fellows of the Society, and three others were "admitted" in the usual form. Two papers were read at this meeting; the first by C. O. F. Cator, Esq., of Parkside, Beckenham on a "Description of Mr. Cator's Anemometer, as newly arranged with the spiral apparatus, and its registrations from September 11th, 1868, to February 11th, 1869." After detailing the changes and improvements which he had effected in his instrument, the author went on to speak at length on the stormy periods through which we have passed since the beginning of October last. It would be utterly impossible to give even a sketch of the peculiarities which he pointed out, but they will be printed in detail in the Society's *Proceedings*. Both the grouping of the gales into "storm," and the lighter winds into "calm-periods," were very interesting, and the value of constant records such as that described is becoming daily more and more recognized. A discussion took place respecting the nature of a peculiar storm which visited the S. of England on February 12th, and this was followed incidentally by some argument as to the conversion of wind-pressure values into equivalents of velocity, without, however, any very valuable result. The question is an old one, but one which deserves far more attention than it has hitherto received.

A second paper, which promises to be of great value, was read by C. Meldrum, Esq., of Mauritius, "On the connection between the rotation of the wind in the South Indian Ocean and the relative positions of the Polar and Equatorial Currents." The paper is but a tithe of a vast amount of work to which the author has devoted both time and means, respecting the weather of the Indian Ocean—especially in connection with the so-called "Mauritius Hurricanes." This paper will be printed, as usual, by the Meteorological Society.



THE THERMOMETRICAL ENCLOSURE, STRATHFIELD TURF.
[LOOKING SOUTH.]

SYMONS'S

MONTHLY

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THERMOMETER STANDS.

IN previous numbers we have described the various forms of thermometer stand; we now proceed to consider the arrangements made for their impartial trial, including—(1) Their construction; (2) The position chosen for their erection; (3) The instruments employed upon them; (4) The mode of observation.

(1) The construction was most carefully superintended, not the slightest deviation from the designs of the authors, either in substance, angle or dimensions being allowed. They were made of seasoned wood, and reflect much credit on the carpenter employed. The Kew Stand (A) is the original one so long used at Kew, and most kindly lent by the Kew Committee of the British Association. Pastorelli's (H) was supplied by Mr. Pastorelli; and Stevenson's (F) was purchased of Messrs. Brydon and Son, of Edinburgh, who have the exclusive manufacture.

Having given separate scale drawings of all the stands, it is only necessary just to explain that their arrangement is as follows:—

- A Kew Stand.
- B James's Stand.
- C Lawson's Stand (which also carries the aspirated thermometer.)
- D Stow's Stand.
- E Martin's Stand.
- F Stevenson's Stand.
- G Glaisher's Stand.
- H Pastorelli's Stand.
- I The 13 ft. Thermometer.

(2) Their position is correctly indicated by the accompanying engraving, except that the artist has somewhat drawn on his imagination for the hills in the background. The enclosure is about 140 ft. long (*i. e.*, from E. to W.) by 20 ft. broad (*i. e.*, from N. to S.) The sketch is taken looking to the S.; at the west end will be seen the poles sup-

porting the 13 ft. thermometer (1), which together with the guide-ropes which support it, has had to be rather increased in size, in order to render it visible. Mr. Griffith's own stand is in its original position in the garden at the back of the spectator, and so is Morris's, which is on the wall of the house; the position of these two stands is shown in the frontispiece to *British Rainfall*, 1868.

(3) The instruments employed on each stand are—

A Standard Maximum.	
Minimum.	”
Dry Bulb Thermometer.	”
Wet	”

They are in every respect identical—even the threads of cotton to supply the wet bulbs being counted, and the muslin being of the same size and fineness for each; both the muslin and the conducting threads are changed monthly. We shall have more to say concerning the management of wet bulb thermometers on a subsequent occasion. All the thermometers were supplied by Mr. Casella, and reflect much credit upon him. Through the kindness of the Kew Committee their index errors have all been determined at Kew, and subsequent experiments, which we need not detail, have shown that the errors so determined were astonishingly correct. As mercurial thermometers are liable to change unless very old when originally tested, it is intended to re-verify all the thermometers at the close of the experiments, and thus to ascertain if any, and what, change has taken place.

(4) The mode of observation consists of one reading daily of all the self-registering thermometers, and three readings daily—viz., 9 a.m., 3 p.m., and 9 p.m.—of all the dry and wet bulb thermometers; and at certain periods of hourly observations of the dry and wet bulb thermometers on all the stands for twenty-four consecutive hours. This involves the reading and entering of more than 500 separate observations. The confinement, regularity, punctuality, and self-denial involved in undertaking these observations single-handed, is only equalled by the accuracy with which Mr. Griffith takes and enters the observations: One illustration of his care may be mentioned: if the stands were always read in the same order—say, Kew first and Morris last—the 9 a.m. reading of Kew would be below that of Morris, because *both* could not be read at 9 a.m., one must be a minute or two before the hour, the other a like period after it, and during the interval the temperature would on the average have risen. It is therefore Mr. Griffith's custom to begin with a different stand each day, in regular order, thereby neutralizing this possible source of error.

We do not intend on this occasion to discuss the observations

already made, but we may mention that they are most puzzling; sometimes the thermometers on all stands will be, when corrected for index error, within $0^{\circ}\cdot 2$, another time they will differ several degrees, and these differences are not due to one cause alone, such as capability of protecting the thermometers from sun; if so, the difference would vary with the amount of solar radiation, which is not by any means regularly the case. One disturbing cause is rain; we may give an instance. On a recent occasion Mr. Griffith was taking term-day observations, *i.e.*, consecutive readings each hour for 24 hours. About 8 a.m. a driving shower came from the west; at that hour of course James's and Glaisher's stands were facing about W.N.W., the rain therefore reached the bulbs, and it was two hours and a half before they were again dry. If the shower had come from the S.E. instead of the W., they would have been as dry as those on (say) Martin's. The thermometers in Stevenson's stand would have been thought (at any rate we thought) quite safe from rain reaching them, but in practice this is not the case; the rain falls on the louvre boards, hangs on their edges, is blown upwards, and so finds its way on to the thermometers. Mr. Griffith says they are almost as often wet as the others. Irrespective of the readings of the instruments, we have a singular but very useful guide as to the exposure of the instruments in the rate at which the varnish on their frames perishes; the wood and the varnish, and the date of making being identical, the comparison is not uninteresting. The Kew stand *seems* unduly to diminish the daily range of temperature, and also to retard the occurrence of the maximum and minimum. But we must not be betrayed into a discussion of their merits until the observations have been longer continued, and more fully discussed.

RAINFALL AT HARBOUR LIGHTHOUSE, PORT ELIZABETH,
CAPE OF GOOD HOPE.

1867.		1868.	
January	·47	January	·26
February	1·37	February.....	3·87
March	1·71	March.....	1·59
April	1·31	April	1·89
May	2·74	May.....	·80
June	4·60	June	·65
July	1·92	July	3·95
August	3·10	August	1·25
September	3·91	September	·35
October.....	2·65	October	1·28
November	9·27	November	2·58
December	·72	December	1·50
Total.....	33·67	Total	19·97

—From the *Eastern Province Herald*.

TIME INTERVAL.

As the period when thunderstorms are most prevalent is fast approaching, it may be well to direct attention to the desirability of more frequent observations of the above element, to facilitate which the following table has been prepared. The observer will only have to note by a seconds' watch the time between the flash and the thunder, and against the number of seconds he will find the distance in miles.

TIME-INTERVAL AND EQUIVALENT DISTANCE.

sec.	miles.	sec.	miles.	sec.	miles.	sec.	miles.	sec.	miles.	sec.	miles.	sec.	miles.
1	·2	11	2·3	21	4·5	31	6·6	41	8·7	51	10·8	61	12·9
2	·4	12	2·5	22	4·7	32	6·8	42	8·9	52	11·0	62	13·1
3	·6	13	2·8	23	4·9	33	7·0	43	9·1	53	11·2	63	13·3
4	·9	14	3·0	24	5·1	34	7·2	44	9·3	54	11·4	64	13·6
5	1·1	15	3·2	25	5·3	35	7·4	45	9·5	55	11·6	65	13·8
6	1·3	16	3·4	26	5·5	36	7·6	46	9·7	56	11·9	66	14·0
7	1·5	17	3·6	27	5·7	37	7·8	47	10·0	57	12·1	67	14·2
8	1·7	18	3·8	28	5·9	38	8·1	48	10·2	58	12·3	68	14·4
9	1·9	19	4·0	29	6·2	39	8·3	49	10·4	59	12·5	69	14·6
10	2·1	20	4·2	30	6·4	40	8·5	50	10·6	60	12·7	70	14·8

METEOROLOGY IN INDIA.

In 1867 the Government of Bengal appointed a meteorological reporter to make reports on the phenomena of weather, similar to those published in the Punjab and North-western Provinces, and to carry on a system of storm-warnings for the protection of the port of Calcutta, which had been duly sanctioned. The observers, from whom he derives his information, are generally assistants in the telegraph department, stationed at different places round the Bay of Bengal, and some other localities in communication with Calcutta. They note the barometric pressure, the humidity of the air, the direction and force of the wind and rainfall; and these particulars they flash twice a day—at 9:30 a.m. and 4 p.m.—to the head office in Calcutta, which is attached to the office of the Surveyor General of India. Similar reports are transmitted by the observatory at Madras; the daily registers of the Calcutta Observatory are consulted, and from all these a tabular report is drawn up and sent, after careful examination, to the Master Attendant of the port, and to the newspapers. In critical states of the weather, additional pains are taken to communicate the information more frequently. This system is a good one, and we were prepared to hear that it works well, and that the reporter was thereby enabled to give to the shipping in the port a fore-warning of some hours of the approach of the violent cyclone of November last. May we not hope that from this comparatively small beginning, a system of storm-warnings may be developed, which shall embrace the whole range of coast from Japan to the Red Sea? The committee, under whom the reporter works (for there is a Meteorological Committee in Calcutta as

well as in London), express themselves as fully alive to the importance of a knowledge of the normal laws of local meteorology, in order to derive full value from the telegrams, but they find this knowledge nowhere available. They have been able to collect a few scattered records, but with the exception of these, as they state, the meteorology of Bengal and its coasts remains but little known; and no trustworthy data can be looked for until continuous and careful observations shall have been made during a course of years. They are working to this end by preserving all the reports which they receive, and embodying them in a systematic summary. They are also taking pains to ensure accuracy on the part of the observers, and have given notice that all instruments issued in future will first be tested in the head office at Calcutta. Taken in connection with the grand system of meteorological observations now so actively carried on over a large part of India, this system of storm warnings cannot fail to be attended by the happiest results. Already its records may be consulted with advantage, as set forth, with tables, in the Report just published for 1867-68.—*Athenæum*.

ANOTHER EARTHQUAKE.

ON March 15th a decided shock of earthquake was felt in the south of Lancashire and Yorkshire. It was rather stronger than most of those which have recently occurred, cracking a wall, throwing down a chimney, also a clock and sundry crockery. One most noticeable feature is the marked agreement in the time; one observer says 6h. 4m. p.m., five observers say 6h. 5m., one says 6h. 7m., one 6h. 9m., two 6h. 10m., and one (evidently wrong) says 6h. 30m. Omitting him, there is only 6 minutes between the earliest and latest. We will not be so conceited as to imagine that our recent remarks as to the imperative necessity of observers keeping their clocks right has induced this improvement, but we trust the example set by these north country people will be even a stronger inducement than any words of ours.

A PILLAR OF FIRE (?)

On Saturday morning, between four and five o'clock, a ball—or more properly speaking, a pillar of fire—passed from east to west over the City of Carlisle, and was plainly visible for fully a score of miles around. It resembled an ordinary gate-post in size and shape, and seemed as though it were prevented from falling by some invisible connecting cord. It travelled in a westerly direction, and was plainly visible at Cumberdale, and at Glasson, 10 miles distant from Carlisle. At Glasson, a respectable yeoman watched the pillar intently, and he says that it caused a great heat, while another person in the same locality says that the fiery substance seemed to pass within a score of yards of him, and that the heat was almost overpowering. It exploded in the air, and immediately after the report, resembling the sound of the discharge of cannon, a singular brightness lit up the heavens.—*Manchester Examiner*, April 7th, 1869.

PRE-INSTRUMENTAL METEOROLOGY.

To the Editor of the Meteorological Magazine.

SIR,—Will you allow me to raise the above subject for discussion in your pages? I cannot help thinking that very much is to be learned from old chronicles; although some of them were doubtless guilty of exaggeration, yet “in the multitude of counsellors,” &c, and so if anything like a comprehensive collection was made, these faults would soon be detected. You stated (*British Rainfall*, 1868, p. 58) that one of your deceased correspondents had been comparing farm registers some two centuries' old with contemporary rain returns, and had found a close accordance. I wish to suggest a similar course on a large scale, believing that many most important results could thereby be deduced. I wish some one to volunteer (I have not time myself) as superintendent, and I wish all your readers, each so far as in him lies, to assist. Vague suggestions generally produce poor results; I would therefore venture to suggest details, and that will be best done by an example. I recently borrowed from a friend a pamphlet, entitled “Annals of the Diocese of Lichfield, Past and Present, being a Supplement to the Lichfield Church Calendar, 1861;” therein I find a series of extracts from the oldest register of Ashley Church, two of which will serve as types of the whole:—

“1614, Feb. 28th.—Predicta hiemalis intemperies a vicesimâ die Januarii ad decimam quartam Martii.”

(A wintery severity of weather, as predicted, from the twentieth day of January to the fourteenth day of March.)

“1634, June 23rd. — Circiter occasum solis mirandus tonitruï fulguris et grandinis increbuit horror una cum pluvie immensâ copiâ circa Shrawardine in comitatu Salopiæ perierunt segetes plurimæ grandine demissæ longique labor periit mitus anni.”

(About sunset there prevailed a wonderful and terrible storm of thunder, lightning, and hail, together with an immense quantity of rain, around Shrawardine, in the county of Salop. A great deal of corn was destroyed, being cut down by the hail, and the undertaken labour of the long year was lost.)

My idea is, that each of your readers should, before copying any extracts, send a line to the superintendent, and ask if the book they propose to search has already been undertaken by anyone else; this would avoid waste of labour. The superintendent or secretary should have some cards printed after this style:—

DEAR SIR,

The work you mention has been searched.

Yours very truly,

It would take very little time to fill in the word “not,” when required; and by keeping an alphabetical list of books searched, it would be easy to be sure whether the “not” should be inserted or omitted. All persons making extracts should write on one side of the paper only, and they should be very careful to give correctly the title, date, volume, and page whence each separate extract is made. The duties of the secretary would simply consist in sending the above-mentioned cards, and in filing the extracts in the order of their date.

It would obviously be inexpedient to think of printing them until the collection approached completion.

I hope that it will not be asking too much if I request that you will receive offers of assistance in this matter, and I trust that none of your readers will refrain from offering their aid through mistaken ideas of the greater capability of others. It is pre-eminently a work in which all can and all should help, so far as in them lies.

I am, Sir, your obedient Servant,

K. C. T.

[Our sole comment on this proposal is hearty approval, and earnest hope that the scheme so ably promoted by K. C. T. may be carried to a successful issue. We have no shadow of doubt as to the value of the results to be obtained in the manner suggested. The work of the "superintendent or secretary" would not be great, and the main requirements being habits of regularity and arrangement, we trust several of our readers will volunteer their services, and we are sure they will be well repaid by the consciousness of useful labour. We are not certain whether "Extra-Instrumental Meteorology" should not be substituted for "Pre-Instrumental," for the following reason, which however we only give from memory :—Oundle Church, Northamptonshire, has a fine lofty spire, so have many other churches, but Oundle Church has certainly been struck by lightning three times, and probably more. Why? Possibly the presence of iron ore in the district accounts for it; but if so, may not a careful chronicle of such like "accidents" reveal other unexpected facts? Had the frequent damage of this church been known, might not the so-called recent discoveries of iron ore have been anticipated? If the chronicle is to touch such questions as these, it must not stop short at the date of the introduction of meteorological instruments, but must be brought down to the present time. The subject is of great importance.—Ed.]

PREDICTIVE METEOROLOGY.

To the Editor of the Meteorological Magazine.

SIR,—I beg to send you the following extract from the *Gardeners' Chronicle* of Saturday last, as perhaps you may not have seen it, and I thought it might be interesting to some of the readers of the *Meteorological Magazine*.—I remain, Sir, your obedient Servant,

J. BRYAN.

Audley End Gardens, Saffron Walden, Feb. 24th, 1869.

"THE WEATHER.—As the present year is affording another illustration of the remarkable law pointed out by Mr. Brumham (*Pro. Met. Soc.*, Vol. IV. p. 89) it may be worth while to direct the attention of your readers to it. It is as follows :—'When the mean temperature of December is more than 2° above that of November, the remainder of the winter, or rather the winter quarter (consisting of January, February, and March), will always have a mean temperature consider-

ably above the average.' The following are all the instances in the last 97 years relative to this rule :—

Year.	Mean Temperature of November.	Mean Temperature of December.	Year of Winter.	Difference of mean of January to March, from the mean of 97 years, which is 38·5.
	deg.	deg.		deg.
1789	38·7	41·6	1789—90	+ 2·5
1795	40·7	44·8	1795—96	+ 2·8*
1827	41·5	44·1	1827—28	+ 2·7†
1842	42·8	45·0	1842—43	+ 1·1‡
1851	37·9	40·4	1851—52	+ 2·9
1862	39·8	43·6	1862—63	+ 4·1||
1868	41·5	46·0	1868—69	+ 2·8

* The warmest January on record occurred this winter.

† A mild winter.

‡ A mild and stormy January.

|| A remarkably mild winter.

R. C. C. L."

SOLAR RADIATION TEMPERATURES.

To the Editor of the Meteorological Magazine.

SIR,—The time is approaching when many observers will be again trying the heat of the sun's rays, and if some uniform plan can be adopted, even if not the best, it would be much better than the discordant results of last summer.

I would propose a very simple matter, merely a board say 8 in. by 12 in., supported by legs say 3 in. long, the board of course to be blackened a dead black, for which there is nothing better than glue and lamp black, and the board left rough from the saw.

There are many obvious disadvantages in placing a thermometer on the grass; one is that it is very liable to be trodden on, another that a few blades of grass will often escape observation, and interfere with the results.

It is too late to discuss what plan will be best, but if you suggest one, I have no doubt it will be at once adopted, and so we shall avoid the really ridiculous returns of last summer.—Yours, &c.,

JOHN DAVIS.

Derby, March 31st, 1869.

[We think that the plan recommended by the Rev. F. W. Stow is the best, viz., to place a dull black bulb maximum vacuum thermometer so that its bulb points to S.E., is 4 ft. above the ground, and not in the least sheltered or shaded by the post by which it is supported.—ED.]

MEAN DAILY HUMIDITY.

To the Editor of the Meteorological Magazine.

SIR,—Will you be kind enough to inform me of the correct mode of computing the above? I have hitherto worked with *Glaisher's Diurnal Range Tables, 4th Edition, 1867*, but the observations during

November and December last have frequently resulted in the absurdity that the mean temperature of the wet bulb has been much greater than that of the dry, although, as in the following instance, at 9 a.m. the wet has been 0°·6 below the dry, and at 3 p.m. 0°·1 below. If you can explain how to avoid this palpable error, you will greatly oblige, yours very truly,

C. H. GRIFFITH.

CALCULATIONS IN DETAIL, OCTOBER 24TH.

9 a.m.		3 p.m.			
Dry Bulb.	Wet Bulb.	Dry Bulb.	Wet Bulb.	Max.	Min.
45°·6	45°·0	55°·4	55°·3	60°·2	38°·4
	Max.....		60°·2	} Range, 21°·8	
	Min.....		38°·4		
	Sum	2)98·6			
	Mean... ..	49·3			
	Corr. from Table V. ...	-0·9			

48·4 = Mean from max. and min.

DRY BULB.		WET BULB.	
9 a.m.	3 p.m.	9 a.m.	3 p.m.
45°·6	55°·4	45°·0	55°·3
Cor. from Table III. ... -0°·2	-7°·4	-0·8	-3·9
<hr/>	<hr/>	<hr/>	<hr/>
45·4	48·0	44·2	51·4
48·0		51·4	
<hr/>	<hr/>	<hr/>	<hr/>
2)93·4		2)95·6	
46·7	} =Mean from		
	Dry Bulb.	47·8	=Mean from Wet Bulb.

Therefore the wet bulb temp. is 1°·1 above the dry bulb, which is absurd.

[The cause of the above anomaly is evidently the much larger subtractive correction to be applied to the dry bulb reading in the afternoon than that to be applied to the wet one (-7°·4 as against -3°·9), but we must confess we do not know how the mean daily humidity is otherwise to be determined. We are sure that Mr. Glaisher, as the author of the *Diurnal Range Tables* and of the *Hygrometrical Tables*, would confer a general favour by indicating the proper course to be pursued.—ED.]

WHEEL BAROMETERS.

To the Editor of the *Meteorological Magazine*.

SIR,—I can hardly take up any book on Meteorology without finding the wheel barometer held up to ridicule and condemnation. Can you tell me why? I find most books make abusive remarks take the place of reasons. I am the more puzzled, because the aneroid rarely suffers condemnation, and yet its larger companion invariably does.

I am, Sir, Yours very truly,

L. T. K.

[If our memory serves us aright, we are under promise to follow

the articles on thermometer stands with a series on thermometers, otherwise the above would almost tempt us to take up barometers first. However, we will reply briefly to L. T. K.'s inquiry, and leave the general question of barometers *in futuro*. We partly agree with L. T. K., who evidently thinks the old wheel barometer hardly used. Our opinion (by no means infallible, and only to be taken *quantum valeat*,) is that a *good* wheel barometer is by no means a useless instrument. Ever since barometers were invented, men have been trying to render the changes more readily visible to the eye than is the case with the simple upright column of mercury. We had in the olden time the diagonal barometer and the wheel barometer; in modern times we have had Howson's and several others, but to our own thinking none better than the wheel barometer. Why, then, has it become in such bad repute? We believe it, like many other things, has suffered from undue cheapening, undue desire for profit on the part of the makers, and ignorance on the part of many who use it. The first and second causes have led to the use of a tube narrow in bore, even at its widest, and (simply to save a pound or two of mercury) contracted through a large part of its length; the tube is not mounted as it should be, on a slab of flint glass at the bottom, but is simply stuck in a frame-work of stained deal, which may swell and shrink as much as it likes; the silken string is generally cotton; and the pulley, which ought to be carefully poised to work in agate bearings, is often hardly good enough for a roasting-jack; there is no provision made, by unequal graduation, to compensate for the string winding on itself, and therefore unduly increasing the leverage, and very often the hand itself, is not properly counterpoised; and it is rare to find them adjusted correctly, even when new; while to find that they are an inch wrong, and be told, "Oh, is it now? well I said I saw some of the quicksilver run out one day when we were moving it," is a very common event. These are a tolerable string of indictments, and of course do not apply to *all* wheel barometers, but to sadly too many. Perhaps, however, the greatest foe of the wheel barometer as at present made is dust. The frame-work, as we have said, is ordinarily stained deal, veneered with rose-wood; At the back there is a long door, which enables one to obtain access to the tube, but as the wood is often not too well seasoned, three months in a warm room dries the wood, and even if it fitted well originally, it soon allows access to the dust, of which a plentiful store is almost always to be found in the chamber, in the tube, on the strings, and worst of all on the axle, forming with the oil previously put there, a delightful resisting medium. Many persons may think these drawbacks sufficient to condemn any instrument; we do not; we believe they are all removable, and should be glad to hear that some one would undertake to supply wheel barometers in which they were all guarded against. Of course we do not for a moment contemplate observers making and publishing readings from wheel barometers; the effect of moisture on the cord would prevent that being expedient; but we believe there are many men who would like to have a wheel baro-

meter which would go without being knocked—as, for the reasons above stated, is now almost always necessary. Such a barometer would not only be a companion, but also a boon to regular observers, by telling them at once of any change, and thus, with the mere trouble of a glance, informing them whether or not extra readings of their standard barometer should be taken. The manufacture of aneroids is at present in the hands of opticians worthy of the name, hence its workmanship is incomparably superior.—Ed.]

REVIEW.

The Origin of the Seasons considered from a Geological Point of View.

By S MOSSMAN.—xvi.-472 pages, map and diagrams.—W. Blackwood and Sons.

A WORK on the Origin of the Seasons would generally be expected to be devoted to meteorology, but that is not the case with the one under notice, for the author is not treating of the seasons but of their origin. It is not very easy to condense Mr. Mossman's 500 pages into *one*, but the drift of his argument we take to be that during the earlier ages of the world the planes of the ecliptic and equator coincided, and there were no seasonal changes; that at a later epoch a gigantic earthquake threw up the existing continents, and caused such an excess of elevated dry land in the Northern Hemisphere, that the centre of gravity and axis of rotation were altered, and so the seasons dawned upon the earth. The author throws down the gauntlet to reviewers and readers alike, by devoting a page at the commencement of his work to the following extract:—

“Whenever a new and startling fact is brought to light in science, people first say ‘it is not true,’ then that ‘it is contrary to religion,’ and lastly, ‘that everybody knew it before.’—*Professor Agassiz.*”

We do not presume to offer ourselves as champions of the ordinarily received theory, nor will we say Mr. Mossman's “is not true,” but we must tell the author that our verdict is the excellent Scottish one—not proven. For instance, let us take two paragraphs, which are to a certain extent the foundation stones of Mr. Mossman's theory:—

“*Stupendous Elevations and Depressions of the Earth's Crust.*—But even this stupendous inequality on the earth's surface is not its greatest elevation or depression. There are other points at the sea-level where the mountains inland rise on the one hand to double the height of the Alps, and on the other hand the bed of the ocean reaches to twice the depth of that just indicated. Such a position exists at Point de Galle in Ceylon, or more appropriately, perhaps, Cape Comorin, at the extreme verge of Hindostan, where the observer stands between the Himalaya Mountains and the central bed of the Indian Ocean. Gaurisankar, the monarch of the Himalayas, and the highest mountain in the world, is 29,000 feet above the sea, while the greatest ascertained depth of the ocean is upwards of 35,000 feet. Here then we have a depression and elevation of the land 12 miles in perpendicular height. However, as the distance between the two extremes is not far short of 2000 miles, this indentation of the earth's crust would not appear greater in proportion than that between the Alps and the bed of the Atlantic

already given. A more striking example of precipitous elevation and depression exists between the highest peaks of the Andes and the bed of the Pacific Ocean adjacent, where they rise 'like a wall on an immense crevice,' as Humboldt remarks, which is not less than eight miles in perpendicular height in a distance of about 200 miles by horizontal measurement."

Surely both Humboldt and our author have allowed themselves to be misled by the artificial mode of representing sections of the ocean bed which has been so generally adopted, for how can a gradient of one in 167 be considered a "stupendous inequality," or a gradient of one in 25 be considered "like a wall on an immense crevice."

Then, on page 40, he writes—

"The form and movements of the Earth like a top spinning.—In computing the polar diameter of the earth at 7,898 English miles, as compared with the equatorial diameter of 7,925, astronomers show a difference of 27 miles. Without disputing that calculation, it is not illogical to conclude that the depression at the north pole is considerably greater than at the south, inasmuch as the water is immediately affected by the diurnal revolution of the globe where the land is not. At all events, the flattening at the north pole has not its equivalent in the south. Moreover, if we take the land as the ruling body, by virtue of its ponderosity, in the rotation of the earth, this diversity of contour is more apparent. Suppose the world emptied of its seas, the bed of the Arctic Ocean would present a still greater depression at the north pole, while those of the Atlantic, Indian and Pacific Oceans in the south would give the antarctic regions something of a tapering form. In that case the solid framework of the earth, as the rotating power which sustains its diurnal revolution, may be considered an oblate-oblong spheroid, or, to use a familiar comparison, top-shaped; and that well-known toy, which has beguiled our boyhood's hours by its rotation, may show to the popular mind a familiar example of the obliquity of the ecliptic when the top leans to one side while spinning, yet describing a circle in its course while kept in motion, the former illustrating diurnal revolution and the latter annual rotation."

Doubtless we shall be indited for presumption, but we not only object to Mr. Mossman's suggestion that the world is top-shaped, but also to the traditionary orange. If the obvious fact that the equatorial diameter exceeds the polar only by $\frac{1}{320}$ th part is not sufficient proof of the absurd exaggeration indicated by the orange, perhaps the following extract will be :—

*"The departure of the terrestrial spheroid from the form of an exact globe is so inconsiderable, that if an exact model of it turned in ivory were placed before us, we could not, either by sight or touch, distinguish it from a perfect billiard ball. A figure of a meridian actually drawn on paper could only be distinguished from a circle by the most precise measurement."**

This being the case with reference to a difference of 25 miles, we need not point out how difficult it is to believe that depths and heights of 5 or 6 miles can have caused any change in the motion of a mass containing some 260,000,000,000 of cubic miles.

Our author is great at quotations, and deserves credit for the strict honesty with which he assigns them to their original sources; he is greater still on Chinese, Australian, and New Zealand questions, and supplies much useful information respecting their climate and natural productions.

* Lardner's Museum, Vol. III. p. 68.

MARCH, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which ≥ 1 or more fell.	Max.		Min.		
				Dpth.	Date.		Deg.	Date.	Deg.	Date.	
I.	Camden Town	1.97	— .11	.55	20	16	54.0	5	26.8	13	11
II.	Staplehurst (Linton Park) ...	2.91	+ .42	.66	20	23	50.0	5*	24.0	4, 8	19
III.	Selborne (The Wakes).....	1.93	— .56	.60	16	12	48.4	19	22.5	7	21
IV.	Hitchin	1.46	— .71	.62	18	19	50.0	18	26.0	6	10
V.	Banbury	1.54	— .66	.62	19	21	50.7	5	26.0	7	18
VI.	Bury St. Edmunds (Culford). ..	1.87	— .33	.46	27	12	51.0	5, 26	19.0	3	24
VII.	Bridport	2.25	— .62	.60	19	15	57.0	5	27.0	16	13
VIII.	Barnstaple	1.06	— 2.09	.25	2	9	...	...	...	...	...
IX.	Bodmin	2.85	— .90	.58	16	12	52.0	5	29.0	15	3
X.	Cirencester	1.60	— 1.00	.66	19	9	46.0	19	35.0	11†	...
XI.	Shifnall (Haughton Hall) ...	1.59	— .35	.62	19	12	52.0	5	25.0	17	15
XII.	Tenbury (Orleton)	1.79	— .63	.53	19	16	53.5	5	26.3	7	11
XIII.	Leicester (Wigston)	1.96	— .15	.80	19	12	52.0	26	26.0	6, 26	12
XIV.	Boston	2.72	+ .93	1.18	19	22	52.0	25	27.5	13	12
XV.	Killingholme (Lincoln)	2.69	— .67	.67	27	21	50.0	26	27.0	3, 17	6
XVI.	Derby.....	1.64	— .61	.56	19	15	51.0	5, 26	27.0	30	10
XVII.	Manchester	1.27	— 1.42	.44	19	10	...	...	...	...	...
XVIII.	York	1.82	— .17	.37	19	20	50.0	26	25.0	3	13
XIX.	Skipton (Arnccliffe)	2.17	— 2.64	.55	1	17	49.0	25†	28.0	3	4
XX.	North Shields	1.30	— 1.05	.27	10	16	54.0	28	26.8	3	8
XXI.	Borrowdale (Seathwaite).....	3.21	— 10.29	.97	1	16	...	...	...	...	...
XXII.	Cardiff (Town Hall).....	1.70	— .46	.46	19	11	...	...	...	...	...
XXIII.	Haverfordwest	3.14	— .31	1.18	16	13	51.8	18	22.5	14	14
XXIV.	Rhayader (Cefnfaes).....	1.78	— 2.06	.40	18	8	51.0	...	22.0	...	...
XXV.	Llandudno.....	1.37	— .89	.42	1	13	53.5	18	30.3	10	3
XXVI.	Dumfries .....	.53	— 2.45	.20	1	7	59.0	31	27.0	27	12
XXVII.	Hawick (Silverbut Hall) ...	1.15	— .17	1.10	18	18	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	.67	— 3.06	.37	1	9	53.0	3	23.0	11	17
XXIX.	Castle Toward	1.28	— 3.31	.32	1	12	55.0	22	21.0	2, 10	21
XXX.	Leven (Nookton) .....	.94	— 1.13	.31	2	11	55.0	6	23.0	3	14
XXXI.	Stirling (Deanston)	1.00	— 2.53	.48	1	12	55.2	23	16.9	3	25
XXXII.	Logierait .....	.76	— .21	.28	9	9	...	...	...	...	...
XXXIII.	Ballater	1.78	— .38	.5	19	19	49.0	30	17.0	3	18
XXXIV.	Aberdeen	1.90	— .59	1	19	19	51.6	19	25.2	3	14
XXXV.	Inverness (Culloden) .....	.94	— .45	.4	...	...	49.0	25	27.0	3	13
XXXVI.	Fort William .....	...	— .47	.17	17	23	...	...	...	...	...
XXXVII.	Portree	3.41	— 5.63	.47	17	23	...	...	...	...	...
XXXVIII.	Loch Broom	2.63	— .53	.4	20	20	...	...	...	...	...
XXXIX.	Helmsdale	2.77	— .26	.26	23	23	...	...	...	...	...
XL.	Sandwick	2.85	— .48	.40	3	25	47.0	25	26.5	1	13
XLI.	Cork	2.85	— 1.18	.12	10	10	...	...	...	...	...
XLII.	Waterford	2.55	— .34	.46	1	11	51.0	5	31.0	19	1
XLIII.	Killaloe	3.86	— .47	1.53	1	17	52.5	7	25.0	15	6
XLIV.	Portarlington	2.09	— 1.22	.55	2	23	52.0	7	27.5	14	5
XLV.	Monkstown	2.90	+ .32	.46	19	18	53.0	18	27.4	12	9
XLVI.	Galway	3.44	— .85	1	15	15	56.0	24	30.0	13	2
XLVII.	Bunninadden (Doo Castle) ...	3.43	— 1.01	.18	13	13	52.0	7	25.0	31	11
XLVIII.	Bawnboy (Owendoon)	3.38	— .80	.18	18	18	55.0	7, 23	27.0	14	9
XLIX.	Waringstown	1.83	— .33	.19	18	18	54.0	7	25.0	11	13
L.	Strabane (Leckpatrick)	2.37	— .35	.1	21	21	59.0	22	25.0	11	18

* And 18th & 24th. † And 27th. ‡ And 13th & 25th.
 + Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON THE MONTH.

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.—Exceedingly dull, cold month, ground frequently covered with snow, and scarcely any sun; temp. only eight times above 45°; winds mostly N. and N.E., but not high; great floods on the 21st. Vegetation made scarcely any progress during the month, the ground being very wet and cold; max. bar. 29·94 on 7th, and min. 29·79 on 2nd.

SELBORNE.—Tempestuous night on 2nd, wind N.W.; heavy snow at 2 p.m. on 27th. The vegetation, which had been very forward, has been checked throughout this month, but hitherto nothing injured.

BANBURY.—Heavy snow, with high wind, on 19th.

CULFORD.—Four inches of snow on 27th. In this locality March came in like a lion, and went out in the same way; it has certainly been the coldest March that I can remember; the mean or average temp. has only amounted to 36°·2, while that of the two preceding months, January and February, was respectively 39°·9 and 43°·1.

BRIDPORT.—General direction of the wind N.E.; heavy N.W. gale on the 18th; lightning on the 28th.

BODMIN.—Average bar. 29·85; temp. 44°·0.

CIRENCESTER.—A uniformly cold month, without hard frosts, a seasonable change from the mild January and February, saving the fruit buds from destruction. The storm of the 19th was most unusual, after ·30 in. of rain, with wind S.S.E. and S., it became calm for four or five hours, when the wind at 7 p.m. went to the N.E. with a gale, and snow, hail, and thunder, doing some damage; wind during the month principally N.E., without sunshine.

SHIFFNAL.—The month has been true to its character of coming in like a lion; it continued much colder than February, the temp. in shade only once exceeding 50°. Storms of snow or sleet on the 2nd, 8th, 10th, 12th, 13th, 14th, 27th, and 28th; high wind on 1st and 20th from N.W.; prevailing winds during month N.W. and N.E. Vegetation at a stand-still throughout the month, and the pastures at the close gone off considerably from what they were on the 1st; ribes sanguinea in blossom on 3rd, and gooseberries on the 29th. Plovers pairing on 16th, chaffinch singing on the 18th, and blackbird on 31st.

ORLETON.—Cold and cheerless month, with very slight changes of temp. and frequent slight falls of snow and hail, the winds generally strong from the N. and E., and the sky filled with cloud, except for a few hours in the nights; violent winds on the 2nd, 19th, 27th, and 28th; sudden change of wind at 5 p.m. on 19th. The temp. of the month more than 2°·50 below the average, but was not so low as the same month in 1865 or 1867.

WIGSTON.—Snow fell on six days, but on the 28th it was continuous for 12 hours, yielding ·60 in. of water, equal to 7 in. of newly-fallen snow. A remarkable characteristic of this month, compared with January is, that the mean temp. was one-third of a degree below that of January, and 4°·75 below that of February.

BOSTON.—Barometric pressure very unsteady all the month; temp. uniformly low, and much lower than the average of the season. Severe gales during the month, especially on the night of the 19th, when there occurred a heavy storm, attended by much injury to the shipping along the east coast. Vegetation checked by the cold, and considerable damage done to the blossoms of apricot and peach trees by the severe frosts.

KILLINGHOLME.—Very cheerless and sunless month, the polar current prevailing throughout; vegetation at a stand-still; such an Easter-day has seldom been known; it would have been a seasonable day for Christmas; sea roaring at night on 2nd and 20th; yellow auriculas began flowering on the 4th; rooks beginning to build on 5th.

DERBY.—The genial weather of the preceding two months has given place to snow-storms and piercing north-easterly winds, which doubtless will be beneficial

in checking the too forward vegetation. The temp. has been $3^{\circ}62$ above the mean of the last seven years for the month of March.

NORTH SHIELDS.—The first week rather fine, afterwards cloudy, with E and S. T and L on 10th, with S; lunar rainbow on 27th.

SEATHWAITE.—No day on which the rainfall reached 1 in., and only two on which it exceeded half-an-inch, the total being more than 10 inches below the average for March.

W A L E S.

HAVERFORDWEST.—The gale which commenced on February 27th, increased in violence on the 28th, abated a little on the morning of the 1st, but at 1 p.m. it recommenced, W.S.W. to N.W., increasing in force to the morning of the 2nd, when it was terrific in violence, tearing up trees and doing much damage; generally supposed to be the heaviest gale of the present season of gales; there was likewise a furious gale on the 19th, commencing suddenly at 2 p.m., raging with fearful violence till 6 p.m., and continuing from the N.W., to which point the wind had suddenly changed at the last-named hour from the S.W.; this gale did not entirely abate until the morning of the 21st, and was thought by some to have exceeded that at the beginning of the month. Frequent showers of snow and sleet; the Precelly range covered with S on the morning of the 9th, but notwithstanding the wintry character of the month, everything seems very forward; the white thorn was observed in bloom on the 25th.

CEFNFAES.—A cold, dry month, frost more or less severe from the 8th to the end of the month; winds generally N.E. or S.E. Lambs doing well.

S C O T L A N D.

DUMFRIES.—Month dry and cold, with withering northerly winds; vegetation much checked and pastures injured; the mean temp. $4^{\circ}06$ below the corresponding month of last year.

HAWICK.—This month has been remarkable for cold, cutting, easterly winds, with frequent showers of hail, sleet, and snow; and also for frosty nights, which have kept vegetation very much in check.

AUCHENDRANE.—A month of comparatively high bar., with small range, and low temperature. The very small rainfall and the large evaporation provided an excellent seed-time, but the frequent frosty nights checked growth. The winds were principally polar, and their mean force moderate. On 1st, 5th, 10th, 20th, and 28th, the weather was boisterous; some S fell, but it did not lie.

CASTLE TOWARD.—A dry, frosty month; vegetation, which had previously made much progress, has been checked by the winds from N.E. and N.W.; the ground has been dry and in fine condition for the seed since the middle of the month, and a great breadth has been sown; the frosty nights have been of great use in giving fine mould, but have been too severe for the garden and fruit trees without protection.

DEANSTON.—The month has been characterized by prevailing N. and N.E. winds, which have injured pastures in a forward state from previous mild weather, fruit trees in a forward state may suffer; health of society moderately good; very favourable seed-time toward the end of the month, which work has been well got forward.

LOGIERAIT.—Cold and stormy; vegetation backward; lapwings seen on the 3rd.

BALLATER.—Very cold and backward month, commencing with a sharp S storm, succeeded by others at intervals, one on the 26th being very fierce, but of short duration; agricultural work much interrupted, but oats sown on the 23rd; brilliant flickering aurora on the 2nd.

ABERDEEN.—The month has been cold and stormy, though drier than usual; vegetation completely checked, but starting again; frequent fall of S, but it did not lie, and was never more than two inches deep.

PORTREE.—Cold and stormy throughout; very strong gale on the 5th, from 5 a.m. to 2 p.m., from W. to N.W.; solar halos on 12th and 13th, from 7 a.m. to 9 a.m.

SANDWICK.—Temp., $2^{\circ}77$ below the mean of 42 years, in short we had our

spring weather in winter, and our winter in spring. On 9th, aurora coruscating to zenith, and from zenith to south.

I R E L A N D.

OWENDOON.—Fine weather for husbandry; H and T on 1st, and S on the mountains.

DOO CASTLE.—Middle and latter end of month dry.

WARINGSTOWN.—Cold and stormy, but latter part dry and favourable for labour. Temp. about half a degree below the average, a great contrast to last year, when the wind was from some westerly point on 29 days, this month only on six.

DE OMNIBUS REBUS.

A LARGE pile of short letters have recently accumulated on two subjects; the answers are similar, and will probably be generally useful, we therefore print the replies, which we really have not time to write.

Several questions are asked as to the proper way to enter the maximum and minimum temperatures. We have more than once stated the rule and explained the reasons (in addition to the paramount one of uniformity) which support the rules. They are these: the lowest temperature of the air takes place about an hour before sunrise, therefore the minimum temperature shown at 8 a.m., or any later hour, will 19 times out of 20 belong to that day, and even in the rare cases in which the observer knows that the minimum really occurred before midnight on the previous day, we think he should not depart from the rule, which is, *The minimum temperature is always to be entered against the day on which it is read.* The maximum temperature generally occurs about 2 p.m., therefore if the thermometer is read after that hour, it should be set against the day on which it is read, but if it is read in the morning, then it must be entered against the previous day.

Why put the thermometers 4 ft. above the ground, 5 ft. would be much better, nearer the level of the eye, and just at the point where the air meets the external organs of respiration? Is it too late to change?

We think so. Moreover, it must be remembered that the *bulbs* are to be 4 ft., which makes the scale reach nearly to 5 ft. If the bulbs were 5 ft., the top of the scale would be nearly 6 ft., and decidedly above the level of most people's eyes, whence the readings would always be in defect. We do not know why 4 ft. was fixed upon, but see *Met. Mag.*, vol. III., p. 74.

LATEST INTELLIGENCE.

CAMDEN TOWN.—The shade temperature on Sunday, April 11th, was 77°·6, an almost unexampled heat for that date.

SHEFFIELD.—A very sharp thunderstorm hovered over this town on Wednesday, 14th inst., between 6 and 8 p.m.; the lightning was mostly forked, and of a pale pink colour; the rain was not so heavy here as in South-West Lancashire.

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DESTRUCTIVE THUNDERSTORM ON APRIL 14TH.

ACCURATE knowledge of the path and progress of thunderstorms seems as far off as ever. That on the 14th ult. was, as may be seen from the following list of accidents, very severe, yet the reports we have received are so few, that it is impossible to sketch its progress with any accuracy. It seems to have been felt much earlier in the west than in the east, but there is no proof of motion from W. to E. One fact alone is certain, viz., that at 7 p.m. on that day, thunder and lightning were audible and visible at Sheffield, Hull and York, in Fifehire, and in Aberdeenshire.

ISLE OF MAN.

DOUGLAS.—A thunderstorm of tremendous violence swept over the the Isle of Man on Wednesday. In the morning the thunder could be heard rumbling at a great distance off, but at three o'clock in the afternoon the storm had moved immediately over Douglas, when crash after crash followed each other with terrific violence. This lasted about half an hour, and caused great alarm on account of its propinquity. It was followed by a heavy fall of rain, the drops of which were fully the size of shilling pieces.

ANGLESEA.

To the Editor of the Meteorological Magazine.

SIR,—I send you the following notice of a dangerous thunderstorm which took place here on Wednesday last:—

A thunderstorm of dangerous character passed over this place on Wednesday, April 14th. Beyond a slight fall in the barometer, there were, at 9 a.m., no indications of its approach. After a few distant rumblings, beginning at 12.30 p.m., the storm rapidly increased in intensity, and was at its height from 1 to 2 p.m., continuing more or less until 4 p.m. It appeared to travel first from S. to N. with the wind, then back again from N. to S., finally dying out towards N.N.E. The lightning was remarkably vivid, and was followed on several occasions instantaneously by the thunder, which sounded like the irregular rattling off of a chain-cable through a ship's hawse-hole, and ended in a sudden explosion. In a grass field on the farm of Rhyddgaer, a mile W.N.W. from here, the lightning tore two holes in the ground,

bearing N. and S., 20 yards apart, the largest being a square of about 2 ft., the other somewhat smaller. The turf was loosened all around, and clods as big as a man's fist were scattered in all directions, and to a distance of many yards. A thin narrow line, scraping the earth as though a single tooth of a harrow had been dragged over it, extended for 8 yards in an easterly direction from the largest hole. There are numerous reports of accidents, but the only instances I can authenticate are these following:— Three or four persons struck near Llanerch-y-medd, 14 miles off, and two women struck at a place near Llanyefni, 8 miles distant. The rainfall here amounted to no more than .01, but within 2 or 3 miles there was a deluge of mingled rain and hail.—I remain, dear Sir, yours truly,

W. WYNN WILLIAMS.

Menaifron, near Carnarvon (Station No. 23) April 17th, 1869.

LANCASHIRE.

LYTHAM.—A man named John Moore, aged 57, was struck dead by lightning about four o'clock on Wednesday afternoon, during the thunderstorm, while working in the garden of Mr. Cornelius Fisher, at Warton, near Lytham.

PRESTON.—A horse and cart were being driven along Deepdale Road by a man named Thomas Hall, when the animal took fright at a flash of lightning, and started off at a gallop. Hall, who was riding in the cart, was thrown to the ground, and sustained injuries that caused his death on Thursday morning. During the severe thunderstorm which occurred on Wednesday evening, a young man, engaged in field operations with three horses, in Euxton, near Chorley, was struck by the lightning, which caused the total loss of the use of his left arm. Two of the horses were also partially disabled.

STAFFORDSHIRE.

WOLVERHAMPTON.—Here the lightning fused two gaspipes, one at Messrs. Bradshaw's Flour Mills, Horseley Fields, and the other at the residence, at Goldthorn Hill, of Mr. Lloyd. Only in the first case, however, was there any ignition. There the lighted gas set fire to the roof of the mill, but the fire was soon put out.

WALSALL.—A house in Rowley Street was struck by the electric fluid, the chimney being overturned, a part of the roof displaced, and one of the windows broken. In Tantarra Street a house was likewise injured, the chimney being overturned and one of the windows forced out. At Holloway Bank, Hilltop, the chimney of a house in the occupation of Mr. Partridge, brass dresser, was struck by the electric fluid and overturned, the roof and one of the windows being also damaged.

CUMBERLAND.

CARLISLE.—At Parham Beck a chimney was struck by the lightning during the storm and fell with a great crash. In the same neighbourhood the electric fluid played some strange vagaries with a clock, twisting the chain and injuring the works. At Little Corby, near this

city, an old oak tree, well known in the neighbourhood as "the boggle tree," was struck by the lightning. The electric fluid entered the trunk about 20 feet from the ground, and tore a strip down to the bottom. Some of the shattered pieces of oak were found nearly 100 yards away. A young man, who witnessed the occurrence as he was returning home from ploughing, describes it as something terrible. Dust and smoke and splinters were flying in all directions. Fortunately the man and his horses escaped unhurt, although within 50 yards of the tree at the time it was struck.

BRAMPTON.—A little girl was standing at her father's shop door, when a flash of lightning crossed her eyes and rendered her totally blind. Under careful treatment she recovered the sight of one eye during the night, but the other is so much injured that it is feared she will not be able to see with it again.

PENRITH.—In a house in Duke Street the lightning took a very eccentric course. It appears to have disarranged the fire-irons in the drawing room, leaving distinct traces of the direction it had taken in its course; and it then struck the steel pin upon the dial of an American timepiece. The rim of the dial, composed of steel encased in brass, was severed from its hinges, and fell to the ground, breaking the glass into many fragments. The works of the clock stopped simultaneously with the action of the shock.

YORKSHIRE.

SITWELL.—A valuable horse belonging to Mr. W. Salmons, farmer, was struck by lightning whilst grazing in a field near the farm, and killed instantly. Whilst Mr. Henry Salmons, Sitwell, was returning home from Geedingwell in a gig, a flash of lightning caused the horse to take fright. Mr. Salmons and his wife, who accompanied him, were thrown out, but were not seriously injured.

SHEFFIELD.—The lightning struck the spire of Stannington Church, partially knocked it down, and dislodged some large stones, which fell upon the roof and inflicted considerable damage. No one was hurt.—A couple of semi-detached houses, occupied by Mr. Ellison and Mr. Dearden, at Ranmoor, Yorkshire, were struck by lightning. The electric fluid seems to have passed down the bell-rope, which was either molten or snapped asunder. Mr. Ellison was standing close by the door watching the storm at the time, and near him was a metal fall pipe. Whether he touched it or not is not certain, but about the same time that the lightning passed down the bell rope, Mr. Ellison received a severe shock upon his arm nearest the pipe. Immediately afterwards he felt this arm beginning to swell rapidly, and prompt restorative measures had to be taken. He is still suffering from the injury. Mr. Dearden's servant man was still more severely hurt, and was for some time unconscious after the shock.

MALTON.—A violent storm swept over this district on Wednesday, April 14th, its chief force being expended in the vicinity of the village of Scagglethorpe. The storm just missed the village, but on the farm of Mr. Lamb, in a grass field (near the centre) a two years old grey

hunting filly by Malpas—a valuable animal—was seen to leap high in the air, and fall dead. Beside her are two large holes in the ground, and at some yards distant two other large holes, from which masses of earth have been hurled to a distance of forty yards. The mare is literally singed. About a quarter of a mile distant a large elm tree was shivered, and its roots torn out of the stiff clay for a great depth. Here, too, are large holes in the ground, and masses of clay, and portions of root are found seventy yards away. The hedgerow is also torn up for some distance. In the next field an ash tree was struck with similar results. A cast iron roller in a lower field was split into a thousand fragments. In the village two women and a man were slightly affected, and on the low road a man was run over, the lightning startled his horse, he falling from the conveyance. None are much worse. Although no rain fell at Scagglethorpe—the eastern edge of the storm area—at Norton and Malton there was rain, and during the storm a shower of hail as large as nuts.

BURTON SALMON (*between Leeds and York.*)—Some houses, belonging to Mr. Sharp, joiner, of that village, were struck by the lightning. The roof of one of them was greatly damaged, and several windows were broken.

TODMORDEN.—Three houses at Cross Stone were struck by the lightning. The one most damaged was struck at the roof near the chimney at the gable. The thunderbolt penetrated the slate, passed through the bedroom floor, into the house, and through two walls into the third house. In its course a case clock which was in the bedroom of the first house, was smashed to pieces, and part of the ceiling removed from the top of the house. Mrs. Barker, who lived in the house, had her shoe soles nearly torn off, and one stocking and one foot much burnt; she was struck deaf, and so far paralysed that she could not walk. One of the inmates of the middle house was struck blind, but only remained so a short time. Most of the windows of Barker's house were blown out. Some of the slates were carried a distance of 20 yards by the force of the stroke.

PICKERING.—At Shaw End, near Leatholm Bridge, a house was literally blown up and torn from its foundations; two of the inmates were burnt to ashes, and only a child escaped.

HOLMFIRTH.—A cow, belonging to Isaac Sykes, farmer, was struck by a flash of lightning, and died almost instantaneously. A girl, who had been milking the cow, was also struck by the electric fluid. She was deprived of the power of speech, and still remains dumb.

THURSTONLAND.—The lightning descended the chimney of a house occupied by Mr. Lancaster, and greatly alarmed the inmates. The children were knocked about, and the occupants nearly smothered with soot.

HURTON (*4 miles west of Malton.*)—Large angular pieces of ice, some $1\frac{1}{2}$ inches in diameter, fell. In places crops are cut, and fruit trees in bloom on south walls have suffered heavily.

PATELEY BRIDGE, LIMLEY.—The lightning struck a barn in the

occupation of Mr. G. Rhodes, and in a very short period the whole structure was completely gutted. A large quantity of hay and a number of farming implements and machinery were also consumed. Two cows were with difficulty saved.

WHITBY.—The lightning struck a window of Mr. Kipling's house at Barnby Sleights, about eight p.m. on Wednesday evening, and the flame was so powerful that the curtains, wood-work, &c., were entirely consumed before it could be extinguished. The occupants were greatly alarmed, but no other mischief was done. A little later on the same night a servant girl named Colburn, living with Mr. Harforth, farmer, Lyth, was knocked down by the lightning, and remained quite insensible until about four o'clock on Thursday morning, when she partially recovered, and is now doing well. She is suffering, however, from a painful obliquity of vision, in consequence of the accident.

ABERDEENSHIRE.

HUNTLY.—The storm here was the most severe that had occurred since 1846. The lightning flashes were forked, and were frightfully vivid and alarming, the crashes of thunder being also terribly distinct. People ran from their houses in alarm after one flash, which was followed by a dreadful crash; and it was soon found that a house in M'Veagh Street had been struck, several stones dislodged from the wall, and the plaster torn from the inside walls. The house is presently undergoing alteration with the view of enlargement, so that, fortunately there was no one living in it. We hear of several other cases of damage done in our neighbourhood. During the storm the rain fell like "whole water," and large hailstones accompanied the showers. At Loanhead the family residing in Charlotte Villa were much alarmed by a loud crash, the lightning having struck the top of the chimney. The family had just finished tea, when in a moment they were all covered with soot, which spread over the floor. A piece of an arm-chair on which Mr. Gray was sitting was wrenched off, and the top of the vent is much shattered. Fortunately none of the family were injured.—*Scotsman*.

THE METEOROLOGICAL OFFICE.

On Friday, April 30th, Mr. R. H. Scott, the director of the Meteorological Office, delivered a lecture at the Royal Institution on the past and present work of that office. He stated that the primary object for which the office was established was the acceleration of ocean routes for vessels by the investigation of winds and currents, a work in which Maury has taken so prominent a part. The first impulse to the present work was given by Sir J. Burgoyne in 1852, and after that, at the Brussels Conference in the following year, a scheme of international co-operation in the investigation of marine meteorology was resolved upon. Mr. Cardwell founded a Meteorological Department of the Board of Trade in 1855, and placed Admiral Fitzroy at its head. Allusion was then made to the other nations which are working on the same subject. The system of the office has been to lend instru-

ments, verified at Kew Observatory, to captains in the mercantile navy, and to receive on their return from the voyage the observations made during that period. The subjects of inquiry to which the office directed its attention were laid down by the Royal Society in a letter to the Government in 1855. Materials accumulated faster than they could be dealt with, and as Admiral Fitzroy's own attention was diverted in 1861 to the subject of storm warnings, the marine work did not go on so briskly as it might have done, and at his death not very much had been published of the work which he had commenced. At this period a committee was appointed, at the request of the Board of Trade, to inquire into the office, and these gentlemen presented a report to Parliament in 1866, in which they recommended that the study of marine meteorology should be diligently pursued, and that the entire management should be handed over to a scientific committee, to secure that no portion of the work should be neglected. The Royal Society were again consulted by Government, and agreed to appoint a committee to superintend the office. The Royal Society itself has nothing to do with the office or its funds, it only appoints the committee. This body entered on their duties in January, 1867, and in order to secure the sea work being properly done, appointed Captain H. Toynbee, of the Mercantile Marine, to assist the director by taking charge of that Department. The work left unfinished by Admiral Fitzroy is being completed, and either published independently or sent to the Admiralty to be embodied in the new pilot charts for the oceans. As new work, the region of the Atlantic Doldrums, lying between 20° N. and 10° S., is being closely examined. It is a remarkable coincidence that this is the very region the investigation of which, on the identical plan now followed out, was urged by Mr. Marsden and Mr. Dalrymple at the Admiralty at the beginning of this century. Marine meteorology is and will be the main subject to which the attention of the office will be directed, although other branches of investigation may appear more attractive, and be more generally popular.

Weather Intelligence.—In 1859 the British Association at Aberdeen sanctioned the appointment of a committee, who suggested a system of storm warnings; in fact, the telegraphy of the fact of the existence of a storm from one place to another. Admiral Fitzroy instituted storm warnings in February, 1861, and began to foretell, or rather "forecast" the weather for three days in advance. This system, though distrusted by some authorities, went on for five years. On his death, the Committee of Inquiry reported against the system as carried on, and the Royal Society declined to undertake it. The warnings were suspended in December, 1866, by the Government, but remonstrances began soon to come in, and the matter was urged in Parliament. Ultimately, in June, 1867, the committee, at the request of the Board of Trade, consented to issue telegraphic information of facts, virtually the plan proposed eight years before at Aberdeen, and this system was set on foot at the end of the year. Now the drum signal is hoisted at 100 stations,

and intelligence is sent to the adjacent coasts of the Continent. The reporting stations have been inspected, and much improvement has been observable in the reports received from them. Most cordial co-operation in the work is afforded by the French authorities, especially by M. Le Verrier and the Ministère de la Marine. The difficulties in the way of carrying out storm warnings were illustrated by the storm of August 22nd, 1868, which came on very suddenly, and did a great deal of damage; but it was shown that as a general rule storms travel from west to east, and out of 37 storms of which intelligence was sent to Hamburg during the past year, 19 reached that port, while only 3, and those easterly storms, were felt there before the telegram arrived. The method of weather study followed in the office was described, and some encouraging results of the work were communicated, and rendered intelligible by means of diagrams. The first of these was the confirmation of the law laid down by Professor Buys Ballot, of Utrecht,—namely, that the barometer is lower on the left-hand side of a current of air than on the right. It was shown that this principle is true for our storms, and that it enables us to tell with some certainty for 24 hours in advance the wind which is going to be felt on any line of coast. The account of this inquiry has been privately printed by the committee.* The second principle is one urged by Mr. Meldrum, of the Mauritius, which, however, had been independently arrived at in the Meteorological Office here—viz., that whenever the polar and equatorial currents are observed at the earth's surface, the former lying to the northward of the latter, a serious southerly gale is nearly sure to follow within two or three days. This was the history of the hurricane in Edinburgh on January 24th, 1868, and also of the storm which occurred at the time of the Naval Review, July 16, 1867. It was also stated that evidence was being accumulated of the recurrence of types of weather, a subject which cannot fail to yield useful results.

Self-recording Observatories.—Lastly, the system proposed by the Royal Society in 1865, for the study of British meteorology by means of self-recording instruments, was described. This system is now in operation, and is managed principally by Dr. Balfour Stewart at the Observatory, Kew, under whose superintendence is the central and normal station. The observatories are distributed over the British islands. In addition to Kew, two are in England, at Falmouth and Stonyhurst; two in Ireland, at Armagh and Valentia; and two in Scotland, at Glasgow and Aberdeen. The instruments in use were described, and an anemograph and a barograph were exhibited by the kindness of Messrs. Beck. A complete account of these instruments is to be found in the committee's report for 1867. The observatories were started in the beginning of 1868, and some months were expended in getting the entire system into thorough working order. This, it is hoped, has now been effected, and the attention of the committee is

* See *Meteorological Magazine*, Vol. III., p. 157.

being directed to the discussion of the results yielded by the instruments. Some of the curves were exhibited, and diagrams were shown exhibiting the passage of barometrical changes as recorded at each station, but it was stated that matters were not yet ripe for a complete account of the work done with these new instruments. In conclusion, Mr. Scott stated that he hoped the audience would see that the work was a strictly national one, and one which must be carried on, if at all, at public expense. All other European countries, almost without exception, have established meteorological offices, and the science is more important to us than to any other nation. The grant made for it is not made to the Royal Society in any sense; that body were requested to take the management of a Government Office, the sphere of whose action extended equally to the whole United Kingdom, and this they consented to do, and have done it in the way described in the lecture.—*The Times*.

MIGRATORY BIRDS.

Cuckoo first heard at Hillingdon, Linton, Killingholme, and Dumfries, on the 10th; at Selborne, Banbury and Boston, 11th; Orleton and Derby, 13th; Bridport, 14th; Rhayader, 15th; Llandudno, 18th; Shiffnal, 20th; and Logierait, 27th.

Swallows seen at Killingholme, on 8th; Bridport, 9th; Llandudno, 13th; Hillingdon, 14th; Shiffnal, 15th; Boston, 25th; Hawick, 26th; Dumfries, (building), 11th.

Nightingale heard at Hillingdon and Banbury on 12th.

LUNAR AND SOLAR INFLUENCE ON THE WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—In the *Meteorological Magazine* for August, 1868, I stated "that the perigee and apogee positions of the moon with regard to our meridian, as well as perigee of the sun, have an extremely important influence on the rainfall." I will now endeavour to prove this statement, and, at the same time, show that the moon's position in the equator with regard to our meridian exercises an equally important influence on rainfall, or rather I should say on drought, for the laws I am about to give are of a negative rather than of a positive character. They refer to the moon's influence in preventing rain, and therefore only indirectly to her power as regards producing it. The laws relative to the lunar positions that appear to cause rain I will, with your permission, discuss in a future letter.

1. When on any day between the middle of March and the middle of September the moon reaches perigee or apogee in the afternoon, within about an hour (say seventy minutes) of the time that she comes to our meridian, (and here I may say that the southing must occur in the afternoon, or at any rate at not more than 20 minutes after midnight), a long period of deficient rainfall will occur about that time, or set in a few days afterwards.

2. In any year when lunar perigee occurs entirely or very frequently

in south declination, if the moon crosses the equator on some day between March and October within 15 minutes of her southing, a long period of drought will set in, (if it has not already commenced), shortly after the day when these latter phenomena occur. The following table contains *all* the instances that have occurred since 1833 relative to these two laws. The descriptions of the weather are chiefly taken from Mr. Whistlecraft's notes.

Date.	Time of Lunar Apogee or Perigee.	Moon Souths.	Time of Moon's crossing Equator.	The Weather in the Metropolitan and Eastern Counties.
1834, March 24	12.0 aft.	12.0 aft.	...	A sharp drought all March, April & May.
1835, July 7	8.37 ,,	9.43 ,,	...	At Thwaite, in Suffolk, no rain whatever fell from July 14th to Aug. 25th.
1837, March 16	9.22 ,,	8.16 ,,	...	The whole of March was very dry.
1837, April 18	..	10.36 ,,	10.25 aft.	Very dry weather from the end of April to the end of July.
1838, June 28	6.0 ,,	5.53 ,,	...	In July the hay harvest was favoured by fine weather for the greater part.
1838, August 9	...	3.42mg.	3.45 mg.	August was very fine after the 9th, and Sept. was a very fine harvest month.
1839, May 24	10.14 ,,	9.16 aft.	...	May was very dry, and the rainfall was below the average to the 21st of June.
1840, April 4	2.26 ,,	1.38 ,,	...	Very dry all April, first rain fell on May 7.
1840, June 13	10.48 ,,	11.0 ,,	...	Very dry in June and July; the rainfall was nearly an inch and a half below the average.
1840, August 7	7.43 ,,	7.43 ,,	...	A very dry and hot August, and fine weather continued till the 13th Sept.
1842, March 24	10.42 ,,	10.36 ,,	...	April was a very dry month.
1842, April 21	10.16 ,,	9.17 ,,	...	May was fine and very dry, almost without rain in the Eastern Counties.
1842, August 7	0.43 ,,	1.0 ,,	...	The whole of August was severe drought and most extreme heat.
1843, April 13	10.36 ,,	11.19 ,,	...	April 8th to May 2nd the rainfall was more than an inch below the average; very warm weather also occurred at this time.
1844, April 14	...	10.19 mg.	10.10 mg.	A quarter of an inch of rain during the 12th and 13th April, but from the 14th of that month to the 24th of June there was a most extraordinary drought, scarcely any rain at all for 71 days.
1844, August 29	...	1.24 ,,	1.15 ,,	The latter part of August was very dry, and only half the usual rainfall in Sept.
1845, August 15	10.0 ,,	10.28 aft.	..	From the 21st August to 14th September, the weather was very fine.
1846, Sept. 4	11.0 ,,	11.21 ,,	...	The first 22 days of September were extremely droughty.
1847, Sept. 11	0.52 ,,	1.11 ,,	...	Rainfall of September considerably below the average, and but little rain in October, except on 7th, 9th, and 23rd.
1848, Sept. 3	4.37 ,,	4.12 ,,	...	September was chiefly fine till the equinox.
1854, April 4	4.30 ,,	5.30 ,,	...	A very dry April.
1854, May 22	...	9.25 mg.	9.30mg.	Very dry weather, 31st May to 26th June.
1857, July 29	7.26 ,,	6.20 aft.	...	Unusually bright and hot weather from 10th July to end of August, with heavy thunderstorms at times.

Date.	Time of Lunar Apogee or Perigee.	Moon Souths.	Time of Moon's crossing Equator.	The weather in the Metropolitan and Eastern Counties.
1861, March 26	11.31 ,,	12.19 nt.	...	A very dry April.
1861, August 10	2.36 ,,	3.20 aft.	...	A very fine, dry, and hot August, and a dry September.
1863, June 18	1.30 ,,	1.44 ,,	...	Remarkably dry weather from June 20th to August 7th.
1864, July 9	...	4.5 ,,	4.19 aft.	Remarkably dry from the 4th of July to the 9th August, after which the great drought went on to the 2nd September.
1865, August 25	3.20 ,,	2.58 ,,	...	A very great drought from August 29th to October 8th; in many places not a drop of rain fell during that time.
1868, July 20	0.45 ,,	0.40 ,,	...	Very great drought all the summer to the 18th of September.
1869, May 21	9.39 ,,	8.46 ;	...	
1869, August 9	1.2 ,,	1.37 ,,	...	
1871, March 26	4.26 ,,	4.8 ,,	...	
1872, June 9	3.20 ,,	2.46 ,,	...	
1872, August 17	11.0 ,,	11.18 ,,	...	

When the sun reaches perigee within 40 minutes of noon or midnight, the succeeding summer has always several months of very dry weather, and the rainfall of the period from March to September inclusive is always below the average. The drought is usually accompanied by very great heat. The following are all the instances since 1833 :—

Date.	Time of Solar Perigee.	Remarks on the Weather.	Diff. of rainfall of Mar. to Sept. from Greenwich average of 54 years.
1836, Dec. 30	11.29 noon	Very dry in May, June, and July of 1837; rainfall at Greenwich 21 in. for the year.	—3.8 in.
1847, Jan. 1	Noon.	The summer of 1847 was very dry; only 17.8 inches of rain for the whole year at Greenwich; max. temp. at Chiswick, 93°	—5.9 in.
1849, Dec. 31	0.25 noon	June, August and September of 1850 were very dry; only 19.7 inches in the whole year at Greenwich.	—2.9 in.
1855, Dec. 31	0.32 noon	Very dry in June and July, 1856; max. temp. at Greenwich, nearly 90°	—0.3 in.
1857, Dec. 31	11.23 mid.	Very dry in June, August, and September, 1858; rainfall at Greenwich only 17.8 in. for the whole year; max. temp. 97° at Chiswick.	—3.2 in.
1865, Jan. 1	midnight	Extremely dry weather in April, June, and September, 1865. The summer was one of the hottest and finest on record.	—0.3 in.

The foregoing meteorological rules appear to be infallible. Certainly they have never failed since 1833. This is very satisfactory, for, as

these laws depend upon positions of the sun and moon, which can be calculated many years before they occur, it is evident that the periods of drought and fine weather which they cause may also be predicted many years before they happen.

In conclusion, I will say a few words with regard to the application of these laws to the weather of the coming summer. On the 9th of August, 1869, the moon will reach perigee at two minutes after one in the afternoon, and will reach the meridian of Greenwich 35 minutes afterwards. Therefore, according to the law I have given, fine weather for harvest must set in (if it has not already set in) a few days after the 9th of August, and for a long period the weather should be chiefly dry in these parts. It appears also that a long period (that is nearly a month or more) of deficient rainfall should commence, if it has not already commenced, in the latter part of May of the present year.—(See Table I.)

The second of the above rules does not at all apply to the present year, as the time of solar perigee was 10h. 17m. a.m.—Yours, &c.,

Barnsbury.

G. D. BRUMHAM.

METEOROLOGY AT HAMBURG.

Meteorology makes progress. The Chamber of Commerce at Hamburg have published a quarto pamphlet, "Jahres-Bericht der Norddeutschen Seewarte für das Jahr 1868" ("Annual Report of the North German Sea Observatory for 1868"), under the direction of W. von Freeden, formerly Rector of the School of Navigation at Elsfleth. This Report will be welcomed by all who take an interest in the subject of which it treats: it contains the history of the foundation and development of the Nautical-Meteorological Institute, including the observatory above referred to, and an account of their proceedings. From these we learn that the objects of the Institute are to make navigation safe, to shorten sea voyages, and as a means thereto to collect systematic meteorological observations, give storm-warnings, and to establish as speedily as possible uniformity in the instruments employed in the observations. In the carrying out of these objects some hundreds of Weather Books and Sailing Directions have been distributed to vessels sailing from ports embraced in the scheme of the Hamburg Seewarte. A considerable number of the former have been returned, filled with observations of wind and weather; and by tabulation and comparison they will be made to reveal whatever is important to navigation. Records of the quickest voyages will be kept, together with the particulars showing how the quickness was achieved. In this way the Hamburg Sea Observatory will co-operate with other similar establishments, in discovering the shortest and safest ship-routes across the great ocean, and in ascertaining what winds and weather may be expected to prevail in any part of the route in any month. As we lately remarked, our own Admiralty has done excellent work of this sort; and with the principal seafaring nations of the world engaged therein, important results, whether for commerce or science, cannot fail to accrue.—*Athenæum.*

APRIL, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		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	inches.	in.							
I.	Camden Town	1.28	+ .15	.41	23	8	78.0	14	28.6	22	5
II.	Staplehurst (Linton Park) ...	1.33	+ .11	.46	4	13	78.0	12†	31.0	19	4
„	Selborne (The Wakes).....	1.26	— .24	.35	23	8	71.0	14	29.0	19	6
III.	Hitchen	1.74	+ .74	.66	23	9	71.0	14	30.0	1	1
„	Banbury	1.33	+ .17	.30	23	11	74.0	14	30.0	19	5
IV.	Bury St. Edmunds (Culford).	1.23	+ .48	.45	23	10	73.0	11‡	22.0	1	7
V.	Bridport	1.11	— .37	.20	3	13	73.0	27	31.0	5	1
„	Barnstaple.....	1.89	— .12	.38	6	12	76.0	12	35.5	2, 19	...
„	Bodmin	1.51	— .19	.29	15	13	74.0	28	36.0	2, 5	0
VI.	Cirencester	1.42	+ .13	.33	6	9	...	...	...	...	...
„	Shifnall (Haughton Hall) ...	1.73	+ .63	.60	20	13	71.0	11	23.0	19	4
„	Tenbury (Orleton)	1.47	— .07	.45	20	12	75.2	11†	29.2	19	2
VII.	Leicester (Wigston)	2.65	+ 1.30	1.05	14	10	78.0	11	33.0	1, 3¶	...
„	Boston	1.91	+ .94	.44	16	14	75.5	11	31.8	2	1
„	Grimsby (Killingholme)	2.18	..	.67	20	13	70.0	11†	32.0	2	...
„	Derby.....	1.48	+ .05	.40	20	12	75.0	11†	34.0	2, 19	...
VIII.	Manchester	2.10	+ .34	.38	2	12	78.5	14	32.0	1**	...
IX.	York	2.17	+ 1.07	.71	16	12	76.0	14	30.0	1	1
„	Skipton (Arncliffe)	3.95	+ .91	1.07	2	14	72.0	26§	32.0	i	...
X.	North Shields	1.76	+ .45	.67	14	10	72.5	11	32.2	4	0
„	Borrowdale (Seathwaite).....	10.26	+ 3.36	2.75	7	17	...	...	...	...	...
XI.	Cardiff (Town Hall).....	1.82	..	.36	20*	11	...	...	...	...	...
„	Haverfordwest	2.99	+ 1.13	.55	7	10	71.6	28	32.5	2	...
„	Rhayader (Cefnfaes).....	2.77	+ .88	.50	6, 17	14	75.0	25	30.0	13	...
„	Llandudno.....	2.17	+ .67	.45	9	11	70.8	14	32.0	1	...
XII.	Dumfries	1.42	— .25	.31	9	17	73.0	26||	29.5	9	1
„	Howick (Silverbut Hall)....	1.32	..	.29	2	9	...	...	...	...	...
XIV.	Ayr (Auchendrane House) ...	2.00	— .22	.49	9	13	70.0	27	28.0	1, 9	2
XV.	Castle Toward	2.03	— .47	.67	9	11	74.0	27	26.0	2	9
XVI.	Leven (Nookton)	1.64	+ .39	.51	15	10	69.0	14	24.0	9	3
„	Stirling (Deanston)	1.42	— .33	.31	15*	12	71.0	26||	21.3	9	3
„	Logierait	1.30	..	.81	15	10	...	...	...	...	...
XVII.	Ballater	2.56	..	.75	16	9	71.3	26	22.0	9	7
„	Aberdeen	2.43	..	.57	3	13	70.4	12	28.1	9	9
XVIII.	Inverness (Culloden)	1.48	..	..	..	..	66.4	13	30.6	9	1
„	Fort William .....	..	..	..	..	..	..	..	..	..	..
„	Portree	4.26	— 1.01	.89	2	19	..	..	..	..	..
„	Loch Broom	2.41	..	1.00	3	19	..	..	..	..	..
XIX.	Helmsdale.....	3.43	..	1.10	4	16	..	..	..	..	..
„	Sandwick	3.75	+ 2.01	1.55	2	18	62.8	26	26.0	9	1
XX.	Cork	2.58	..	.70	7	15	..	..	..	..	..
„	Waterford	2.00	— .23	.36	8	20	62.0	28	37.0	1	...
„	Killaloe	3.89	+ 1.76	.75	15	18	72.0	28	32.0	1	...
XXI.	Portarlington	1.82	— .20	.42	16	25	67.0	10	33.0	1	...
„	Monkstown	1.43	— .21	.30	16	15	72.0	12	33.0	4	...
XXII.	Galway	3.41	..	.76	19	19	70.0	30	37.0	6	...
„	Bunninadden (Doo Castle) ...	3.34	..	.66	19	13	66.0	26	28.0	1	1
XXIII.	Bawnboy (Owendoon).....	3.54	..	.61	19	20	73.0	27	32.0	3	1
„	Waringstown	2.42	..	.46	15	14	75.0	25	29.0	2	2
„	Strabane (Leckpatrick)	3.01	..	.68	19	17	71.0	26||	27.0	1	6

* And 19th. † And 14th. ‡ And 12th. § And 28th. || And 27th. ¶ And 18th.

** And 2nd & 19th.

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

METEOROLOGICAL NOTES ON THE MONTH.

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.

CAMDEN TOWN.—Very warm from the 11th to 14th; splendid weather during the last week.

LINTON PARK.—A dry, favourable month; very hot from 10th to 14th; cuckoo heard on 10th; hawthorn in bloom on 25th, both earlier than I have ever known. Dry, cold, N.E. winds, with bright sun towards the end. Vegetation in a general way more forward than usual.

SELBORNE.—Dense fog on 10th, wind S.E.; fog on 22nd, and again on 26th, wind N.E.; aurora on 17th; martin first seen on 9th; cuckoo heard on 11th; max. on 22nd, 62°·0, min. 32°·0, range 30°.

HITCHIN.—T on 14th.

BANBURY.—High wind, S, R, H and L on 2nd; cuckoo on 11th; nightingale and swallow on 12th; TS on 14th; high wind and splendid aurora on 15th; apple in bloom on 25th.

CULFORD.—A month of very pleasant spring-like weather, without the usual frequency of April showers; T on 14th.

BRIDPORT.—Fine month, with much easterly wind; swallows seen on 9th, cuckoo heard on 14th; horse-chestnuts in leaf on 16th; silver poplar in leaf and double cherry in blossom on 18th; elm in leaf on 24th, lilac in blossom on 23rd, and May on 26th; several wasps about on 25th.

BODMIN.—Mean temp. 53°, or 3° above the average; difference between wet and dry bulb on 27th, 13°, the greatest I have ever registered.

CIRENCESTER.—A fine and very early spring month; lilacs, laburnam, and even a free blossoming of hawthorn out, and much grass.

SHIFFNAL.—Great changes of temp.; cold at the beginning, with sleet on 3rd; much warmer on 5th, and on 11th perfect summer, oppressively hot, 71° in shade, and 97° in sun; white frosts and strong E. winds, with bright sun, at the latter part of the month, prevailing winds previously N.W. and W. Blackthorn in blossom on 7th, damson on 18th, peas and beans on 22nd; oaks and ash here and there in leaf on 24th, and hawthorn in blossom on 28th; sulphur butterfly and large humble bee first seen on 11th; swallows (*H. rustica*) on 15th, and orange-tipped butterfly on 27th; chiffchaff first heard on 14th, and cuckoo on 20th.

ORLETON.—T showers in afternoon of 14th, and TS in N. at night.

WIGSTON.—The temp. of the month has been 3° above the mean of the month of April for many years. Although during the last 10 or 12 years there has been an average of *six frosty nights* during this month, I have not had to record one night under 33°, 4 ft. above the ground. On the evening of the 14th a terrific storm of H and R, accompanied by heavy T; more than an inch of R fell in less than one hour.

BOSTON.—The month was ushered in by very cold weather, but a very sudden and remarkable rise in the temp. took place on the 11th; on that day the max. temp. was 75°·5 in shade, and the black bulb *in vacuo* on the grass stood at 123°·5, the mean temp. of the 11th being 60°·1; during the three following days the heat (73°·8 on 12th, 69°·8 on 13th, and 74°·0 on the 14th) was almost without parallel. The field elm, lime, and horse-chestnut were in leaf on the 20th; the wych elm, sycamore, and hawthorn on 22nd, and the poplar on 24th. The cuckoo was first heard on the 11th, and the swallows appeared on the 25th; TS on 14th; H on 2nd and 3rd, and fog on the 8th.

KILLINGHOLME.—Vegetation progressed slowly, except during the warm weather from the 10th to the 16th. Wheat on strong lands looks healthy, and promises a good crop; TS on night of 1st; swallow seen on 8th; cuckoo heard on 10th, willow warbler on 15th, lesser whitethroat on 22nd, garden warbler on 26th; cowslips, peas and cherry in flower on 18th.

DERBY.—The month was remarkably fine, and the temp. unusually high,

having reached 75° on two days, being 2° higher than has been recorded here in April for the last 25 years ; a severe T S (the second during the month) on the 14th ; cuckoo heard on 13th ; migratory birds somewhat earlier than usual. N.E. winds prevailed towards the end of the month.

YORK.—T S at 7 p.m. on 14th.

NORTH SHIELDS.—Solar halos seen on 4th and 10th ; lunar halos on 22nd and 25th ; H on 9th ; L on 11th ; T S and whirlwind of dust on 14th ; very bright meteor on 12th from W. to S.W. ; pear in blossom on 10th.

W A L E S.

HAVERFORDWEST.—The month commenced cold and wet, H showers mixed with cold R ; L all night of the 2nd ; very warm on the 10th and 11th ; stormy on 15th and 16th, when the bar. fell from 29·67 to 29·12, and rather wet ; the rest of the month fine and spring-like ; the last week very warm, but accompanied by a scorching E. wind and a cloudless sky ; very little grass ; rain much wanted ; winds chiefly W.N.W and S.E. ; last four days from N.E.

CEFNFAES.—The month has been dry and fine ; nights more or less frosty ; hot with unclouded sunshine during the last few days ; wind generally S.E. and N.E. Vegetation forward ; cuckoo heard on 15th, and corncrake soon after.

S C O T L A N D.

DUMFRIES.—The first week showery, with some S on the 3rd ; the third week sunshine and showers ; the last week fine, with high temp. ; T on the 14th ; cuckoo heard on 10th, swallows seen building on 11th ; vegetation made great progress during the month ; fruit trees blossoming well ; temp. above the average.

HAWICK.—Keen frosty nights up to the 8th ; hills white with S on the 2nd and 3rd ; ice full half an inch thick on the drinking troughs, &c., on the 5th, 6th, 7th and 8th ; violent T S on the afternoon of the 14th, L of the forked and ball kind most vivid, damaging some fine trees. Intensely hot and sultry on 26th and 27th ; cold, with E. winds, on 28th and 29th ; R very much needed. Swallows first seen on 26th.

AUCHENDRANE.—The barometer, both as to pressure and range, may be said to have given forth indications quite in harmony with the fine seasonable weather which has characterized this April throughout, and especially towards its close ; the mean temp. has been rather high, and the solar radiation strong, owing to the small amount of cloud, complete saturation having taken place only 11 times, and 9 of these were in the evening. April is our driest month, and this April the rainfall is below the average, but not in the number of days on which it fell, as in that it coincides with the mean ; Moreover, the evaporation has exceeded the rainfall by more than an inch. The mean force of the wind has been moderate ; calms have been 8, and equatorial winds to polar as 14 to 8. The northerly gales of the 3rd and 28th, and the gale from the S. on the 22nd, were not of long duration.

CASTLE TOWARD.—The first few days cold and stormy, but has been since a mild dry month. Some very warm days (about 11th and 27th) for the season, which burst many of the deciduous trees into full leaf in a few days ; banks of blue hyacinths and many of the horse-chestnuts are in flower. A hive of bees swarmed on the 27th, and another on the 30th. Grass abundant and stock healthy ; braird promising ; all kinds of fruit trees and shrubs have flowered most profusely, owing no doubt to the fine autumn. Distant T on 14th

NOOKTON.—On 14th, T between 1 and 2 p.m., and between 6 and 7 p.m.

DEANSTON.—First part of the month showery, windy and frosty at night ; very warm on 11th, 26th and 27th ; latter part of month dry, with much sun, but cool easterly winds and frosty nights. Vegetation far advanced ; horse-chestnut, plane, and beech trees in full leaf, hawthorn blossom, however, not yet out on the 30th.

LOGIERAIT.—The early part of the month partook of the ungenial character of March ; the latter part has been unusually favourable ; high temp. and much sunshine ; vegetation very forward ; cuckoo heard on 27th.

BALLATER.—Hills white with S on 2nd and 8th ; aurora on 2nd ; T S with heavy H and R at 6.30 p.m. on 14th. The past month has been remarkable for the

sudden fluctuations of its temp., it having been 22° on 9th, and 70° on the 11th, the highest ever recorded here at the same period of the year; red butterfly and a bat seen on the 11th, and white butterfly on the 28th; blossoms on fruit and forest trees very rich; grass healthy. Bar. very high (30·020 at 660 ft. above sea) on 28th.

ABERDEEN.—T and L at 6.30 p.m. on 14th, and again at a distance at 9 p.m. on 27th; estimated wind pressure half-pound less than the average; winds from N.W. double the average. A remarkably warm fine month, notwithstanding the excess, '42, in R; the crops at the end of the month beginning to suffer from drought. Mean temp. 4°·4 above the average.

PORTREE.—A strong gale from S.W. to N.W. from 5 a.m. to 11 p.m. on 3rd; on the whole the month has been very favourable for out-door labour; the seeds have been got into the ground in good condition.

LOCHBROOM.—With the exception of Saturday, the 3rd, which was wild and stormy, this month on the whole has been finest for the time of year ever known here, but rather too dry for the country.

SANDWICK.—The first part of the month cold, with some S storms; some days in the middle fine and warm, but towards the close cold again, with dry N. winds. Splendid aurora at zenith and S. hemisphere on 15th; auroræ also on 7th and 8th.

I R E L A N D.

DOO CASTLE.—Temp. of the month high; last week we have had dry parching winds from the E., which were injurious to the corn, and retarded the growth of grass, it was otherwise favourable for farming operations.

OWENDOON.—Swallow first seen on 13th, cuckoo on 21st, and cornerake on the 25th.

WARINGSTOWN.—Fine and seasonable, labour well forward, and crops generally looking better than I ever saw them; abundance of luxuriant grass; foliage early.

REVIEWS.

Note on the Determination of Heights, chiefly in the interior of Continents from Observations of Atmospheric Pressure. By ALEXANDER BUCHAN, M.A.—[Proceedings Royal Society, Edin.] 8 pages, 8vo. A NATURAL sequel to Mr. Buchan's paper on "The Mean Atmospheric Pressure over the Surface of the Globe," and another illustration of the practical importance of a branch of investigation which some might think by no means promising of useful results. The author points out the error necessarily resulting from the adoption of 29·9 in. or 30·0 in. as the constant sea level pressure, and the difference therefrom at any observed altitude as the measure of that altitude. He points out the necessity for giving with greater detail observations intended as accurate measures of height, and shows that by noting the year, month, day, and hour of observation with the latitude and longitude of the place, and the general character of the weather during preceding and following days, a practiced meteorologist may approximate very closely to the truth, even from one observation, while on the other hand, many published heights may be, in fact probably are, in error from 500 to 1000 ft. The cause of this is very obvious. Let us conclude with an example from Mr. Buchan's paper:—

"From my paper, read before this Society in March, 1868, on the Mean Pressure of the Atmosphere over the Globe, illustrated with three charts, showing the *Mean Isobaric Curves* for July, January, and the year, it may be seen that a pressure of from 29·9 to 30·0 inches is very near the mean annual pressure over the greater part of the globe, particularly over those portions of it explored by

travellers. But when we examine the months, it is at once apparent that 29·9 inches is very far from the mean pressure in many regions. This point will be illustrated by the pressures at Barnaul, Siberia, which on an average of 19 years are, reduced to 32° and sea-level, as follows.—

Mean atmospheric pressure at Barnaul in July, 29·536 inches.

“ “ “ January, 30·293 “

“ “ “ Year, 29·954 “

Suppose, now, it be proposed to ascertain the height of Lake Balkash on some day in July, the pressure at the time being the average of the month. Let the observed pressure be 28·8 inches reduced to 32° F., and the temperature of the air be 70°·0, then if the sea-level pressure be assumed to be 29·9 inches, it is plain that the difference due to height is 1·10 inches; in other words, the height of the lake would be, in round numbers, 1080 feet. But since the sea-level pressure of this locality, which is nearly that of Barnaul, is 29·536 inches, the difference of pressure due to height is only 0·736 inch; the height, therefore, is only about 730 feet. Again, if in January, when the barometer is the mean of the month, the pressure at Lake Balkash was observed to be 29·42 inches, and the temperature of the air 1°·0, assuming that 29·9 inches is the mean sea-level pressure of January, 0·48 inch is the difference of pressure due to height—that is, the lake is about 400 feet above the sea. But since the mean pressure is nearly 30·3 inches, 0·88 inch is the pressure due to height; the lake is therefore nearly 730 feet above the sea. Thus in July the lake would be made 350 feet too high, and in January 330 feet too low—the difference of the two observations, each being here supposed to be taken under the most favourable circumstances, and with the greatest accuracy, being 680 feet.

The fact is, if geographers wish for accurate results, they have only to acquaint themselves with what meteorologists have done, to make their observations with completeness, and work out the results with discretion.

Cardiff Naturalists' Society. [First Annual Report, 1867-8.] Cardiff: Lewis and Williams. 8vo, 86 pages and 1 plate.

A CAPITAL “first” report, containing several excellent papers, well got up, and promising to be of much benefit to the members and to the county generally. The Society is to a certain extent an offshoot of the well-known Woolhope Naturalists' Field Club, and its objects are similar. We regret to find that as the annual meeting is held in October, all the meteorological tables are arranged for twelve months ending with August. We have already protested against these irregular twelvemonth periods as incomparable and useless, and we hope this young society will abandon this bad plan. We should also be glad to see the fall of rain at Fairwater in each month, in addition to the form in which it is now given.

Abstracts of Two Papers on the Geography of Disease. By ALFRED HAVILAND, M.R.C.S., &c.—London: Kimpton. 8vo., 20 pages.

SCARCELY within our province, save that by mapping the relative prevalence of diseases in different localities, Mr. Haviland appears to have *proved* the influence of certain climatic conditions, whose effects had previously been asserted without proof. The present pamphlet gives a concise summary of the results, and is to be followed by a series of maps in the course of the present season, which we hope our medical friends will carefully consider.

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THE INDICATIONS OF THE SKY.

SURPRISE is often felt at the slight confidence which can be placed in the dicta of even the most careful observers as to impending changes of the weather, and uncomplimentary comments not unfrequently attend their failure. Although by no means considering predictive success a measure of meteorological skill, we do not see why observers of education should in this respect be behind both the sailor and the farmer. Would it not be advantageous for a few observers to concentrate their attention on the optical and chromatic changes of the atmosphere and the sequences thereof? There are many parts of the country where observers are thickly clustered; one of them might abandon part of the ordinary routine of observation, and give his time and thought to the changes of the sky, to which as a rule so little heed is paid. The best observers simply note the proportion of sky covered, the character of the weather, and perhaps the prevailing form of cloud such as "ci-cu." There are several modes of investigation, which we intend to submit for consideration, and, we hope, for trial.

CLOUDS.

We doubt if since Luke Howard's time any observer has given close attention to the constant changes of form, nay to the formation and dissipation of those fleecy masses which look, and are, softer than the softest down, and yet which are storehouses of water adequate to the wants of the largest towns, or capable of driving the most ponderous machinery. Probably some observers may be dismayed at the very frequency of change, and picturing to themselves long pages full of such entries as—

May 24th, 9 a.m., grey ci-cu in W., lighter in N., ci in zenith, clear elsewhere.

3 p.m., ci-cu in W. have almost gone, clear sky, except ci across zenith in line from S.W. to N.E.

may think the undertaking too great, and so *without method* it would prove; but surely the reasons in favour of throwing such observations into a tabular form are even stronger than those which have long ensured the adoption of that plan with reference to changes in pressure temperature and hygrometry. Moreover, graphic representation of

instrumental records has long been practised with advantage; this might also readily and appropriately be applied to prevalent forms of cloud. This investigation, and one or two others yet to be proposed, are especially suitable to those whose residence is not sufficiently permanent to secure good, continuous, meteorological records. A meteorological register kept properly for two months, then missing a fortnight, then resumed, and so on, would be of very little value, but we think an accumulation of interrupted cloud and weather records would be of considerable service, although certainly of less than if continuous. Probably the simplest and easiest mode of entering observations would be to procure a faint ruled foolscap sized book, with about 40 lines to the page; then to rule the left-hand page with 16 columns—(1) date, (2) hour, (3) temperature, (4) barometer, (5) wind direction, (6) wind force, (7) rain, (8) amount of cloud, (9) form of cloud; (*a*) cirrus, (*b*) cirro-cumulus, (*c*) cirro-stratus, (*d*) cumulus, (*e*) cumulo-stratus, (*f*) stratus, (*g*) nimbus, (*h*) scud. The entries will be of the usual kind as far as, and including, column (8), which will contain the proportion (0 being none and 10 wholly overcast) of cloud. The columns under the general heading of "Form of cloud" should, we think, contain figures representing, however approximately, the area of each form of cloud; for example, let the total amount of cloud be 7, and let it consist of a bank of cumulus in the horizon, and a wisp of cirrus in the zenith—the apparent magnitude might be 3 for the cirrus and 4 for the cumulus—all this would be represented by a 3 in the "ci" column and a 4 in the "cu" column. The right-hand page should be used for remarks. Such a register as is above indicated would be very little trouble, and would give more insight into the sequences of cloud configuration than all that has been done during the half century which has elapsed since the publication of Luke Howard's capital "Essay on the Modification of Clouds."

In proof that we are not alone in our estimate of the usefulness of such enquiries, we will conclude with an extract :—

"Since clouds are subject to certain distinct modifications from the same causes which produce the other atmospheric phenomena, the face of the sky may be regarded as indicating the operation of these causes, just as the face of man indicates his mental and physical states. The ancient meteorologist was content with discerning the face of the sky, in order to predict the coming weather. It is to this chiefly that the weather-wise sailor and the farmer still look in foretelling the weather; and their predictions are frequently more correct than are those made solely from the indications of the barometer and other meteorological instruments. The best system of weather prediction comprises both methods."*

In subsequent articles we shall draw attention to the experiments which we think should be made with Saussure's cyanometer—[Can any person oblige us with the loan of one? ED.]—with the spectroscope, and with the polariscope, as well as some other observations on the optical phenomena of the atmosphere.

* Buchan's *Handy Book of Meteorology*, 2nd edition, p. 177.

LUNAR AND SOLAR INFLUENCE ON THE WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—Your correspondent Mr. Brumham has certainly brought together a formidable array of cases in support of his theory that “the perigee and apogee positions of the moon with regard to our meridian, as well as perigee of the sun, have an extremely important influence on the weather.”

Nevertheless, I cannot think that he will succeed in convincing *scientific* meteorologists that his rules are “infallible,” or indeed that the connection between the weather and the positions of the heavenly bodies, so far as he has established such a connection, is anything more than the merest coincidence. Even as regards the limited area from which Mr. Brumham draws his illustrations, the evidence by which he endeavours to prove his point will be found to be in many cases far too vague, and often quite insufficient—[for instance, in two cases, viz., the years 1855 and 1865, a deficiency in the rainfall to the extent of 0·03 in. [0·3 in., Ed.], or something less than the third of an inch on the six months from March to September, is regarded as sufficient evidence of a drought!]—and if we extend the range of our enquiry a little, the rule utterly and palpably breaks down. For surely, if Mr. Brumham's rule has anything in it, it ought to hold good of all places on the same meridian, which, after the most liberal allowance for local differences, is notoriously not the case. Take for example the weather of last year. The summer season of 1868 was in this country one of the driest and hottest on record. But we now know that in the south of Europe it was as exceptionally cold and wet as it was here dry and warm. I have before me an extract from the letter of a correspondent in the *Tablet* newspaper, who, writing of the weather of last year in Rome, says, “During a nine years' residence in Rome I never remember such a year as this. June and July were wet and cold as an English spring; August and September scarcely warm; November and December wet, cold, and foggy.” Now, as the difference between the meridian of Greenwich and that of Rome, as represented in time, amounts to no more than 50 minutes, and the time of lunar apogee or perigee was, according to the table, within 5 minutes of the moon's southing in England, and therefore within 55 minutes of its southing at Rome, the case comes fairly within the scope of Mr. Brumham's rule.

It is when they are brought to the test of considerations like these that all the weather rules which I have ever met with, in which the state of the weather at a given time is made to depend on certain positions of the heavenly bodies, break down.

No doubt it would be very delightful to be able to predict periods of dry or wet weather with the same precision as we now predict an eclipse, but so long as one and the same position of the heavenly bodies may coincide with a period of extreme drought, say, in the south of England, and an equally exceptional period of wet weather in the north of Scotland, *both districts being on the same meridian, a*

case which has happened within my own recollection, I cannot help thinking that astro-meteorological speculations of this kind would be better suited to the readers of *Zadkiel* than to those of a sober scientific periodical.

I will only add, while on this subject of weather predictions, that we have so far no appearance here of the warm and dry weather which has been so confidently predicted as about to set in towards the end of May. A steady rain has been falling nearly the whole day, with a cutting wind from N.E., and temperature at 1 p.m. 46.—Yours, &c.,
G. T. RYVES.

Cheltenham, May 28th, 1869.

[We had some doubts as to the insertion of the above, because it seemed trenching closely on the personal, but on re-perusal we have arrived at the conclusion that *we* are the principal offenders, in that we have inserted in “a sober scientific periodical” “astro-meteorological speculations,” “better suited to the readers of *Zadkiel*.” We consider they are not “speculations” but facts, and we doubt not that most of our readers will agree with us that their true import ought to be ascertained. Mr. Ryves would, we presume, have refused insertion to Mr. Brumham’s letter; we think suppression a dangerous process, and that the progress of truth has always been most advanced by free discussion. Mr. Brumham will doubtless say a few words on the defensive; our duty at present is simply to see fair play, and defend ourselves—and even that we leave to our readers.—Ed.]

POLAR AND EQUATORIAL CURRENTS.

To the Editor of the Meteorological Magazine.

SIR,—As an instance of extreme rainfall consequent on the admixture of polar and equatorial currents of air, I enclose a table containing the returns from four different sources in the vicinity of Dublin, for the week ending May the 8th, 1869.

It will doubtless be in the recollection of your readers that during the above-mentioned week a remarkable wind system held over the western shores of Europe; that at the same time corresponding barometric curves were noticeable, and that great variations of temperature were experienced.

While over France the wind throughout the week was south-westerly and westerly, in Scotland, Ireland, and part of England it was at the same time north-easterly and easterly. So, while in France a barometric gradient of considerable steepness sloped from the south to the north of that country, a like gradient over the British Isles sloped from north to south, a “trough” of low pressure being thus caused in the neighbourhood of the British Channel.

Along the line of this trough, intermingling of the *warm moist* S.W. and of the *cold* N.E. current took place, and the result was a large rainfall, better marked on the N. side of the line of union of the currents than on the S. border of the same.

The effects of this system are, as regards Dublin, given in the appended table, for which, with this note, I will be glad if you can find a corner in the *Meteorological Magazine*.—Yours very truly,

J. W. MOORE, M.B., Trin. Col. Dub.

40, Fitzwilliam Square West, Dublin.

Rainfall at Dublin, week ending Saturday, May 8th, 1869.

MAY.	40 Fitzwilliam Square West, Dublin. 57ft. abv. sea.	Bloomsbury, Dundrum, Co. Dublin. 279ft. abv. sea.	Easton Lodge Monkstown, Co. Dublin.	Ordnance Survey, Phoenix Park Dublin.	Wind.
Sunday, 2nd	·054	·084	·040	·115	E., S.E., E.
Monday, 3rd	1·320	1·305	1·290	1·155	S.E., E.N.E.
Tuesday, 4th ...	·098	·135	·151	·110	E.N.E., E.S.E.
Wednesday, 5th.	·185	·258	·225	·177	S.E.
Thursday, 6th ...	1·082	1·332	1·250	·875	E., N.N.E.
Friday, 7th	·320	·410	·350	·285	N.N.E., E.N.E.
Saturday, 8th ...	...	...	...	...	N.E.
Total	3·059	3·524	3·306	2·717	...

Until Saturday, S.W. and N.E. currents of air were in continual conflict; the upper clouds (cirrus) were at times seen to be moving from S.W., while the lower clouds and wind were generally moving from N.E. to S.E. On Saturday the polar currents proved triumphant, and at 3 p.m. on that day the sky cleared with a brisk gale (force 6) from N.E.

THE THUNDERSTORM OF APRIL 14TH.

To the Editor of the Meteorological Magazine.

SIR,—A very unusually heavy thunderstorm has passed over this neighbourhood to-day. The morning was unusually warm and bright, indeed it was one of the most glorious spring mornings I ever remember. There was but little wind, and at times a perfect calm. At 2.45 p.m. a strong electrical breeze sprung up, and made me look out towards the quarter from which the wind was blowing. The sight that met my view was one the like of which I never remember. A dense brown-coloured cloud seemed to be advancing in one solid mass. In four or five minutes it reached us, and proved to be what it seemed to be in the distance, a regular dust storm. The wind was from the south.

I have seen many a thunderstorm, and under nearly all circumstances, but I never remember to have remarked more vivid and curiously zig-zagged flashes of lightning. During the course of the storm the wind veered from S. to W., then N. to E., back again to S., and is now (7 p.m.) E.N.E. The rain is still falling heavily. I have not heard of any damage done as yet. The sea, which was high last night, is as calm as it is possible for it to be. The barometer fell about two-tenths of an inch between 7 a.m. and 3 p.m.

Since writing the above I find that the storm extended over all Northumberland and Durham. The description I have had from various persons who witnessed it elsewhere singularly corresponds

with what I have before said. The thermometer rose to 68° during the day. It is placed with a north aspect, well shaded, and about 5 ft. from the ground.—Faithfully yours.

R. F. WHEELER.

The Vicarage, Whitley, North Shields, April 14th, 1869.

To the Editor of the Meteorological Magazine.

SIR,—I regret that I should have omitted to send you a memorandum of the thunderstorm of April 14th, as it would have cleared up one point, at least as regards our district, as to which you express yourself in doubt (see first page of Magazine for May), viz., the direction of the storm, which was here clearly from W. to E.

I was able to trace the storm during its whole course, as far as it was visible and audible from here, viz., from a point about ten miles west of us to a point some twenty miles to the eastward, say from the neighbourhood of Derby to somewhere in the neighbourhood of Sleaford in Lincolnshire.

I first heard thunder in west about 5 p.m., and on making an observation saw the storm-cloud, then at a low elevation above the horizon, advancing with a remarkably even and well-defined edge. There was frequent thunder, gradually increasing in loudness, from this time till 6.30 p.m., when the storm broke overhead, and raged furiously for about a quarter of an hour, the lightning seeming to flash from every quarter of sky, and the thunder rolling almost continuously. The storm then broke away to the east of us, and I watched it retreating to a distance of probably 20 miles. The thunder ceased to be audible when at a distance, estimated by time-interval at about 12 miles, but the lightning continued visible for some time after, and the point of discharge could not have been less than 20 miles distant, when the storm gradually died out between 8.30 and 9 p.m.

I have been interrupted in writing the above by another thunderstorm, which has passed 3 or 4 miles to the S. and S.E. of us; thunder first heard at 10.30, and ceased at 11.10 a.m. This makes six storms of greater or less violence which have visited this district since February 18th inclusive, a striking contrast to last year, when, notwithstanding the extraordinary heat, we had but one thunderstorm during the summer, viz., that on August 11th, with which the fine weather broke up.

I shall be happy to send you memoranda of any future storms that may occur in this district, if by so doing I can contribute, however humbly, towards the attainment of "more accurate knowledge of the path and progress of thunderstorms."—Yours very truly,

G. T. RYVES.

Nuthall, Nottingham, May 19th, 1869.

3.30 p.m. I add a line to say that we had a renewal of the storm this morning between 0h. and 1h. p.m., with a heavy downpour of rain, this time in an E. current.

To the Editor of the Meteorological Magazine.

SIR,—We had thunder from 2 o'clock p.m. on April 14th; sheet lightning at intervals; at 7 o'clock fork lightning and peals of thunder, continuing with torrents of rain. Two horses were struck in a stable at Wheldrake, one killed and the other most seriously injured. The storm cleared off soon after 9 o'clock, and the following fortnight was cold and wet; before, the heat was most oppressive—Yours sincerely,
M. C. DUNNINGTON JEFFERSON.

Thicket Priory, York, May 19th, 1869.

[The first of the foregoing letters was accidentally omitted in our last. The three jointly appear to agree with an actual travelling storm, but reports must be more numerous and (if our correspondents will forgive us for saying so,) more precise as to time and azimuth, if the results are to be of the nature we desire.—Ed.]

NORWAY RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—I have much pleasure in forwarding Ex-Consul Jens Beer's return of rainfall for 1868. You will see that the fall in 1868 was more than 50 per cent. above that in 1867.—Yours truly,
C. O. F. CATOR.

Parkside, Beckenham.

RAINFALL IN 1868 AT ÖJE, FLEKKEFJORD, NORWAY.

Rain Gauge—Funnel, 12½ in. square; height of top above ground, 8 ft.; above sea level, 18 ft.

Month.	Total Depth.	Greatest Fall in 24 hours.		Days on which ·01 or more fell.	Days of Snow.
	Inches.	Depth.	Date.		
January	8·68	1·93	26	14	8
February	9·04	1·30	1	27	5
March	8·83	2·06	17	20	6
April	4·45	·97	22	14	...
May	2·11	·94	24	12	...
June	2·31	·47	25	8	...
July	1·01	·45	19	9	...
August	7·62	1·43	27	16	...
September ...	3·44	·75	2	13	...
October	6·57	·86	10	21	...
November ...	5·59	2·66	23	11	1
December ...	7·79	1·82	11	19	7
Total	67·44	...	...	184	27

Unusually little snow at the latter part of the year; with exception of a little frost, 19–21st November, and 8–10th December, down to -6° Reaum. ($18^{\circ}5$ Fah.); mild weather to end of year, with temperature from 0° to $+6^{\circ}$ Reaum. (32° to $45^{\circ}5$ Fah.) The ground quite soft, and the grass green up to the 12th January, 1869.

C. O. F. CATOR, FOR EX-CONSUL JENS BEER.

[The position of this station has already been described, (*Met. Mag.*, Vol. III., p. 32,) and the returns from it agree remarkably well with those Scotch stations whose positions most resemble it. We have

previously dwelt (*British Rainfall* 1868, p. 97,) on the irregularity of the Scottish fall in 1868, so far as concerns total quantity, several stations having even greater excesses than Flekkefjord. The wet and dry months also agree remarkably well.—ED.]

TEMPERATURE OF THE EARTH AT GREAT DEPTHS.

THE experiments described in previous numbers of this magazine have been steadily continued, and some remarkably consistent results obtained. We have not space on the present occasion to describe them fully, but may incidentally mention that the rate of increase is very steady, averaging 1° Fahrenheit for every 52 feet of depth, so that the temperature at 1050 feet is 69°·0, while at the surface it is 49°·0. This would indicate almost exactly a rise of 100 degrees for each mile of vertical depth.

Several persons having expressed a desire to visit the bore, Mr Symons will be happy to forward cards of admission (with map showing the locality), for Saturdays June 19th and 26th, to those who may intimate their wish to receive them.

RAINFALL AT THE OBSERVATORY, NELSON, NEW ZEALAND.

Lat. 41° 16' 17" S. ; Lon. 173° 18' 46" E. ; height above sea, 18 ft.

	1863.	1864.	1865.	1866.	1867.
January	·00 ...	·75 ...	3·48 ...	3·33 ...	16·55
February	6·90 ...	·60 ...	8·43 ...	16·18 ...	·62
March	1·84 ...	·18 ...	3·80 ...	4·75 ...	·47
April	1·29 ...	2·54 ...	5·88 ...	1·59 ...	3·05
May	3·80 ...	4·17 ...	14·35 ...	·31 ...	2·11
June	·87 ...	5·81 ...	3·80 ...	1·01 ...	2·95
July	8·07 ...	8·13 ...	3·44 ...	4·94 ...	4·37
August	13·54 ...	2·03 ...	2·26 ...	8·64 ...	1·46
September	12·49 ...	14·76 ...	6·84 ...	4·65 ...	·75
October	12·72 ...	5·08 ...	2·18 ...	3·34 ...	1·94
November	2·60 ...	10·23 ...	3·60 ...	10·46 ...	3·29
December.....	2·08 ...	6·48 ...	3·10 ...	12·85 ...	9·54
	66·20	60·71	61·16	72·05	47·10

(60·76)

HENRY CLOUSTON, *Meteorological Registrar.*

REVIEWS.

A Report on the Sanitary Condition of the City and Borough of Bath during the years 1867 and 1868, with a Synopsis of that of several previous years, together with a Geological, Meteorological, and general Topographical Sketch of the City and its vicinity in relation to matters connected with the Public Health. By C. S. BARTER, M.B. Lond., F.R.C.S., &c.—Davies, Bath. 8vo, 101 pages.

WE do not remember to have seen a better report by any Medical Officer of Health than this of Dr. Barter's, nor one compiled with

greater care and judgment. In almost every respect it is characterized by sound knowledge and discretion, but singularly enough he either intentionally or unintentionally adopts a plan of obtaining mean pressure, and mean temperature, different from all other observers, taking simply the arithmetical mean of the extreme readings, *e.g.*, in 1868 he gives the following elements:—

Mean Max of Barometer, 30·425 in.
 „ Min. „ 29·204 „
 „ Height „ 29·814 „

Evidently here we have the arithmetical mean of the highest and lowest readings in each *month*. On a previous page (3), however, he takes the mean of the highest and lowest in each *year* as the mean for that year, and the same with respect to temperature. On page 3 the mean temperature of each of eighteen years is taken from the arithmetical mean of the max. and min. temp. in the *year*; on page 74 from the mean daily max. and mean daily min. in the usual way, no corrections being applied.

We cannot accept this delightful short cut without proof of its accuracy, but if it can be shown that any simple correction will always bring out the true value, none will be more ready than ourselves to bring it under the consideration of observers. It is clear that in 1868 the correction would have been large, for the max. was 89°·8, the min. 23°·5, and the mean of these is 56°·6, while the daily readings give 53°·4, thus giving no less than 3°·2 difference.

Another thing which puzzles us very much is the mode of obtaining “mean daily range of temperature.” We always thought it was the difference between the mean daily max. and the mean daily min., but Dr. Barter's values sometimes agree exactly with this rule, sometimes differ widely from it, *e.g.*—

1867.	Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Max.	42·1	52·9	46·2	60·8	64·1	71·0	71·8	73·6	68·7	58·1	47·6	44·5
„ Min.	34·1	44·3	35·3	46·8	48·0	50·6	54·8	54·6	53·1	46·5	37·6	37·2
„ Range	8·0	8·6	10·9	14·0	16·1	20·4	17·0	19·0	15·6	11·6	10·0	7·3
„ (as printed) ...	8·0	8·5	10·6	13·3	16·7	17·0	16·6	19·0	15·6	11·6	10·3	7·3
Difference	0·0	—1	—3	—7	+6	—3·4	—4	0·0	0·0	0·0	+3	0·0

It is most unpleasant, yet it is certainly our duty, to point out every departure from established usage, hence while on the whole praising Dr. Barter's work most warmly, we have been obliged to notice certain practices which require some explanation.

The Rainfall in Devonshire during 1866 and 1867. By W. PENGELLY, Esq., F.R.S., &c. [Reprinted from the Transactions of the Devonshire Association for the Advancement of Science, Literature, and Art, 1868.] 8vo. 18 pages.

THIS is a somewhat striking illustration of exhaustive treatment, and shows the same well-directed energy and indomitable perseverance as

have won for Mr. Pengelly so distinguished a place among geologists. But the paper is a most difficult one to review, there being scarcely anything redundant or which can be omitted without damaging the whole. Mr. Pengelly explains in an introductory note that having a few years since commenced careful observations of the rainfall at Torquay, he has been led on to make certain calculations and comparisons as to the fall in various parts of England and of Devonshire in particular. These calculations have been based on *British Rainfall*, 1866 and 1867. The first table consists of nearly forty columns, containing elements from 36 stations—that is to say, some 1500 entries. The following are some of the details given:—Name of Station, Distance and Direction of nearest Arm of the Sea, Distance and Direction of Centre of Dartmoor, Diameter, Height above Ground and above Sea of each Gauge; then, for 1866, Total fall of rain, Ratio to mean of all stations including Prince Town, and also excluding that very wet station, Days on which .01 in. fell, Ratio to mean at all stations, Mean daily fall. Similar details are given for 1867, and finally for the mean of the two years.

Of the remarks on this table we can only quote one, but we note with great pleasure that Mr. Pengelly brought prominently under the notice of the Association the dearth of observers in certain parts of the county; we trust he will secure recruits in those unrepresented districts:—

“*Mean Daily Rainfall.*—If the total rainfall of the year at any station be divided by the total number of wet days, the quotient will, of course, be the *mean daily fall* at that station for the year. The question of this quantity or element in the meteorology of any district is one of more than mere curiosity; for on it depends the further question of whether a large or small portion of the year's rain has or has not penetrated the soil, which, in its turn, is closely connected, not only with the agriculture of the district, but with the geological changes it is undergoing, and with its general thermal condition. Heavy falls are calculated to furrow the surface; sluggish ones, to promote its *general* degradation.

On the other hand, the latter, by penetrating the soil, are calculated to do more internal work than the former, to disintegrate and decompose rocks beneath the surface, and to excavate subterranean water-courses. The latter also render the district more uniformly an evaporating surface, and in every way promote the augmentation of the quantity of vapour yielded by it. Vapour is formed by the abstraction of heat which does not raise temperature. Hence, all other things being the same, a district devoted to sluggish rain, that is to a low average daily rate of fall, is thereby kept cooler than one having a more energetic rain. Further, the motion of the falling drops is necessarily destroyed, as motion, when they reach the ground; and, according to the doctrine of the correlation of forces, is converted into heat, the amount of which varies directly as the square of the velocity of the moving body; hence the heat into which the motion of rain is transmuted is greatest when the rain falls most energetically, and *vice versa*. In other words, the quotient of the total rainfall of the year divided by the annual number of wet days, is a quantity on which to some extent, probably a small one, the mean temperature of the district depends.”

In Table II. Mr. Pengelly gives interesting comparisons of Devonshire with the other South-Western Counties, and in Table III. he gives some results from the whole of the English and Welsh returns

for 1866 and 1867, published in *British Rainfall*. The table contains name of county, mean fall at all stations in the two years, relative mean annual fall, mean annual wet days, relative ditto, mean daily fall, relative ditto. It is obviously impossible to make this table perfect, nor is it expedient to attempt it. Supposing such a marvel as a grant of £10,000 per annum for rainfall purposes, it would not enable anyone to determine *accurately* the mean rainfall in any one county, unless it was Rutland. We are getting yearly nearer and nearer to the truth, but so long as hills and valleys, woods and downs, and rivers and lakes, remain, so long will it be impossible *accurately* to give the mean rainfall of any county. Take Carnarvon, for instance, a county of no great size, yet having at some places 115 inches, at others not one-third thereof; or take a flat county, of which the mean would be most easily ascertained. Cambridge is perhaps the most level, only one station being more than 100 ft. above the sea; still we find the fall varies from 24 inches to 19 inches—that is as 100 : 30 in the former case, and as 100 : 79 in the latter. In the latter case it is not improbable that the arithmetical mean of the returns from any dozen stations selected hap-hazard would give the mean fall of the county within two or three per cent. of the truth, but in a hilly country no such approximation is possible; as a rule (with many exceptions) the gauges are near residences, and therefore as a rule *not* in very wet places, but for experimental purposes they are sometimes so placed; for example, the Stye gauge, with its 165 inches per annum, is one of 48 stations in Cumberland, and represents, therefore, 31 square miles, or one forty-eighth of the whole county; but no one would contend that that enormous fall really applies to a district $5\frac{1}{2}$ miles square. Admitting to the fullest extent these difficulties, and knowing them to be insuperable, we are brought face to face with the question, Is it therefore useless to take the arithmetical mean of the returns as they stand? We think not, and Mr. Pengelly's table seems to support the opinion, for the counties at the top and bottom of his list are just those we should have expected to see there. Wettest of all is Cumberland, then Westmoreland, Merioneth, Montgomery, and at the bottom of the list (reading upwards), is Bedford, then Cambridge, Huntingdon, Lincoln, Surrey, Norfolk. The average fall at all stations during the two years was 35·77; the average in Cumberland was 66·73, and in Bedfordshire 23·20. Devonshire is thirteenth in descending order, and its total fall 23 per cent. above the average of the whole country.

It is somewhat singular that the rainfall of this county has been the subject of the two most suggestive monographs of county rainfall yet published—that by Mr. Eaton, in Vol. I. of the *Proceedings of the Meteorological Society*, and the present; yet they have hardly two points in common, and by no means exhaust the subject. Mr. Pengelly intimates that his may be looked upon as the first of a series, and we have much pleasure in registering his intention.

An Account of certain Experiments on Aneroid Barometers made at Kew Observatory at the expense of the Meteorological Committee, by DR. BALFOUR STEWART, F.R.S. — [Proceedings Royal Society.] 10 pages, 8vo.

It is generally known that there exist at the Kew Observatory of the British Association facilities for testing barometers at any required pressure. The able director, Dr. Stewart, availed himself thereof for the purposes of the experiments described in the above paper, our duty to which will be most faithfully discharged by quoting the results as summed up by the author, simply premising that from the tables it appears that by the terms "good results" and "tolerably correct," errors of less than 0·10 in. are to be understood.

"From all these experiments we may perhaps conclude as follows :—

"(1) A good aneroid of large size may be corrected for temperature by an optician, so that the residual correction shall be very small.

"(2 a) If an aneroid correct, to commence with, be used for a balloon or mountain ascent, it will be tolerably correct for a decrease of about 6 inches of pressure.

"(2b) A large aneroid is more likely to be correct than a small one.

"(2 c) The range of correctness of an instrument used for mountain ascents may be increased by a previous verification, a table of corrections being thus obtained.

"(3 a) If an aneroid have remained some time at the top of a mountain, and be supposed correct to start with, then it will give good results for about 8 inches of increase of pressure.

"(3 b) A large aneroid is more likely to be correct than a small one.

"(3 c) If the aneroid has been previously verified, it is likely to give a better result.

"(4) After being subjected to sudden changes of pressure the zero of an aneroid gradually changes, so that under such circumstances it ought only to be used as a differential and not as an absolute instrument, that is to say, used to determine the distance ascended, making it correct to begin with, or to ascertain the distance descended, making it correct to begin with, it being understood that the instrument ought to be quiescent for some time before the change of pressure is made."

Report of the Sanitary Committee of the Borough of Nottingham for the Year ending September, 30th, 1868. Stevenson, Nottingham. 8vo, 19 pages and folding tables.

THE meteorological observations are taken by Mr. Tarbotton, C.E., with his usual care—perhaps the most important one is the maximum temp. on July 23rd, viz., 94°·3. Sanitary matters seem well cared for, but the water supplied to the town appears from the analyses to be of considerable hardness; the application for power to construct new works has been rejected by Parliament within the last few days, and we therefore trust the borough will bring forward such a scheme for next session as shall by its own merits command success, and be a benefit to the town for years to come.

We regret very much that the report is made up to the end of September, instead of to the end of the ordinary year; and hope the advantages of adopting a chronology similar to other towns, and to established usage, will sooner or later become obvious to the authorities, and induce them to to adandon this bad practice.

MAY, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which more than 1 in.	Max.		Min.		
				Dpth	Date		Deg.	Date.	Deg.	Date.	
I.	Camden Town	inches 3.27	+ .87	inches .61	3	17	71.2	26	33.0	30	0
II.	Staplehurst (Linton Park) ...	3.78	+ 1.54	.93	4	17	78.0	7	31.0	2	3
„	Selborne (The Wakes).....	4.68	+ 2.20	.83	3	14	65.0	25	29.1	30	2
III.	Hitchin	3.31	+ 1.38	.82	3	19	64.0	7*	35.0	29	1
„	Banbury	4.47	+ 2.25	.72	3	22	65.0	25	30.5	2	0
IV.	Bury St. Edmunds (Culford).	3.23	+ 1.07	.76	3	16	65.0	7, 25	23.0	29†	6
V.	Bridport	4.74	+ 2.71	.86	3	14	63.0	13	32.5	2	0
„	Barnstaple.....	4.89	+ 2.45	1.50	3	18	68.0	1	37.5	21§	...
„	Bodmin	6.28	+ 3.82	1.00	3	22	70.0	24†	39.0	3, 5	0
VI.	Cirencester	4.09	+ 1.81	.65	3, 8	15	...	...	...	...	...
„	Shifnall (Haughton Hall) ...	4.73	+ 2.47	1.05	25	16	66.0	24	32.0	13	0
„	Tenbury (Orleton)	5.51	+ 2.63	1.15	25	19	64.7	2	31.8	12	1
VII.	Leicester (Wigston)	4.72	+ 2.60	.86	3	15	69.0	24	33.0	4||	...
„	Boston	3.71	+ 1.77	.55	3	18	70.0	10	35.8	5	0
„	Grimsby (Killingholme)	5.47	..	1.83	26	19	65.0	10	39.5	2	...
„	Derby.....	3.97	+ 1.81	.81	3	20	64.0	10	35.0	5, 13	...
VIII.	Manchester	2.73	+ .07	.71	7	17	65.0	1	33.0	13	...
IX.	York	4.49	+ 2.54	1.18	26	13	61.0	10	32.5	5	0
„	Skipton (Arncliffe)	4.11	+ .76	.96	19	13	71.0	2	35.0	12	...
X.	North Shields	2.58	— .06	.62	6	16	59.0	30	35.7	13	0
„	Borrowdale (Seathwaite).....	3.16	— 6.38	1.00	6	12	...	...	...	...	...
XI.	Cardiff (Town Hall).....	4.92	..	.86	3	18	...	...	...	...	...
„	Haverfordwest	5.65	+ 2.93	1.34	5	13	66.3	25	33.0	1	...
„	Rhayader (Cefnfaes).....	4.59	+ 1.74	1.10	3	19	63.0	...	51.0	...	...
„	Llandudno... ..	3.90	+ 1.52	.58	7	13	65.5	24	38.4	13	...
XII.	Dumfries	1.87	— .52	.58	6	13	69.0	1	29.5	12	3
„	Hawick (Silverbut Hall) ...	2.51	..	.80	6	15	...	...	...	...	...
XIV.	Ayr (Auchendrane House) ...	1.02	— 2.09	.40	6	13	63.0	1	26.0	9	4
XV.	Castle Toward .....	.49	— 2.90	.29	6	6	66.0	1	28.0	10¶	13
XVI.	Leven (Nookton)	1.56	— .44	.80	6	12	60.0	1	31.0	29	2
„	Stirling (Deanston)	1.04	— 1.61	.41	7	10	71.0	1	26.0	9, 29	10
„	Logierait .....	.73	..	.23	18	10	...	...	...	...	...
XVII.	Ballater .....	.96	..	.53	6	18	68.5	1	24.0	9	9
„	Aberdeen	1.56	..	.55	6	14	62.6	1	28.7	5	11
XVIII.	Inverness (Culloden)	2.01	..	.73	7	12	64.1	1	32.9	8	0
„	Fort William .....	..	..	..	..	..	..	..	..	..	..
„	Portree	1.33	— 4.32	.34	12	10	...	...	...	...	...
„	Loch Broom	1.74	..	.37	6	13	...	...	...	...	...
XIX.	Helmsdale	1.27	..	.15	5, 19	19	...	...	...	...	...
„	Sandwick	1.03	— 1.23	.24	19	15	52.1	10	34.5	9	...
XX.	Cork	5.48	..	1.13	16	18	...	...	...	...	...
„	Waterford	4.87	+ 2.62	1.16	6	21	63.0	31	40.0	12	...
„	Killaloe	4.20	+ 1.02	.76	6	20	67.0	1	30.0	12	2
XXI.	Portarlinton	3.14	— .06	1.01	7	22	65.0	1	34.0	12	...
„	Monkstown	5.73	+ 3.82	1.15	6	19	60.0	23	34.0	12	...
XXII.	Galway	4.80	..	.79	6	21	69.0	1	35.0	28	...
„	Bunninadden (Doo Castle) ...	2.72	..	.62	3	15	61.0	29	27.0	9, 13	3
XXIII.	Bawnboy (Owendoon)	2.93	..	.76	3	23	71.0	1	32.0	12	1
„	Waringstown	2.25	..	.45	3	17	68.0	1	30.0	12	3
„	Strabane (Leckpatrick)	2.84	..	.43	18	19	68.0	1	27.0	9	14

* And 10th, 24th & 26th. † And 26th. ‡ And 31st. § And 30th. ¶ And 11th & 12th.

¶ And 13th & 30th.

‡ Shows that the fall was above the average : — that it was below it.

METEOROLOGICAL NOTES ON THE MONTH.

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.

[We cannot help prefacing the following notes by calling attention to the remarkable contrast in the character of the month north and south of latitude 54°. In the south, and especially in the south-west, the fall was greatly above the average; for instance, at Bodmin, 155 per cent. above, while in Scotland it was remarkably dry, for example, Castle Toward, 86 per cent. below the average. See also the remarks from Linton Park and Portree, also Dr. Moore's letter p. 68.—ED.]

ENGLAND.

CAMDEN TOWN.—TS on 19th; H at 11.30 a.m. on 31st.

LINTON PARK.—The wettest May I have on record, excepting in 1856; it has also been the coldest, the average day temp. having been 8° below that of last May. Frost occurred on the 2nd, 20th, and 30th, beside several times nearly approaching the freezing point; the bar. very unsteady, and the wind frequently changing, and bringing R with it from all directions.

SELBORNE.—Very fine aurora on the 13th; remarkable earth currents reported at all the railways in the S.W.; H, R, T, and violent storms (wind S.W.) from 10 a.m. 19th; white frost on 29th; dahlias, &c., nipped, in the valley the potatoes blackened, scarlet runners destroyed, and even the young shoots of oak and ash nipped.

BANBURY.—T on 19th and 20th; T and L on 10th, 22nd and 26th; H on 18th 19th and 20th; aurora on 28th; mean temp. 49°.

CULFORD.—Altogether an exceedingly cold and sunless month, the mean temp. being below that of the preceding month; the max. temp. also has been under that of April, being 65° instead of 73°. On the nights of the 29th and 31st the frost severely injured the dahlias and bedding plants, as well as the beans and potatoes; T on 7th, 10th, and 19th, and H on the 20th.

BRIDPORT.—Cold month, and much E. wind; TS on 27th.

CIRENCESTER.—A month of varied wind; ungenial on the whole, but no absolute frosts, and more than an average rainfall; TS on 10th and 25th; H with T on 10th.

SHIFFNAL.—A most unusually cold and wet May; more R has fallen than in any May for 35 years, the nearest approach to it having been in 1862, when 4.14 in. fell; the prevailing winds were from N.E., from the 18th to 24th only being from W. and N.W. Fearful TS on the 25th at 4 p.m., with violent rain, nearly an inch falling in three hours. Abundance of blossom on all trees, whether fruit or forest; the hollies unusually full. The oaks and ash in full leaf early in the month. Swifts first seen on 6th; corncrake heard on 18th, and turtle-dove on the 20th.

ORLETON.—The fall of R the greatest for May in the last 40 years. A succession of heavy TSS passed over from S. to N. on the 10th, between 11 a.m. and 6 p.m., and again on the 25th, between 1.30 and 2.45 p.m., with great R on the 25th and 26th. On the 26th the rivers all full or overflowing, which has not occurred in May for more than 40 years; the sky generally cloudy. Temp. very low, 3°·5 below the average. Distant T on 18th and 19th.

WIGSTON.—The greatest rainfall I have recorded in May for 30 years; the mean temp. 8° below that of May, 1868. Great abundance of grass.

BOSTON.—The weather has been cold, wet and stormy throughout the month; the only occasions on which 3.00 of rain have fallen in May since 1850 are 1860 (3.48), and 1867 (3.72). In 10 days, from 2nd to 11th, 2.18 in. fell, and from 16th to 26th, 1.50; the river Witham was swollen by the R, but no serious flooding of the fens occurred. E. and N.E. winds prevailed. Large numbers of swallows were found dead, partly from the severity of the cold, and partly from want of the usual insects on which these birds feed. TSS occurred on the 9th, 10th, 17th, and 18th. Lunar halo on the 21st. Potatoes much injured by the

soaked condition of the soil ; pasture lands very rich in grass ; wheat promising to yield a good harvest.

KILLINGHOLME.—Cold and wet month, the polar current prevailing, with scarcely an exception. The corn crops on inferior soils have suffered considerably, and the meadows are backward. The old saw has proved true—

“ Who doffs his coat on a winter's day,
Will gladly put it on in May.”

Hawthorn began to flower on 7th ; first swarm of bees on the 30th ; on the 26th the heaviest rainfall for several years, 2 inches in about 12 hours ; S in the N. of Yorkshire on 27th. T on 10th.

DERBY.—Rainfall much above the mean ; E. and N.E. winds prevailing most of the month ; wheat and barley looking very yellow. T on the 19th ; a magnificent aurora seen on the night of the 13th ; sun's disc on the same day had an unusual number of spots.

NORTH SHIELDS.—Strawberries in blossom on the 11th ; globe ranunculas, lily of the valley, double red campion, and white and purple lilac in flower about the same time.

SEATHWAITE.—Only one day on which the fall exceeded half an inch.

W A L E S.

HAVERFORDWEST.—The wettest and one of the coldest Mays during the past 20 years. Sudden and severe storm of wind and R on the morning of the 19th ; H and sleet, mixed with R ; the storm, quite cyclonic in character, commenced at 9 a.m., and raged till 1 p.m., doing great damage to gardens and stripping trees of their foliage, branches strewn in every direction, vegetables literally blown out of the ground. Temp. of the month below the average, but did not once reach the freezing point. Vegetation on the whole forward ; general direction of the wind E.

CEFNFAES—A continuance of cold, damp weather ; nights frosty ; S on the hills on the 24th ; foliage luxuriant, and the blossoms on the shrubs, particularly hollies, most abundant and fine.

LLANDUDNO.—Laburnam and lilac, hawthorn and early peas, in flower at the beginning of the month ; honeysuckle at the middle. Splendid aurora on the 13th, from 10 to 11.30 p.m. ; colours most brilliant and varied, particularly in the S.E. and N.W., where they were green, orange, red and purple alternately ; the coruscations shot from all points of the compass towards the zenith. S on the distant hills on the 20th.

S C O T L A N D.

DUMFRIES.—Month cold ; winds mostly E. or N.E. Potatoes much injured on 12th and 29th. S on hills on 4th, 8th, and 27th. Hawthorn in blossom on 10th ; pastures suffering from want of R, from frost, and cold winds.

HAWICK.—Keen frosts on nine nights, which completely destroyed the potatoe stems, and severely injured fruit tree blossom. The ice in the drinking troughs was from one-eighth to half-an-inch in thickness. Singularly beautiful aurora on the night of the 13th. Landrail first heard on the 13th. Summits of the Cheviots white with S on the 26th ; pasture fields are deficient, and young grasses are indicative of a bad harvest.

AUCHENDRANE.—With a bar. below the mean, and bar. range somewhat above it, this May has been a month of small rainfall, of very low mean temp., and stunted evaporation ; and although these may have somewhat retarded vegetation, never were the “ green crop lands” more thoroughly cleaned and dressed.

CASTLE TOWARD.—Remarkably dry but cold. Crops healthy, but not making much progress ; white hawthorn in flower on the 3rd, and the scarlet on the 14th. The want of R and frequent frosts have been much against the hay crops and bedding out plants, but have been favourable for preparing the turnip fields for the crop.

NOOKTON.—Dry, cold, and ungenial ; prevailing winds E. and N.E..

DEANSTON.—Month very dry ; much E. wind ; frost frequent during the nights ; potatoes cut down by that of the 28th.

LOGIERAIT.—A very cold and ungenial month ; keen frosts on the nights of the 8th and 27th. Magnificent aurora about 11 p.m. on 13th, radiating from a circle in the zenith to all points of the horizon. Landrail heard on 20th.

BALLATER.—A cold, dry month, with almost constant N. or N.E. winds, very unusual for this quarter ; rainfall below the average ; temp. 4° below the mean of May for last 5 years. Vegetation seriously injured by the frost ; T on 11th ; heavy H shower (pellets conical, quarter of an inch in diameter at the base) on 12th at 2 p.m. Cuckoo heard on 1st.

ABERDEEN.—H on 3rd, 4th, 7th, 11th, 12th and 31st. A cold ungenial month ; crops have made very little progress ; potatoes blackened by frost all along Dee side on morning of 29th.

PORTREE.—Coldest and driest month on record ; many sheep on the hills died for want of water. Severe frost on 31st, which nipped all the potatoes.

LOCHBROOM.—The month has been remarkably dry and cold ; H and S more common on elevated ground than E.

SANDWICK.—A lamentable continuance of N. winds, with cold weather, there being only 6 days on which the wind did not touch the N., and on two of these it was E, which was as cold ; it was also very dry, so that vegetation is very backward. S on Hoy Head (1500 ft.) on 6th ; auroræ on 7th, 8th, 9th, and 13th, on the last date, about 11 p.m., red, and reaching almost to the S. horizon.

I R E L A N D.

DOO CASTLE.—One of the wettest and most ungenial months of May on record. In a gentleman's garden adjoining, myriads of caterpillars attacked some goose-berry bushes, and though picked off most carefully on five different occasions at intervals of four days, have been replaced by others equally numerous. I am curious to know, were they produced by ova deposited this year, and how it is that they were confined to about half a dozen bushes ? Few butterflies have been seen about this month.

OWENDOON.—Great prevalence of E. and N.E. winds ; crops fully three weeks late.

WARINGSTOWN.—Very cold and ungenial, especially the last ten days. Almost constant N. and E. winds. Rainfall much below the average, and crops much in want of showers towards the end of the month.

LECKPATRICK.—Cold month, but very favourable for farm operations, and turnip crop sowed in good time. Frost on grass on 14 nights, ther. registering 21° on 9th and 13th.

STEVENSON'S RAIN GAUGE.

To the Editor of the Meteorological Magazine.

SIR,—I observe in the report on rain gauges that reference is made to the form which I suggested.

It occurs to me to mention that I never used any glass tube. The only peculiarity of the instrument, which may have a float with a graduated stem, or any other convenient method of observing, is the form of the rim and funnel, which assume a symoidal section.

I mention this merely to explain that I have no preference for the glass tube, which, as I stated, I have never adopted myself. Trusting you will kindly excuse this trouble,

I remain yours faithfully,

THOMAS STEVENSON.

Chambers, 84, George Street, Edinburgh, March 26th, 1869.

[We are very glad that Mr. Stevenson disclaims the very clumsy glass tube which was fitted to the instrument by the Scotch optician who supplied what *he called* Stevenson's Rain Gauge ; that part of the arrangement will be ignored in future.—ED.]

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XLII.]

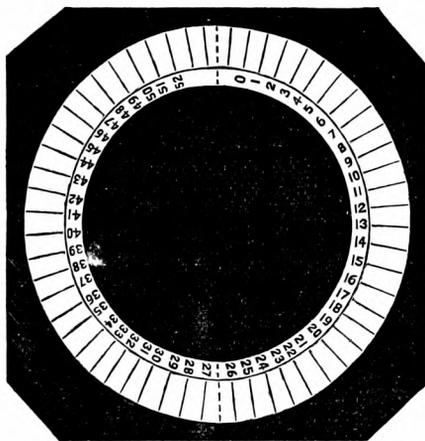
JULY, 1869.

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THE INDICATIONS OF THE SKY.

(Continued from page 66.)

HAVING now to describe Saussure's Cyanometer (*κύανος* blue, and *μέτρον* a measure), we have extracted from the pages of almost the only English meteorologist who has used it, his account of the construction and mode of using this ingenious instrument.



“OF THE CYANOMETER.

“One of these instruments having been put into my hands by Professor Pictet at Geneva in the summer of 1816, I brought it home to make trial of its use, but the almost continual recurrence of turbid skies since that period has nearly defeated my purpose hitherto. I shall, however, describe and figure it for the readers' information. The figure is drawn one-fourth of the actual dimensions. I have not attempted to express more than the general outline.

“The Cyanometer of Saussure is, in effect, a circle of small pieces of paper tinted with blue and pasted on a card, which is open in the middle and folds in two with the patterns inward. They are numbered from 0 to 52; the last is or the color of solid indigo, that is, nearly black, and the colors lighten gradually through the whole series till at 0 nothing remains but the white paper; the color goes quite to the outer edge, but on the inner, a space is left for the number. Its use is, to assist the judgment in determining the degree of intensity of the blue color of the sky, which varies greatly in different seasons and still more indifferent

climates and at different elevations in the atmosphere. For this purpose it is held up in such a direction that while a full light falls on the pattern, the sky may be seen at the same time, and the card is turned till the sameness or near approximation of the tint of some number is decided on, which is then set down for the color of the sky.

"This invention is chiefly useful to the traveller, who, in ascending mountains and in changing climates, meets with a range of color to which a single situation scarcely affords a parallel. About half the range of the scale may be found, probably, in our own skies. That they do not attain to the intensity of those on the Continent, is manifest from the surprise with which our travellers view for the first time the blue rivers and lakes of those countries. They forget that they are in fact contemplating, in a natural Cyanometer, a phenomenon, to which, by gradual approach, the eye had already become accustomed when turned to the vault of heaven.

"Simple as this little instrument appears, I have great doubt whether our workmen, who may attempt it, can give it any improvement, save, perhaps, by securing the back with morroco leather and providing a case. The form and size were certainly adopted after mature reflection and different trials. Those who incline to exercise their ingenuity on this subject, may do it with more promise by trying different combinations or thicknesses of *blue glass*, to be viewed against a ground of dead white in the manner above mentioned."

Saussure evidently adopted various sizes, if not actual varieties of the instrument, some being less than 4 inches in diameter, others as much as 8 inches. The mode by which he obtained the large number of 53 gradations was ingenious and careful, although probably liable to error, and we think more troublesome than modern opticians would like to undertake, except at a price which would prohibit the general use of the instrument. In order to draw out its scale, Saussure availed himself of the well-known fact that the difference between two very similar shades of colour is imperceptible beyond a certain distance. Taking, therefore, as his measure of distance that at which a circular black spot 0.15 inch in diameter, painted on a white ground, became invisible, he prepared a series of sheets of paper, coloured with various shades of blue, and beginning with the extremes, he selected a series, the difference of shade between each of which was such as to become invisible exactly at the distance at which the black spot was also imperceptible. It will be obvious from this description that there are very great difficulties in the way of so constructing these instruments that their indications shall be accordant.

Our readers will notice that Howard referred to the possibility of substituting tinted glass. This plan was tried by Professor Trail, who thus refers to it in his Treatise on Physical Geography, in the Seventh Edition of the *Encyclopædia Britannica* :—

"Some years ago we endeavoured to give greater permanence to the tints by employing thin films of blue glass in constructing a cyanometer. The first degree was formed of a single film enclosed between plates of thin crown glass, and each succeeding degree consisted of an additional film."

Saussure* gives a great many results of observations made by himself in various places, which are therefore probably fairly comparable, and show—(1) that the deepest blue is in the zenith at mid-day on mountain

* Voyages dans les Alpes, 4to Genève, 1786.

tops, and (2) that in plains and at all altitudes above sea-level the deepest blue is at mid-day and in the zenith. We greatly object as a rule to long extracts, but when our precursors have expressed in clear and forcible language the views we desire to lay before our readers, we think it more honourable to quote verbatim from their works than to bring forward the ideas of others in words of our own. With this brief preface we proceed to quote from the excellent [but in a perfect state rare] treatise on meteorology by Kaemtz :—

“Blue color of the air.—One part of the luminous rays is absorbed, the other reflected by the air ; the latter, however, does not act equally on all the colored rays, of which white light is composed ; it acts like a milky glass, it rather allows the rays of the red extremity of the spectrum to pass, and, on the contrary, reflects the blue rays ; but this difference is not sensible until the light has traversed large masses of air. De Saussure has shewn that the blue color of the sky is due to the reflection of light, and not to a peculiar color belonging to the aerial particles. If the air were blue, he said, mountains that are very distant, and that are covered with snow, ought to appear blue, which is not the case. An experiment made by Hassenfratz also proves that the blue ray undergoes the greatest reflection. Indeed, the thicker the stratum of atmosphere in which the ray traverses, the more do the blue rays disappear, which make the red ray visible : now, when the sun is near the horizon, the ray traverses a greater thickness of the atmosphere ; thus this body appears to us red, purple or yellow. The predominance of red, and the absence of blue, when the sun is near the horizon, have been confirmed by an experiment of Hassenfratz : he passed the solar light through an opening, and received it on a prism ; he then measured the width of the prism at a certain distance ; the observation was repeated when the sun was at different heights above the horizon. In the long days of summer, at mid-day, the length of the prism was 185 parts ; and in winter, during the shortest days, at sunset, only 70 parts. All the rays of the extreme violet were wanting, for the spectrum was only composed of red, orange and green, an evident proof that all the blue rays had been absorbed. The blue rays also are often wanting in rainbows that appear a short time before sunset.

“Other apparatus has been devised, but all are intended for measuring the intensity of the blue. Now, as the atmosphere presents other colors, such as yellow, red, greyish blue, &c., instruments should be constructed for each of these colors. The following apparatus might serve to indicate the shade of color, but I leave others the care of verifying by actual experiments the utility of this idea. The colour of objects is due to the want of certain of the colors of white light ; thus, then, if we knew the principal elementary colors in white, and in the light coming from any body, we might know the color of that body. In order to determine the number of elementary colors, we should select a perfect prism of flint glass, and fix it at the extremity of a tube 11·8 or 15·7 in. long. The light of a body whose color we desire to know is received through a narrow opening, and the prism decomposes it ; but in order to distinguish the colors well, they are received, as they pass out from the prism, on the achromatic object-glass of an astronomical telescope. By means of a micrometer-screw the length of the spectrum and the width of each color is measured ; in this way we may not only indicate with great accuracy the different shades of the sky, but on repeating the experiment when the sun is at different heights above the horizon, we arrive at a positive knowledge of the number and the nature of the different elementary colors of solar light.

“The mere contemplation of the sky at once proves to us that its color is not the same at all points of the same vertical ; it is generally deeper in the zenith, then it becomes brighter towards the horizon, when it is frequently completely white. This contrast becomes still more striking by the use of the cyanometer. Thus de Saussure found one day that the color corresponding to No. 23 of his cyanometer was in the neighbourhood of the zenith, and that corresponding to

No. 4 near the horizon ; M. de Humboldt arrived at analogous results. But the color of the same part of the sky changes very regularly during the day ; in that it becomes deeper from morning to mid-day, and becomes clearer from this time until evening.

“When we ascend from the plain to mountains the sky appears deeper and deeper ; the chamois-hunters and shepherds have long known this. Deluc was the first to direct attention to this fact, which de Saussure verified in the Alps and M. de Humboldt on the Cordilleras. In our climates the sky has the deepest blue color when, after several days rain, the east wind drives away the clouds. According to M. de Humboldt the sky is bluer between the tropics than in the higher latitudes, but paler at sea than in the interior of countries.

“The color of the sky is modified by the combination of three tints—blue, which is reflected by the particles of air, the black of the vault of heaven that forms the ground of the atmosphere, and finally, the white of the vesicles of fog and flakes of snow that swim in the atmosphere. Indeed, the tint of the blue rays is darkened by the black color of space, and, on the other hand, it is made lighter by the white of the vesicles of fog. When we ascend in the atmosphere we leave a great portion of the vesicles of vapour beneath us, so that while rays reach the eye in less proportion, and the sky being covered with a lesser number of particles reflecting its light, its color becomes of a deeper blue. For the same reason the blue in the neighbourhood of the horizon is less intense than at the zenith. If the sky is paler in the open sea and in high latitudes, than in the interior of the continents and in the neighbourhood of the equator, it must be attributed to the vesicles of fog.”

In spite of ourselves, the above extract has led from the original subject of this article—the cyanometer—to what must, we presume, be held to be its legitimate successor—the spectroscope—and cannot refrain from pointing out how nearly its present form was sketched, five and twenty years since, by the indefatigable Professor of Dorpat. The length of this article precludes our discussing the subject of spectroscopic observations of the atmosphere on the present occasion.

(To be continued.)

THE SPRING OF 1869.

To the Editor of the Meteorological Magazine.

SIR,—It may interest some of your readers to learn a few details of the weather on the north-east coast during the last quarter.

The 27th of March was remarkable for one of the most violent snow-storms I ever encountered, followed by a hurricane of wind at night, accompanied by thunder and lightning. The sea was a magnificent sight on the morning of Easter-day, the only difficulty was to see it without being blown away.

The beginning of April was cold, though not excessively,¹ but from the 10th to the 14th exceptionally hot. At Ripon, on the 11th, the thermometer was as high as 77°, being 2°·5 higher than in the very warm April of 1865. Here the max. was 74° on the 14th. A thunder-storm occurred about 7 p.m. that evening, the cloud rising slowly out of the W. in the afternoon. At Ripon, thunderstorms were passing on different sides from noon to 8 p.m. In discussing the onward movement of a storm, it ought to be remembered that there are often a considerable number of different storms passing simultaneously on the same day in different districts. After the thunderstorm the weather was cold till the 20th, a sharp frost occurring on the 19th.

After this there was fine weather to the end of the month, the temperature however not exceeding 64° here, while at Ripon it reached 74° .

May was remarkable here for cold, cloud, and considerable rainfall. On the 3rd the max. was only 42° , heavy rain continuing all day. On Monday, the 10th, the wind changed for some hours to the S.W., and the temperature rose to 59° , a point never exceeded throughout the whole month. The general direction of the wind was N. to E., but it occasionally blew from the N.W. and S.E. The equatorial current was almost wholly absent, the wind never continuing more than a few hours at a time in the S. and S.W., apparently only passing through those points as it veered round. On three days, the 1st, 11th and 12th, it veered through all the points of the compass within 24 hours. This is considered by the people here a mark of fine weather. I have certainly not observed it except when the sun was powerful. The mean temperature of the air during May was only $44^{\circ}8$, probably one of the coldest Mays ever known. The air was generally moist, and twice, during rain with the wind from the sea, the rain cloud descended to this level (340 feet), causing complete saturation. The neighbouring moors (600 to 800 ft.) were frequently enveloped by it. I have rarely known nimbus in summer descend much below 1000 ft. further inland, even in persistently wet weather in Cumberland, although in winter I have on one occasion emerged *above it* at only 800 ft. Total rainfall in May 3.01 inches, evaporation in 5-inch cylinder, 2.11 in.

June opened with a severe hoar frost, followed by an immediate rise in temperature. It soon became hot, reaching 78° on the 7th, but a reaction set in immediately. A thunderstorm had occurred at 10 p.m. on the 6th, and 24 hours afterwards the cold polar current streamed down from the upper regions of the atmosphere. It seems that thunderstorms occur when the contrast in temperature between the polar and equatorial air-currents is very marked, which seems to be the case this year, but was not so last year, for want of a sufficiently cold polar wind; hence the paucity of thunderstorms last year, and their frequency this. Another thunderstorm occurred on the 15th. The barometer had sunk at 9 a.m. to 29.04; at 3 p.m. clouds gathered; and between 3.30 and 5.30, 0.66 in. fell, the wind veering from S.E. to W. Soon after midnight a terrific gale from N. awoke every one. It is remarkable that the coming storm escaped the vigilance of the Meteorological Office, although their returns for the 15th show a *rapidly increasing difference* of barometrical pressure between stations in the W. and E. The absence of warning doubtless increased the number of disasters. Next morning rain to the amount of 1.02 in. was measured for the 24 hours, and the ther. was as low as 44° . Since then better and warmer weather has prevailed, with a drier air and very little rain. I cannot say, however, that I have observed the drought predicted by Mr. Brumham. I think such researches valuable, but if I may venture on a word of criticism, I must say that in ascribing last year's drought, which began in April, to the position of the moon on July 20th, not long after which (August 6th), wet weather set in,

he did seem to me to "put the cart before the horse"—the effect before the cause. Apologizing for this intrusion upon your space,

I remain, your obedient Servant,

F. W. STOW.

Hawsker, near Whitby, June 28th.

THE TEMPERATURE OF JUNE, 1869, COMPARED WITH PREVIOUS YEARS.

To the Editor of the Meteorological Magazine.

SIR,—That the past month has been an exceedingly dull and cold one, most people will admit, and the annexed figures show to what extent it has been colder than the other years mentioned. Its effects on vegetation would have been more telling, but for the forward state things were in at the end of April, and the good condition of the ground at that time; but as it is, only the most robust herbage makes any progress, tender and delicate things merely exist, and may be said to drag out a wretched existence. The absence of sunshine has also told disastrously on the fruit crop, which in many cases will not be more than one-tenth of what it was last year. Grass has been plentiful, and in places the cereals do not look amiss, there being a prospect of plenty of straw. The unexpected cold has induced many to retain fires in their sitting rooms, and when it is borne in mind that the thermometer has eight times fallen below 40°, and on two or three occasions there were visible tokens of frost, we may conceive what a month we have passed through. It has, however, been a dry month, only 0·87 in. of rain falling; but the same month in 1858, 1867 and 1868, were still more dry, but it has been colder than any corresponding one I have on record excepting 1860, which was a very wet month. The following figures show the average max. and min. temperature in degrees for the 30 days in each month, and also the rainfall:—

	Aver. Max.		Aver. Min.		Rainfall.
June, 1857.....	81·0	.....	50·8	.....	1·67
„ 1860.....	66·0	.....	43·6	.....	5·09
„ 1865	76·7	.....	48·5	.....	1·17
„ 1868.....	74·2	.....	49·0	.....	·51
„ 1869.....	67·2	.....	42·8	.....	·87

From the above it will be seen that the temperature of June, 1860, was somewhat lower than the past month, but the rainfall of that year was excessive, 5·09 in. falling on 23 days, doubtless depressed the temperature, whereas the first ten days of the past month were tolerably fine; the night temperature, however, has been lower than I have any record of, and in addition to the frost of the 1st, registered here, other low-lying places in the district reported frosts on 11th, 12th, 15th and 17th. The barometer has usually been high, and excepting about the 10th, when we had thunder, it has been pretty steady. The winds in the early part of month mostly S.W., but latterly have been in a contrary direction; on the 21st it veered from N.E. to N.W., and nearly W., being N.W. at noon that day, when we had rather a heavy shower of rain.—Yours, &c.,

J. ROBSON.

Linton Park, Staplehurst, Kent, July 2nd, 1869.

NOTES ON JUNE, 1869.

6th.—Sharp earthquake at Gibraltar at 5.57 a.m. Mirage prevailed in several parts of the English Channel from 3 to 6 p.m.; the apparent altitude of Beechy Head was over 1000 ft.

13th.—CULLODEN.—Fresh snow on the high hills, and continuing till the 16th; it was two inches deep on the Highland Railway at its highest level at Dalwhinnie.

14th.—Snow at Braemar. Gale off Tyne and Tees.

15th.—Snow reported from Dumfries, Auchendrane, Castle Toward, Logierait, and Aberdeen, but only as seen on the hills. From Dumfries it is said to have remained till the 22nd, and from Aberdeen it is stated the hills were several times covered with snow; nor was the snow confined to Scotland, as it is stated to have fallen at Mesandbecks, Selside near Kendal, and other places on 15th.

SNOW IN JUNE.—The most extraordinary weather at present prevails in the county of Westmoreland, and has done so for many months past. On Wednesday morning (16th) the hills to the north were entirely covered with snow, and the drifts were three or four feet in depth; nor was this strange and unseasonable phenomenon confined to the higher range of mountains, on the contrary, the white wintry mantle had fallen as far down the valley as Stavely, a village between Kendal and Windermere, and occupying a most sheltered position. The scene was most extraordinary, and, so far as the memory of the oldest inhabitant went, quite without precedent in the whole range of atmospheric phenomena. A sharp cold wind prevailed from the north, and the general appearance of the sky and clouds was more suggestive of February than the middle of June. Indeed, the wind has been, with few exceptions, northerly for the last six months. Vegetation of all kinds is very backward.

15th.—Thunderstorm in London between one and two p.m.; lightning struck the sailing barge SX lying in the Thames off Charlton, and ignited the straw with which it was laden; thunderstorm also at Whitby, see page 85.

18th.—Snow 7 inches deep on the Yorkshire Moors.

26th.—Snow on Skiddaw.

MIRAGE ON THE NORTH-EAST COAST.—A beautiful and perfect mirage was visible from Hartlepool on Saturday afternoon. The whole of the horizon of the sea was reflected in the sky, with several ships and screw steamers far out at sea going southwards, plainly visible, inverted on the surface. The town of Redcar, with some minor villages visible on the Cleveland coast, also presented a most singular and beautiful appearance in the air while the mirage lasted. Towards six o'clock the phenomenon gradually faded away, being replaced by heavy masses of dark clouds, which, for a time, presaged a thunderstorm.

26th.—Earthquake at Bologna, which stopped the clocks and rang the bells.

VIOLENT THUNDERSTORM.—A Monaghan correspondent writes:—

"This locality was visited to-day (Sunday, June 26th) by a thunder and rain storm of great severity. The sky about noon became overcast, and shortly afterwards a whirlwind swept round the neighbourhood of Killevan, much to the terror of the inhabitants. In its course it tossed chimneys, stripped houses, tore up trees, and laid cattle prostrate. The sound as it passed resembled the whistling of an engine. Shortly afterwards the rain began to pour, and continued incessantly for two hours, the thunder being absolutely terrific. I have not heard that any serious damage has been sustained."

LUNAR AND SOLAR INFLUENCE ON THE WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—Your correspondent Mr. Ryves appears to have misunderstood some portions of my letter. Allow me to point out a few instances:—

1. There was nothing in my letter to lead to the supposition that I "regarded" a slight deficiency in the seven (not six) months' rainfall (from March to September inclusive) "as sufficient evidence of a drought." If Mr Ryves will refer to that letter, he will see that I gave other evidence. This shows that the deficiency to which he refers was not "regarded" by me "as sufficient evidence of a drought," but merely as a link in the chain of evidence. It is quite true that a slight rainfall deficiency does not of itself prove the occurrence of a drought, but it is equally true that even an average rainfall is insufficient evidence that a drought did not occur. For instance, July, 1826, was a month of such remarkable drought that the meadows were parched up, to the same extent as in 1868, and yet the rainfall, according to Howard, was 2·6 in., which is about the average. This was the result of heavy showers on a few days. In June, 1856, and June, 1865, similar phenomena occurred. In the latter month we had 25 consecutive days without any rain; yet, notwithstanding this prolonged drought, the rainfall of June, 1865, exceeded the average. If we extend our comparison to the whole season, we find a similar analogy between 1826 and 1865. In the former year the rainfall of the period from March to September inclusive, was 14·7 in.; in the latter year the corresponding period gave 14·6 in. So the rainfall of the extremely dry season of 1826 was actually greater than that of 1865. The truth is, in both seasons we had very great drought, with occasional heavy rains or showers. In 1826, however, there was no month so much below the average in rainfall, or so much above it in temperature, as September, 1865, was. So the year which your correspondent thinks very weak in evidence as to drought is in reality very strong. This he must admit, unless he is prepared to assert that the summer of 1826 was not a very dry one; for if his objection applies to 1865, it does equally so to 1826.

2. I never had anything to do with astro-meteorology, as Mr. Ryves supposes. I do not believe in it. The stars (unlike the sun and

moon) are too remote to exert any appreciable influence on the tides of the ocean, and for the same reason they are incapable of exercising any appreciable influence on the air.

3. In the two rules relative to lunar influence I said nothing about heat, nor did I say that hot weather was to be expected in May or June of the present year, as Mr. Ryves thinks I did. Heat sometimes accompanies the drought produced by lunar influence, but the instances are not so frequent as in the drought caused by the solar influence referred to in the last of the rules. Therefore I did not mention heat in the first two rules, or allude to it in the forecast. It was a period of deficient rainfall that I expected and nothing more.

Mr. Ryves thinks that if my "rule has anything in it, it ought to hold good of all places on the same meridian." In answer to this objection, I may say that the laws I gave were deduced from observations made in this district, and as regards these parts they have certainly been invariably correct. Whether Italy, Scotland, and other places are similarly affected by them, or whether through the law of compensation they are affected in a totally different way, must be determined by future investigation.

Your correspondent asserts that in the south of Europe the summer of 1868 "was as exceptionally cold and wet as it was here dry and warm." It is by no means clear that such was the case, although the weather of Rome was so bad. Certainly it was not so in Tuscany. In the *Times* of July 6th, 1868, the special correspondent gives the following account of the weather in the neighbourhood of the capital of Italy:—

"The accounts of the harvest continue exceedingly favourable. Some rain we had last week did much good to the green crops, and no serious damage to the corn in process of cutting. In the province of Pisa, says a paper published in that city, 'the crops of grain exceed all expectations. The oldest among the peasants can hardly remember such a year. Corn is falling in the markets. The recent rains must have benefited the Indian corn, which in some places had begun to suffer from the drought.'" So Tuscany may be set against Rome.

The long period of deficient rainfall which Mr. Ryves seemed to think would not occur, commenced the day after he wrote his letter. The average rainfall at Greenwich for the period between the 28th of May and the 4th of July is about 2.50 in. The amount registered there during the corresponding period of the present year has been 1.15 in., which is more than 50 per cent., below the average of 54 years. In other places a similar deficiency has occurred. In fact the period has been on the whole unusually dry and unusually cold. In the long period of deficient rainfall which should occur or begin next month, it is by no means certain that there will be any continuance of great heat.—Yours, &c.,

G. D. BRUMHAM.

Barnsbury, July, 1869.

REVIEWS.

[We regret to find that some recent reviews in these pages have been thought unnecessarily severe. We do not concur in the sentiment. We hold that if any useful purpose is to be served by reviews, those who write them must never hesitate to mention every point in which the works reviewed fail to reach the most advanced state of knowledge on all the subjects treated of. But in elementary works this rule does not apply, and in such cases the reviewer should see that all branches are developed to an equal extent, and that up to that limit nothing is incorrectly stated. The standard must therefore rise with every advance of knowledge, and the reviewer must keep *au courant* therewith; hence he will be necessarily often compelled to point out defects which can hardly be called faults; hence also a good reviewer will probably have to criticize far oftener than to praise, and hence another instance of the advantages of anonymous journalism. The sole object of this magazine being the *advancement* of the science, we are confident it would be a retrograde and suicidal step to lower by one iota our standards of accuracy, and we are loth to believe that any persons who possess a real desire for the progress of meteorology can disapprove our resolution.—ED.]

Meteorological Report for the Year 1868. By the Rev. R. F. WHEELER, M.A. [From the Natural History Transactions of Northumberland and Durham.] Stanford, 8vo., 82 pages, and folding tables.

This publication continues to improve yearly. In noticing the report for 1867, we pointed out that the editor would confer a benefit in every respect if he abandoned the large folding tables and substituted consecutive paging; this has been done so far as rainfall, temperature, and pressure are concerned, and none but handy sized tables remain. The editor commences by a brief reference to the frequent slight shocks of earthquake felt in 1868, and then proceeds with detailed notes on the several months, prefacing each month by a line or two of an appropriate saw; some of them are common enough, others are new to us, and all are surely worth the little space they occupy.

January—"When the grass grows in Janiveer,
It grows the worse for't all the year."—*Old Proverb.*

Scarcely corroborated by 1869?

February—"February fill dyke, be it black or be it white,
But if it be black, its better to like."—*Old Proverb.*

We never saw this second line before, as to the first three words of the first line, see *British Rainfall*, 1863, page 15, where the fact that February is in many places a dry month is reconciled (by Rev. W. H. Milner) with its filling the dykes, by considering that the month being

dry and often windy, snow does not lie evenly on the ground, but is blown into the dykes, &c., which it fills to the brim, but this explanation is by no means generally accepted. It may be, that as the term "dyke" is a north country one, we have in this proverb a recognition of the high per-centage of rain in the winter months in mountainous districts.

March—"Comes in as a lion and goes out like a lamb."—*Old Proverb.*

April—"March winds and April showers,
Bring forth May flowers."—*Old Proverb.*

May—"Look at your corn in May, and you'll come weeping away ;
Look at the same in June, and you'll come home in another tune."
—*Old Proverb.*

June—"Calm weather in June sets the corn in tune."—*Old Proverb.*

July—"A shower in July, when the corn begins to fill,
Is worth a plough of oxen, and all belongs theretill."—*Old Proverb.*

August—"All the tears St. Swithin can cry,
St. Bartlemy's mantle wipes dry."—*Old Proverb.*

September—"September blow soft till the fruit's in the loft."—*Old Proverb.*

October—"A good October and a good blast,
To blow the hog acorn and mask."—*Old Proverb.*

November—"November take flail, let ships no more sail."—*Old Proverb.*

December—"He who sows his land, trusts in God."—*Spanish Proverb.*

After full particulars of thunderstorms and various other phenomena, a very copious and important series of tables is given. None but those who have themselves undertaken to carry 60 or 70 pages of tabular matter through the press can fairly estimate the pains Mr. Wheeler must have taken to prevent more errors appearing on his pages ; and yet we have two indictments—one against Mr. Wheeler, and one against either Mr. Wheeler or Mr. Symons, and under each indictment there are a series of counts. To take Mr. Wheeler's first. On page 61 the min. temperature in September is 48·60, the max. 65·07, the mean should be 56·835 but it is given as 51·83 ; unfortunately this is not a misprint but a miscalculation, for the annual value is also wrong, and to render it still more provoking the error is repeated on pages 34 and 35. We regret to find that Mr. Wheeler admits tables of temperature with *two* places of decimals ; unless the observers in Northumberland are far ahead of their *confrères* in other parts, we think hundredths of a degree of temperature an unwise attempt at refinement. Another practice to which we demur is that of adopting different methods of obtaining mean temperature at some stations from that at others. For instance, page 60 *et seq.* At North Sunderland, Wallington, Cragside, Wylam, Seaham, Sedgfield, and Alston, the arithmetical mean of the max. and min. is taken ; but at Bywell, Allenheads, and North Shields, although the same data exist, a different method is adopted.—At Durham both values are given.

The collection of rain returns is remarkably complete and well arranged, but not in all cases correct. We will take first those errors which belong to the author or the printer, and then the more numerous ones in which the error may be chargeable to them, to Mr. G. J. Symons, or to the various observers. Page 43, Stanhope Castle,

37.75 from 39.68 is 1.93, not 1.83; page 44, Ushaw, 25.75 from 26.88 is 1.13, not 1.01; page 46, Cresswell, the mean of 19.82 and 19.95 is 19.89, not 19.58; page 48, Park End, 33.14 from 34.33 is 1.19, not 0.19, and 33.14 should be 33.31; page 54, Craggside, the observations consist of 8 months in 1867 and the whole of 1868, the amounts being 16.25 and 25.54 respectively: these have been added and divided by two, giving 20.89, but that on consideration will be seen to be the average for 10 months, not for a year. Out of 15 pages of tables these are all the errors clearly appertaining to the author, and we wish so short a list was more frequent. We now come to certain cases in which different returns are published by Mr. Wheeler from those given by Mr. Symons, and these will be best thrown into a tabular form:—

	Nat. His. Trans., 1868.		British Rainfall, 1868.		Diff.
Darlington, South End...	37.75	.....	37.25	.....	— .50
Greta Bridge	28.81	.....	28.69	.....	— .12
Sedgefield	26.93	.....	26.84	.....	— .09
Seaham Hall	22.66	.....	22.56	.....	— .10
Otterburn	34.06	.....	32.64	.....	—1.42

We hope the parties concerned will clear up these discrepancies.

Lastly, we give a list of returns not given in Symons' *British Rainfall, 1868*, viz.:—

Station.	Ht. above Ground.		Ht. above Sea.	Depth of Rain, 1868.
	ft.	in.		
Darlington (Brinckburn) .....	...	.....	40?	21.75
Newcastle W. Works, Hallington Village	0	6	469	28.69
Fawcett	0	6	563	27.08
Woodford	0	6	.....	29.17
Camphill	0	6	676	30.60
Green Crag	0	6	800	29.89
Valley of N. Tyne .....	..	.....	.....	30.11
Horsley, near Bywell	0	6	.....	23.77
" "	0	6	.....	24.10
Craggside Rothbury .....	...	.....	400	25.54

(To be continued.)

Report on the Proper Principle of Drainage to be adopted in the towns of Oxford, Eton, Windsor and Abingdon. By COL. EWART, R.E. Harrison. 8vo., 20 pages.

Sewage Irrigation: Being a Second Letter addressed to the Hon. the Lord Provost, on the Sewerage of the City of Glasgow and the Purification of the River Clyde. By MICHAEL SCOTT, C.E. Maclehose, Glasgow. 8vo, 40 pages.

Suggestions for the Sanitary Improvement of Labourers' Cottages and of Villages. By W. MENZIES, Deputy Surveyor of Windsor Forest. Longman. 8vo, 52 pages.

THESE three works are scarcely within the province of these pages, but their titles, coupled with the fact that all of them enter into questions of the amount of rainfall in various districts, add one to the many proofs of the practical use of systematic and accurate meteorological observations.

JUNE, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which ≥ 1 or more fell	Max.		Min.		
				Dpth.	Date.		Deg.	Date.	Deg.	Date.	
		inches	inches.	in.							
I.	Camden Town	1·03	— 2·02	·47	13	6	89·3	7	35·6	1	0
II.	Staplehurst (Linton Park) ...	·87	— 1·87	·29	15	6	88·0	7	32·0	1	0
„	Selborne (The Wakes).....	1·81	— 1·42	·96	13	8	78·0	7	33·5	1	1
III.	Hitchin	1·19	— 1·45	·49	13	9	82·0	7	39·0	16	0
„	Banbury	1·64	— 1·64	·47	13	9	85·0	7	34·0	1	0
IV.	Bury St. Edmunds (Culford).	1·71	— ·87	·31	13	9	87·0	7	24·0	16	10
V.	Bridport	1·14	— 2·10	·48	13	6	78·0	7	38·0	1	0
„	Barnstaple	·54	— 3·58	·23	3	5	82·0	8	42·5	21	..
„	Bodmin	·54	— 3·50	·12	13	10	72·0	27	43·0	12	0
VI.	Cirencester	1·52	— 1·86	·35	13	8	...	...	...	...	...
„	Shifnall (Haughton Hall) ...	·96	— 2·15	·20	2	10	81·0	6, 7	43·0	11†	0
„	Tenbury (Orleton)	1·12	— 2·50	·22	17	8	84·2	7	34·0	1	0
VII.	Leicester (Wigston)	1·71	— 1·05	·61	13	10	80·0	7	37·0	16	..
„	Boston	1·76	— ·43	·41	18	13	87·5	7	40·8	12	0
„	Grimsby (Killingholme)	1·49	..	·32	13	12	82·0	7	40·0	1	..
„	Derby.....	1·41	— 1·48	·41	18	10	82·0	7	40·0	1	..
VIII.	Manchester	1·12	— 2·22	·34	14	9	82·2	7	36·0	1	..
IX.	York	1·05	— 1·05	·40	15	10	81·0	7	38·0	1	0
„	Skipton (Arncliffe)	1·96	— 2·14	·68	15	11	77·0	7	33·0	17	..
X.	North Shields	1·27	— 1·47	·57	15	10	73·0	6	38·0	1	0
„	Borrowdale (Seathwaite).....	5·13	— 5·38	1·04	15	12	..	..	..	..	..
XI.	Cardiff (Town Hall).....	·84	..	·32	14	8	..	..	..	..	..
„	Haverfordwest	·58	— 3·07	·34	1	7	76·6	6	34·6	11	..
„	Rhayader (Cefnfaes).....	..	..	..	..	..	..	..	..	..	..
„	Llandudno.....	·82	— 1·47	·27	15	7	73·5	24	39·3	1	..
XII.	Dumfries	1·02	— 1·88	·48	14	8	81·0	26	36·0	1	0
„	Hawick (Silverbut Hall).....	1·17	..	·62	15	10	..	..	..	..	..
XIV.	Ayr (Auchendrane House) ...	1·87	— 1·48	·40	14	11	72·0	26	30·0	1	4
XV.	Castle Toward	2·71	— ·78	1·24	14	9	76·0	25	30·0	9	3
XVI.	Leven (Nookton).....	2·53	+ ·29	1·15	15	12	72·0	26	37·0	11	2
„	Stirling (Deanston)	2·74	— ·18	·92	15	10	74·2	26*	34·0	11	0
„	Logierait	2·11	..	·68	14	12	..	..	..	..	..
XVII.	Ballater	2·48	..	·89	14	11	73·0	26	28·0	1	1
„	Aberdeen	2·37	..	·78	15	13	74·2	26	37·4	1	0
XVIII.	Inverness (Culloden)	1·69	..	·94	14	10	70·1	25	38·0	1	0
„	Fort William .....	..	..	..	..	..	..	..	..	..	..
„	Portree	3·09	— 1·69	·83	6	19	..	..	..	..	..
„	Loch Broom	1·67	..	·30	14	16	..	..	..	..	..
XIX.	Helmsdale	·89	..	·23	17	11	..	..	..	..	..
„	Sandwick	1·97	+ ·43	·63	6	14	64·3	25	40·0	14	..
XX.	Cork	·18	..	·07	4	4	..	..	..	..	..
„	Waterford	·32	— 2·66	·17	4	7	81·0	29	42·0	14	..
„	Killaloe	1·45	— 2·18	·68	4	7	78·0	26	37·0	16	0
XXI.	Portarlington	·83	— 2·42	·41	5	10	77·0	26	36·5	13	..
„	Monkstown	1·16	— 1·46	·20	4, 13	12	73·0	7	35·0	14	..
XXII.	Galway	1·60	..	·87	4	6	78·0	25†	42·0	14	..
„	Bunninadden (Doo Castle) ...	1·11	..	·28	14	14	76·0	25	33·0	9, 14	0
XXIII.	Bawnboy (Owendoon).....	1·07	..	·38	12	13	82·0	30	35·0	13	0
„	Waringstown	1·13	..	·30	14	9	77·0	26	34·0	13	0
„	Strabane (Leckpatrick)	2·10	..	·44	14	16	76·0	25	33·0	14	0

* And 30th. † And 27th, 29th & 30th. ‡ And 12th and 13th.
 + Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON THE MONTH.

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

ENGLAND.

LINTON PARK.—A dry and very cold month, with visible frost on 1st, and and ther. only 1° above freezing on 17th; *T* on 15th. The average day temp. being more than 8° below that of last year, and that of the nights about 5°·4 lower than those of last June, the month was most ungenial for vegetation.

SELBORNE.—6th, 7th and 8th, three warm summer days; temp. 75°, 78°, and 77°, but the most sunless, ungenial June I remember; the oldest people say they never knew so cold a longest day; prevailing winds after the first week N.E.

BANBURY.—Fog on 6th; *rosa canina* in blossom same day; *R* and *H* at 8·45 a.m. on 15th; wheat in bloom on 27th.

CULFORD.—The month just closed has certainly been one of the coldest Junes ever experienced; the temp. has been below 32° on 10 nights, and the mean temp. has been nearly 7° below that of June, 1860. With the exception of the 6th and 7th, the max. temp. of which were respectively 80° and 87°, the weather during the entire month has been uniformly cold and sunless, with wind from N. or N.E.; no *T*.

CIRENCESTER.—Excepting four days, 6th and 7th, and 24th and 25th, June has been unusually cold; N. and E. winds prevailing, and many days hazy and sunless.

SHIFFNAL.—Cold and ungenial till the end of the month, except the 6th and 7th, when max. was 81°. Only three nights above temperate. Sultry, with signs of *T*, on 24th, 25th, 26th, and 27th. Crops of hay unusuabally heavy. Remarkably few swallows, many said to have died from the cold of May; high wind from N.W., doing much damage to the foliage on 15th. Partridges hatched on the 16th; few butterflies, not common white ones; strawberries began to ripen on 24th; on 27th the hawthorn hedges a mass of cobweb blight, from a caterpillar of some moth.

ORLETON.—The *R* chiefly fell during one week in the middle of the month and was less than half the average; no *R* fell after the 18th; no *T* or *L*; with the exception of a few days about the 7th and 27th the temp. was much below the average, and the sky generally cloudy, with wind between the N. and E.; on 15th and 16th a strong gale from W. to N.

WIGSTON.—The mean max. temp. of this month was 10° below that of June last year, that of the min. 1°·5 below, showing that the mean of the month was about 6° below that of June, 1868. The character of the weather has been dull, and but little sunshine.

KILLINGHOLME.—Wild roses began to flower on 10th; first ear of corn on 14th; many swarms of bees; more buttercups in the pastures than usual, and charlock in the cornfields; this last is thought by some to foretell a good crop of turnips. Many cloudy days at the end of the month caused haymaking to be very tedious; the harvest must be late; in many places the leaves of the oaks have suffered from an insect blight of some kind.

DERBY.—But for the length of daylight, June could scarcely have been recognized, so cold and unsummerlike has it been. Northerly winds on 19 days; temp. on the 7th reached 82°, but the mean of the month was 3° below the average, and nearly 7° below that of June, 1868. Hay crops unusually heavy. Apple and pear crops a failure.

YORK.—Violent wind and storm on 15th, *T* on 16th.

ARNcliffe.—Unusual continuance of E. and N.E. winds.

NORTH SHIELDS.—Strawberry ripe on 29th; St. Bernard lily, French roses, branching larkspur, perennial lupin, yellow melfoil, perennial aster, sweet william, white and purple fraxmella, gladiolus, African marigold, and ranunculus, in flower between 4th and 29th.

SEATHWAITE.—Not quite half the average rainfall ; only one day on which the fall reached one inch.

W A L E S.

HAVERFORDWEST.—With the exception of two days during the first week, and the last six days, this was one of the coldest Junes of which I have any experience, and, (with the exception of June, 1859, when only .30 in. fell), the driest in the last 20 years ; notwithstanding which, in consequence of the wet May, the hay crops are much above the average. Should the present drought continue, water will be very scarce ; even at the end of the second week large ponds were emptier of water than I have ever noticed so early in the year.—[ERRATUM : May should have been described as "one of the wettest," not "the wettest May for 20 years," as May, 1865, had 5.75 in., exceeding May, 1869, by 0.10 in.]

LLANDUDNO.—Wheat in ear on 17th ; privet and elder also in flower. T in early morning on 8th.

S C O T L A N D.

DUMFRIES.—The month has been dry ; for several days in the second week the weather was very cold, and on the morning of the 16th the hills were covered with S, which did not disappear until the 21st ; from the 22nd to the close of the month the weather was very hot and droughty ; pastures getting brown ; the hay crop light, but grain crops, turnips and potatoes looking well ; the season about three weeks later than last year ; both rainfall and temp. below the average.

HAWICK.—Continued warm weather after the 18th ; previously there were many bright warm days, but the nights were chilly, with ther. at times approaching the freezing point. Severe storm of wind and R on the 15th ; at the end of the month R much wanted.

AUCHENDRANE.—With bar., and bar. range and humidity all about the June mean, the mean temp. has been low. Rainfall deficient, evaporation great, and heavy dews common. The amount of cloud and force of wind are also both about the June mean, but the polar current has prevailed to an unusual extent, and on 15th especially produced great disturbance both of bar. and ther., clothing at the same time our hills with S. On seven days the exposed black bulb rose to 110°, and on four nights fell below 32° ; river nearly dried up, springs low ; hay crops light.

CASTLE TOWARD.—First few days mild, with fine growing showers, but became cold again up to the middle of the month ; 1.24 in. of R fell in 16 hours on the 14th ; S on the distant hills on the 15th ; it has been so dry since, that springs are very low, and some are dried up ; plants have been difficult to keep clean, and several turnip fields have suffered from fly.

DEANSTON.—All the R of this month fell before the 18th ; the 15th was a very wild day, with strong easterly wind and heavy sleety R ; S on the Ochills and Grampians. Latter part of the month very bright and warm, but easterly winds ; no T.

LOGTERRAIT.—Heavy R with much cold about the middle of the month ; on the morning of the 15th the hill tops covered with S, which remained to the following day ; from the 24th great heat and rising bar.

BALLATER.—The weather, up to the middle of the month, very unsettled, and unusually cold for the season ; S lying for days on the neighbouring hills, an unprecedented sight for June ; rainfall rather above average, but, during the last fortnight, none fell, and now the want of it is beginning to be felt although the crops are still looking splendid. Bar. high and steady during the latter half of the month.

ABERDEEN.—The first three weeks of the month were cold and ungenial, the hills being several times covered with S, the last week was fine and warm ; rainfall slightly above the average ; winds from N.W. greatly in excess of average ; drought beginning to be felt ; T in evening of 3rd, T, with heavy showers of H on 4th, T on 24th, fog on 20th.

CULLODEN.—Fresh S on high hills on 13th, 14th, and 15th, and two inches deep on Highland Railway at highest level near Dalwhinnie.

PORTREE.—Some fine growing showers, and the weather generally favourable to the crops, though the potatoes were blackened by the frosts of the 1st and 14th; latter part of month warm and dry, rather too dry for the pasture grass.

LOCHBROOM.—We have seldom or ever experienced a June so cold and dry as this; frost and S upon the heights have been very prevalent. Crops are very backward, and stock in bad condition, but the latter part of the month was rather more summer-like.

SANDWICK.—The early part of June was cold, with northerly winds, the latter part dry and pleasant for the animal kingdom, but the vegetable world was dry, and crying for water.

I R E L A N D.

KILLALOE. Prevalence of N.E. winds. My potatoes were not injured, but in many places they were, for many mornings at an early hour the fields were white with frost, though the ther. on stand was never below 37°.

DOO CASTLE.—Dry month, latter end sultry; crops began to show very well towards the end of the month notwithstanding the great drought.

WARINGSTOWN.—Fine and dry, but earliest part of month cold; crops looking very well except early sown flax.

LECKPATRICK.—Very cold month, the average temp. lower than any June this last seven years; during latter part of the month wind invariably from the N.E.; crops and fruit late.

WHY HAVE WE COLD WEATHER AT MIDSUMMER?—Amongst the various causes to which the present cold weather at midsummer has been attributed is the fact that at this moment the disc of the sun has an unusual number of spots. The *Giornale di Roma* publishes a communication from the celebrated astronomer, Padre Secchi, on this subject, in which that savant says—"The sun is at this moment at a period of an unusual prevalence of spots. On the morning of the 7th, 33 principal ones were counted, disposed in seven or eight groups. Their number is rapidly approaching a maximum. The whole surface of the luminary is covered with them, and it appeared to us several times to present the aspect of a mass of white flakes on an ash-coloured ground."

SINGULAR PHENOMENON.—A phenomenon of a most extraordinary nature has lately been witnessed by the inhabitants of the borders of the Caspian Sea. This huge salt lake is dotted with numerous islands which produce yearly a large quantity of naphtha, and it is no uncommon occurrence for fires to break out in the works and burn for many days before they can be extinguished. Early last month, owing to some subterraneous disturbances, enormous quantities of this inflammable substance were projected from the naphtha wells, and spread over the entire surface of the water, and becoming ignited, notwithstanding every precaution, converted the whole sea into the semblance of a gigantic flaming punch-bowl many thousands of square miles in extent. The fire burnt itself out in about forty-eight hours, leaving the surface strewn with the dead bodies of innumerable fishes. Herodotus mentions a tradition that the same phenomenon was once before observed by the tribes inhabiting the shores of the Caspian Sea.—*Pall Mall Gazette*.

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COMPARATIVE OBSERVATIONS OF SOLAR RADIATION.

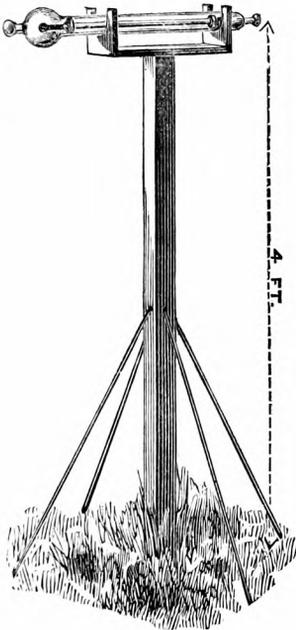


Fig. 1.

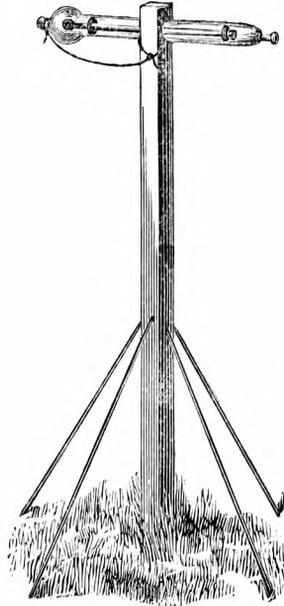


Fig. 2.

MR. STOW has become so thoroughly identified with accurate determination of the amount of solar radiation; and absolute uniformity in constructing, mounting, and using all instruments is so desirable that we cordially welcome the following memorandum:—

SUGGESTIONS FOR OBSERVERS.

1.—Use a sensitive maximum thermometer *in vacuo*, which has the bulb and about one inch of the stem blackened with lamp black.

2.—A thermometer blackened only on the bulb will give readings dependent in some measure on the size of its bulb, and should,

therefore, be compared in full sunshine with one in which the lamp black is extended to the stem, and the difference of reading noted. If this difference be large, it will vary to an appreciable extent with the amount of radiation, and it will be difficult to apply any certain correction to the readings of the instrument, but if the difference be small (say less than 5°) it may be applied as a correction to the observed readings, which will then be fairly comparable with observations elsewhere.

3.—Place the instrument 4 feet above the ground, in an open space, with its bulb directed towards the S.E. It is necessary that the globular part of the external glass should not be placed in contact with, or very near to, any substance, but that the air should circulate round it freely.

4.—One of the most convenient ways of fixing the instrument will be to allow its stem to fit into, and rest upon, two little wooden collars fastened across the ends of a narrow slip of board, which is nailed in its centre upon a post steadied by lateral supports.

5.—The maximum temperature of the air in shade should be taken by a thermometer placed on a stand in an open situation. Any stand, which thoroughly screens it from the sun, and exposes it to a free circulation of air, will do for the purpose.

6.—The difference between the maxima in sun and shade thus taken is the amount of solar radiation.

7.—Those who wish to take observations on this plan are requested to communicate with the Rev. F. W. Stow, M.A., Hawsker, near Whitby, and to send him, from time to time, a copy of their observations on a printed form which he will supply.

As a sketch is generally more instructive than a verbal description, we annex one of the mounting proposed by Mr. Stow, and another of a plan which has been adopted by several observers; it has the apparent advantage of leaving the bulb less encumbered by wood, and the loop of string prevents the possibility of its being tipped over or carried away by a gale of wind. The thermometer in this case rests freely in a hole drilled through the upper part of a stout post; to set the instrument, draw the bulb towards the post, that enables the loop to be lifted off the terminal boss, and the instrument is free. We do not believe there would be the slightest difference of reading between the two plans; it is rather a question of safety and convenience; and we are sure all will bow to Mr. Stow's decision whether fig. 1 or fig. 2 is to be the standard pattern.

We are glad to find that the observers at Holloway, Camden Square, Worthing, Strathfield Turgiss, Wisbeach, Bristol, Malvern, Derby, Huddersfield, Ripon, Whitby, and Tipperary have already commenced observations such as are described in the above suggestions. We hope others will follow their example, not only in this country but abroad.

TYNESIDE NATURALISTS' REPORT.

To the Editor of the Meteorological Magazine.

SIR,—I beg to thank you for your able and careful review of the "Meteorological Report of the Tyneside Naturalist Field Club," in your number for July, 1869.

I am really glad that you have not been able to discover more errors than those which you have pointed out. The report was drawn up amidst the incessant pressure of very onerous duties, and, for the most part, in moments snatched as best they could be from my more regular work.

The arithmetical errors, enumerated in the first four lines of page 92, were made by a person who has the reputation of being an able arithmetician, and whose help I obtained simply to work out the line of average. I now wish I had done the work myself. Unfortunately I did not consider it necessary to go over the work after my helper had finished.

As regards the difference between the amounts of rainfall as published in Mr. Symons's annual volume and those given in the local report, I may remark that, as regards South End Darlington, the error is clearly mine, and arose from copying 1·83 as the amount of rainfall for February, instead of 1·33. Greta Bridge and Otterburn: the differences in these cases I am not accountable for. As regards Sedgfield and Seaham Hall, the quantities are correctly printed according to the figures given to me.

I should have been very glad if there had not been any blunders, but a very considerable experience in dealing with printed matter has taught me how vain it is to indulge in such a hope.—Faithfully yours,

R. F. WHEELER.

[All the differences except four are now cleared up; the observers concerned have been applied to, and in our next the correct values shall be given.—Ed.]

Abstracts of Old Works.

UNDERGROUND TEMPERATURE.

Quelques Observations de Physique Terrestre. Par MM. AUGUST DE LA RIVE et F. MARCET. [Memoires de la Société de Physique et d'Histoire Naturelle de Genève, 1834.] Quarto, 26 pages, one plate.

THIS paper opens by relating the considerable attention given, at the commencement of the present century, to artesian wells in Switzerland, and relates how one M. Giroud had, after great difficulty, sunk one at Pregny, about two miles from Geneva, and at an altitude of 319 feet above the lake of that name, where he bored down 583 feet, or 264 feet below the level of the lake, without obtaining the water he sought. Having expended more than he originally intended to devote to the search, he abandoned it; but before removing the tools and

plant he offered, through his engineer, M. Bertrand, permission to use the same and continue the search, if the interests of science required its prosecution. M. de la Rive, after certain preliminary trials at his own cost, opened a subscription list for thorough and systematic prosecution thereof, and meeting a cordial response, both from government and the public, commenced operations early in 1833, and was enabled to continue them during 8 months, and to a total depth of 727 feet.

The diameter of the tube was only 4·9 inches, and it was lined with wrought iron pipes for 180 feet, which protected (so far) the bore from stoppage by the falling in of fragments of softer soil, which was especially troublesome at a depth of about 320 feet, where it was very friable. The water never rose to the surface, but it showed itself slightly when the boring had been pushed down to 19 feet; its level varied considerably, as is shown by the following table:—

Table showing the height of the water in the bore tube corresponding to different seasons of the year and to different depths of the bore.

Date of Observation.	Depth of Bore.	Depth of Water below surface		Rain in 30 days preceding each observation.	REMARKS.
		ft.	in.		
1831. June 16	55	14	11	0·54	The rainfall in 1831 was above the average.
1832. Feb. 9	147	13	10	1·78	
Mar. 9	293	14	11	0·62	Sudden lowering of water in tube. The summer of 1832 was very dry.
Oct. 19	533	23	9	1·34	
Dec. 19	577	24	3	1·49	
1833. Jan. 25	582	37	8	0·66	
April 1	599	35	7	0·85	
„ 8	606	34	3	2·45	
„ 11	608	33	9	2·36	
„ 13	608	33	0	3·87	
„ 15	612	32	0	4·17	
„ 16	613	30	9	4·44	
„ 18	616	30	1	4·53	
„ 23	620	27	8	4·64	
„ 27	623	27	0	4·82	
May 3	628	26	5	3·53	
„ 11	635	26	1	2·97	
July 15	673	27	0	4·31	
„ 29	683	27	8	2·89	
Aug. 3	687	28	10	1·87	
Sept. 23	718	38	0	3·64	The summer and autumn of 1833 have been very dry.
Oct. 12	727	38	0	1·96	

It seems, from this table, that the greater the depth of the bore the more does the water level sink. Thus:—after being stationary for a long time at about 15 feet below the surface of the ground, it all at once fell to 24 feet when the bore was carried down to 530 feet; then it fell to 32 feet in the spring of 1833, and after having risen again to 26 feet at the beginning of the summer, in spite of the increasing depth of the bore, it fell during the autumn to 38 feet

below the soil. M. de la Rive then remarks that we must not neglect, in considering these results, the influence of the relative humidity and rainfall previous to the dates of observation, and that the failure of the attempt to obtain a supply, even at a depth of 700 feet, must be held to demonstrate the improbability of artesian wells being available for agricultural purposes in the canton. "If it is true, as some *savans* suppose, that the supplies of artesian wells are derived from the rainfall on high lands, which follow the strata of the chalk and take their level, until, by a bore tube, we pierce the beds and allow the water to resume its previous level, then the very considerable inclination of these beds in the Jura range will explain why we have not reached them, even by piercing 400 feet below the level of the lake." The strata traversed by the bore may be very briefly described. Below the superficial beds of vegetable mould, sand, gravel, and conglomerate, a blue and gravelly clay intermixed with molassé* is reached. Below 128 ft. commences a succession of beds of marl and molassé, more or less indurated and variously coloured, which continue without interruption to the bottom of the bore. At 234 ft. we remark a bed of coarse molassé, 2 ft. in thickness, mixed with rounded pebbles, a fact sufficiently remarkable considering the depth. We ought also to mention a fetid and strongly sulphurous odour, which was observed in the yellow marl mixed with the molassé lying at the depth of 298 ft., *i.e.*, nearly level with the bed of the lake, and the presence of a grain of salt in the molassé situated at the same depth. This sulphurous odour is again evident at the depth of about 639 ft., without the presence of any sulphur compound which would account for its origin.†

The main portion of the work is devoted to the rate of increase of temperature at various depths, and so many of the remarks are of importance that we shall almost have to reproduce the whole essay. M. de la Rive commences by remarking that, during many years, isolated cases were on record, showing that there was a gradual rise of temperature at increasing depths, but that to M. Cordier the credit is due of collecting together these isolated cases, adding, moreover, many of his own, and showing, in a remarkable work published in 1827, that all tend to establish as a general fact, and consequently as a law of nature, that the temperature of the crust of

* Soft arenaceous beds, which constitute the middle tertiaries of Switzerland, generally composed of incoherent greenish sandstone.

† This is in such remarkable accord with recent reports from Crossness, that we add the paragraph in the original :—

"Nous devons mentionner encore une odeur fétide et fortement sulfureuse, qui fut observée dans la couche de marne jaune mêlée de molasse située à la profondeur de 280 pieds (298 feet), c'est-à-dire à peu-près au niveau du lac ; et la présence d'un grain du sel dans de la molasse située à la même profondeur. Cette odeur sulfureuse s'est de nouveau manifestée à la profondeur d'environ 600 pieds (639 ft.), sans que la présence d'aucun composé sulfureux ait pu servir à nous expliquer son origine."

the earth rises the deeper we penetrate towards its centre. Since its publication (*i.e.*, between 1827 and 1834) it has been further confirmed by other observations. Although, however, we have found as a universal fact a rise of temperature with depth, we are far from finding a uniform increase. M. de la Rive, therefore, enters into details as to the class of observations upon which M. Cordier had had to rely, namely, observations of the temperature of springs and rivers where they sprung suddenly from the earth at various depths, and of the air in mines and caves in the earth. He then points out the many circumstances necessarily masking true results by either method—such as the mixture of rain and surface water with subterranean streamlets and the uncertainty that their temperature at the outlet is identical with that at their source. In support whereof he quotes three instances where the rise is 1° in 37 feet, 1° in 64 feet, and 1° in 22 feet; the discordance of these results is sufficient evidence of the uncertainty of observations of that class; the other type of experiments are not less subject to error, among the principal of which are the circulation of beds of air of differing temperatures and the heat developed in mines by the labourers and by the necessary illumination. M. Cordier himself drew attention to the errors necessarily caused by air currents in the main shaft and also those produced by the ventilation of the mines; he endeavoured to avoid them in the observations he himself made, by making most of them in coal mines, because the coal is so rapidly extracted that the face of the rock has not time to lose its true temperature, moreover, he was able in a few minutes to bore a hole 20 or 30 inches deep and place his thermometer therein, yet it is not certain but that the friction of the bore, and the inevitable introduction of the air of the workings into the hole, may have vitiated these results. M. de la Rive then proceeds to show how vastly superior are the results obtainable from the boring under notice, that none of the previously mentioned sources of error can exist, that as the bore is so nearly full of water no air currents can exist, the bore is so small in diameter that the water it contains must be identical in temperature with the surrounding strata, and lastly, that the absence of an artesian supply frees the results from the complexities introduced by a current of water from an unknown depth. In short, this bore is simply a hole, just large enough to allow a thermometer to be lowered for the determination of the temperature at various depths. Perhaps some may think that currents of water would prevail in the bore and vitiate the results, but though it is not improbable this may be the case for 100 or 150 feet, it certainly is not at greater depths, for the water becomes so muddy currents could not exist, in fact, towards the bottom it is more properly very wet earth than water. We may, therefore, consider each observation as strictly representing the temperature of the strata at the respective depths; besides our mode of observation must have placed considerable difficulty in the way of any such currents as we have referred to. The thermometer was placed in a close cylinder of such a diameter that its exterior surface

was in immediate contact with the soil surrounding the bore, and must, therefore, at the end of a certain time, have been in thermometrical equilibrium with it. A further proof of the accuracy of the results is afforded by the fact that identical readings were obtained at similar depths, whatever the total depth of the bore might be, and whether its bottom was 100, 200, or 300 feet below the thermometer.

Having thus insisted on the special advantages of the class of observation under consideration, we must describe the details of our experiments.

We first tried a thermometer whose bulb was coated with various non-conducting materials, so that by lowering the thermometer to a certain depth, leaving it there for a considerable time and then withdrawing it rapidly, we might bring up the exact temperature; this plan answers very well for depths not exceeding 300 feet, but beyond that the diameter of the bore precludes our using a sufficient thickness of non-conducting material to effect our purpose, and the thermometer changes before it can be brought to the surface. We were, therefore, compelled to have recourse to maximum thermometers, but as it was impossible to avoid jolting we could not use ordinary index thermometers; we endeavoured to substitute that of M. Bellani, in which the index is of steel pushed through a column of alcohol by one of mercury and retained by a hair which acts as a spring. Eventually M. Artaria constructed for us some large mercurial thermometers, with steel indices so arranged that they could be pushed up into the empty part of the tube by the mercury and yet would remain there in spite of considerable shaking. We also tried, towards the end of our experiments, a maximum thermometer of M. Bellani, constructed on an entirely different principle, and on which shaking could have no possible effect. A small ball of mercury placed in the middle of a column of alcohol indicated by its position the quantity of alcohol which had left the column, and, therefore, the maximum temperature.

The perfect agreement between all these instruments, whether employed simultaneously or successively, leaves no room for doubt as to the accuracy of the results we have arrived at; we have rejected all those where there was any lack of coincidence or suspicion of error, as in our first attempts when the indices occasionally became deranged.

In order to protect the thermometers in their passage we at first enclosed them in a tin case, but the pressure of the water broke both the case and the thermometers; we then had a strong copper one made and it was further protected by a case nearly three feet long, of which we have already said the diameter was nearly equal to that of the bore tube, and being intended to bring to the surface the fragments of soil detached in its descent and also to penetrate through the mud to the very bottom of the bore, was terminated by a borer, and also provided, near its lower extremity, with a valve opening upwards to retain the dislodged fragments. This case was screwed on to the boring rods, for the bore being only lined for a portion of its length, it would have been impossible to make it sink by its own weight or to raise it merely by a cord,

The first observations which we made with this apparatus were at those slight depths which we had previously examined by the insulated thermometer already described; they were utterly discordant, and eventually we were led to the detection of the error, by noticing that when drawn up the large cylinder was never quite full either of water or earth but that there was always air in it. From this it appeared evident that this was air, which, at the instant the cylinder entered the water could not escape, developed under continually increasing pressure an increase of temperature which raised the thermometer. In order to test the accuracy of this explanation we sent the cylinder down as quickly as possible, and found a proportionate increase of temperature. Once detected, the error was immediately removed by piercing the top of the cylinder with holes.

It is, therefore, to be understood that for depths of less than 200 feet we have the insulated thermometer agreeing with the two forms of maximum when the latter are in the pierced cylinder (the two latter agreeing at all depths) and on different occasions. The following tables give an abstract of the results:—

TABLE I.

TABLE II.

Depth.	Abstract of observations made with the thermometer in the pierced cylinder.		Erroneous observations made by placing the thermometer in the closed cylinder
	1st series.	2nd series.	
feet.	deg.	deg.	deg.
32	50·9	...	...
64	51·1	...	...
107	51·8	51·6	53·2
151	...	52·4	...
160	52·7	...	55·0
203	...	...	55·4
213	53·4	53·2	...
245	...	...	56·6
266	54·5	54·7	...
288	...	...	57·5
320	55·6	55·5	...
330	...	...	59·0
352	...	55·9	...
373	56·5	56·5	...
394	...	56·8	...
416	..	...	61·0
426	57·6	57·3	..
458	...	57·9	62·3
480	58·4	58·3	...
512	...	...	64·2
533	59·5	59·6	...
544	...	...	66·2
554	...	...	67·2
586	60·4	60·5	70·3
639	...	61·5	...
640	61·4	..	71·7
693	62·4	62·6	...
725	63·0	...	...

Before proceeding to consider these results we must premise (1) that the thermometers were left at each depth such a time as experience had convinced us was necessary for them to take up the true temperature of the strata, (2) that we ascertained by various trials that no perceptible rise of temperature was produced by friction in raising and lowering the instruments.

The results indicated by Table I are, briefly, that starting from a depth of 107 feet below the surface, at which the temperature is $51^{\circ}7$, the increase of temperature down to 725 feet follows a uniform and perfectly regular progression, and that it amounts to 1° for every 54.4 ft. The distinguishing feature of the results is their wonderful uniformity throughout the whole depth, instead of the sudden and irregular rises we have seen in other cases. Is not this result due to the mode of observation, which enables us to avoid the ordinary sources of error, and does it not, therefore, prove that the progression which follows the increase of temperature as we penetrate deeper into the earth is really subject to a regular law and independent of locality?

It will probably be noticed that the lowest temperature is at the surface of the water 32 feet below the ground, viz., $50^{\circ}9$, we have never had it so low as $49^{\circ}6$, which is the mean temperature of our locality and which we ought to have found at a depth of about 50 feet, if we had been in the solid earth. This result is probably produced by currents in the upper, limpid, parts of the water, but no such currents can exist in other parts of the water column, because the water ceases to be clear and changes into a mud in which they cannot exist, so that their influence ceases at about 100 feet. In concluding this notice we may be permitted to remark that they are the first of the kind ever made on a comprehensive scale in our country.

M. de la Rive next devotes one or two pages to magnetic observations, in which he explains that while two sets of identical needles were prepared and placed for equal times under similar circumstances, depth only excepted, those sunk to the bottom of the tube were, on withdrawal, always found more powerfully magnetised than those left at the top. We may add here a remark concerning the boring rods, which in 16 feet lengths screwed one into another formed virtually a solid bar 727 feet long, and which, from their long continued vertical position, had acquired a powerful magnetism, but this was so distributed that each length presented an opposite pole at each extremity, and what is most singular, each two rods though screwed one into another, preserved their own polarity as if entirely separate, so that one passed (at their junction) suddenly from one pole to the other. The free ends underwent no change when the rods were separated. We think those rods which penetrated deepest were most powerfully magnetised, and that those in the middle were less so even than the uppermost ones. M. de la Rive concludes his able paper by expressing his regret that the small diameter of the bore prevented his further prosecuting this branch of investigation.

REVIEWS.

Meteorological Tables for Smyrna. Lat. 38° 26' 10" N., Lon. 27° 10' 15" E. By E. PURSER, M.A., M.I.C.E. 1864-1867. Quarto sheets, privately printed.

THESE interesting tables have been long waiting that notice to which their importance entitles them. In the first place, we may remark that the observations are taken at the Smyrna station of the Smyrna and Aidin railway, at the head of the Gulf of Smyrna, and about 300 yards from the sea-shore. The ground is nearly level therewith. The barometer is a mercurial standard. The readings are taken at noon, and are printed uncorrected either for height (25 ft.) above sea, for temperature, or index error. We give them as in the originals, and approximately corrected for temperature and altitude. The rain gauge appears to be on the station roof, as it is "without lateral shelter, 38 ft. above the ground, and 45 ft. above the sea."

Months.	BAROMETER AT NOON.							RAIN			
	1864.		1865.		1866.		Mean.	1864.	1865	1866	1867
	Uncor- rected.	Reducd. to 32deg and sea level	Uncor- rected.	Reducd. to 32deg and sea level.	Uncor- rected.	Reducd. to 32deg and sea level.	Reducd. to 32deg and sea level.				
Jan. ...	30·220	30·205	29·964	29·912	30·136	30·105	30·074	3·29	6·47	1·30	2·43
Feb. ...	30·101	30·049	29·787	29·747	30·066	30·014	29·937	1·43	8·26	1·68	2·94
March.	29·942	29·863	29·892	29·823	29·986	29·914	29·868	·54	4·03	1·69	1·06
April..	29·856	29·792	30·102	30·031	30·037	29·952	29·925	3·45	1·32	·20	·37
May ...	29·942	29·850	30·020	29·925	29·977	29·878	29·884	1·49	·23	·95	1·27
June... July ...	29·906 29·885	29·783 29·758	29·886 29·910	29·772 29·784	29·911 29·843	29·795 29·706	29·783 29·749	·74 2·40	·34 ·10	·63 ·13	·67 0·00
Aug... Sept..	29·921 30·001	29·798 29·889	29·898 30·065	29·768 29·959	29·852 29·960	29·722 29·840	29·763 29·896	·50 3·00	0·00 0·00	·06 ·39	0·00 0·00
Oct. ... Nov ... Dec....	30·002 30·000 30·068	29·912 29·933 30·027	30·036 30·098 30·174	29·928 30·034 30·141	30·100 30·053 30·079	30·015 29·994 30·040	29·952 29·987 30·069	3·21 6·20 1·39	1·17 2·47 ·10	·08 3·54 3·61	1·44 5·26 6·48
Total..	29·987	29·905	29·986	29·902	30·000	29·914	29·907	27·64	24·49	14·26	21·92

It is interesting to compare Buchan's Isobars for the locality of Smyrna with the above observations :—

	Buchan's in.	Observed. in.	Difference. in.
January.....	30·13	30·07	—0·06
July	29·85	29·75	—0·10
Year	29·97	29·91	—0·06
„ (according to Schow)..	30·04	29·91	—0·13

The accordance of the above shows the advancing accuracy of meteorology, and leaves it quite a question whether the computed or

* In printed table 29·688 ; the minimum being 29·812, the reading has been conjecturally altered as above.

observed values are the more correct. In addition to the particulars given above, the following remarks are worth notice :—

“1864 was remarkable for the great amount of summer rain, 11·58 in. for the six months, April—September. An unusually heavy storm of hail and rain on July 1st gave 2·40 in.

“1865: the rainfall 3·15 less than 1864, but the rainfall of the six winter months—October, 1864—March, 1865, was 29·56, considered unprecedented, exceeding that of the corresponding period of 1863-64 by 20·95, and that of 1865-66 by 21·76 in.

“1866: rainfall 10·23 less than in 1865.

“1867: the summer rain, April—September, was below the average, and the rain of the last two months was in excess. On the night of January 22nd, 2·24 in. fell.”

The thermometric observations appear to have been made with considerable care. The instruments are said to be exposed to “free circulation of air, but shaded from sun and wind and lateral radiation;” the solar radiation thermometer was in a vacuum jacket; the depth of water in the well was 7 ft., and the sea observations were taken at a depth of 22 ft. The following are the principal results :—

Year.	TEMPERATURE IN SHADE.										IN SUN.		
	Mean max.	Mean min.	Mean.	Absolute max.		Absolute min.		NOON.				Mean max.	Absolute max.
				Date.	Deg.	Date.	Deg.	Mean dry.	Mean wet.	Temp. of well.	Temp. of sea.		
1864	Deg. 73·6	Deg. 52·8	Deg. 63·2	Date. July 14	Deg. 100·5	Date. Jan. 16	Deg. 25·0	Deg. 69·6	Deg. 59·7	Deg. ...	Deg. ...	Deg. 109·3	Deg. 137·0
1865	74·7	53·0	63·8	July 26	100·5	Dec. 31	27·5	70·5	61·1	64·5	65·2	109·9	134·5
1866	75·8	51·2	63·5	July 26	102·5	Jan. 9	24·0	71·0	62·4	...	...	111·9	138·0
1867	..	...	...	..	...	Jan. 9	25·0	...	..	...	..	...	...

LUNAR AND SOLAR INFLUENCE ON THE WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—The average rainfall at Greenwich for the period between the 28th of May and the 28th of July is about 4·50 in. The quantity registered there during the corresponding period of the present year was 1·29 in, which is more than 70 per cent. below the average of 54 years.

From the latter part of May to the middle of July the rainfall was least in Ireland and greatest in the Eastern Counties. Now, supposing the law I gave to apply to England and Ireland generally, this is precisely what should have occurred; for in the latter part of May the moon was 13 degrees west of the meridian of Greenwich when she reached perigee. In the present month the moon will be about 9 deg. east of our meridian when she reaches perigee; it will, therefore, be interesting to observe if there is a corresponding reversal of the rainfall distribution.

Perhaps I ought to have stated in my letter of May, that lunar perigee occurred near our meridian on the 5th of March, 1868. This was a little earlier than the limit given in the rule, but probably the

occurrence inclined the weather to drought. I ought also to have mentioned that there are other causes of great drought. Your correspondent, Mr. Stow, would not then have misunderstood me. Great heat has a tendency to produce drought, though drought does not always produce heat. The principle of uniformity with regard to the moon's positions near the equator (in December, January, April, or May) appears to cause a high summer temperature, and in that way to influence the rainfall. For instance, on the 20th April, 1868, the moon at midnight was $0^{\circ} 45'$ north of the equator, and on the 3rd of May, she was $0^{\circ} 46'$ south of the equator at the same time (midnight). The period of great heat and drought which set in about the end of April appears to have been caused, at least in part, by this uniformity. The instances that have occurred since 1766 are rare, but in every case great heat and drought accompanied the lunar phenomena. 1788, 1800, 1807-8, 1813, 1826, 1842, 1859, and 1868 were the *only* years in which this particular lunar uniformity occurred, and each year gave us a summer of great heat and drought. In 1846, 1857, 1859, and 1868 another kind of lunar uniformity occurred, and those years also gave us intense heat and much dry weather.—I am, &c.,

G. D. BRUMHAM.

To the Editor of the Meteorological Magazine.

SIR,—Referring to Mr. Brumham's letter, p. 56 of the *Meteorological Magazine*—May was very wet, especially last half; in June, 0.70 in. of rain fell in ten days; in July, 0.61 in. fell in ten days. Does this sustain the law alluded to in Mr. Brumham's letter?—Yours, &c.,

H. B. C.

Fartown, Huddersfield, Aug. 1st, 1869.

SIR,—I am sorry that my letter on Mr. Brumham's Lunar and Solar Theories of the Weather should have seemed to you to "trench upon the personal;" but I must admit, on re-perusing it in print, that the tone of the last paragraph but one does, to a certain extent, lay me open to your strictures, though I cannot think that it is quite fair to describe it as *personal*. My letter was written amidst the pressure of other engagements, or I should have probably expunged or modified the offending paragraph before sending it.

At the same time, I see no reason to recede from the main position of my letter, viz., that meteorological science has not yet reached that stage when predictions can be safely ventured on for periods of more than a few days beforehand, and that theories of weather prediction founded on a calculation of the positions of the heavenly bodies, though no doubt possessing a certain fascination of their own, are more likely to divert attention from more fruitful lines of investigation than to lead to any valuable results. I should be the last person in the world to wish to stifle free discussion of any kind, but when a theory can be shown on the very face of it to be *self-contradictory*, like this of Mr. Brumham's, *the same combination of the heavenly bodies frequently coinciding with opposite kinds of weather on the same*

meridian and at the same time, I cannot think any useful result can be gained by discussing it. I will only add, that the allusion to Zadkiel was simply suggested by the similarity of his methods of weather prediction to the theories put forward by Mr. Brumham, and was not intended to be taken as a personal reflection on that gentleman or on yourself, though I did think it a pity that your pages should be devoted to investigations which seemed to me so illusory.

I cannot expect you to find room for this letter, having already occupied too much of your space of late, but you are at liberty to make any use of it you like. I should be sorry that an incautious expression of mine should be the means of importing anything of an acrimonious nature into the discussions in your columns, which have been, hitherto, so free from anything of the kind.—Yours truly,

Nuthall, June 23rd.

GEORGE T. RYVES.

[The immense benefit which even an approximate knowledge of future weather would confer, induces us to welcome Mr. Brumham's communications. At the same time, there must be a limit to everything; we think that by the insertion of the preceding letters we have balanced the discussion, and that for the present the subject must drop. In reply to the letter of H. B. C., we may state that Mr. Brumham said (p. 59) that "a long period (that is, nearly a month or more) of deficient rainfall should commence, if it has not already commenced, in the latter part of May." At Camden Town the fall from May 28th to July 26th (59 days) was 1.22 in., being considerably less than half the average. We think that is very like accurate fulfilment. Mr. Brumham further said: "Fine weather for harvest must set in (if it has not already set in) a few days after the 9th of August, and for a long period the weather should be chiefly dry in these parts." *Nous verrons.*—Ed.]

ERRONEOUS MINIMUM TEMPERATURE.

To the Editor of the Meteorological Magazine.

SIR,—In the table of temperatures at p. 93 of your Magazine for June, the min. temp. at Bury St. Edmund's appears as 24°, on the 16th of June. Can that be correct? The min. at Greenwich on the same day was 43°·6, and here 45°.—Your obedient servant,

D. A. FREEMAN.

Upper Tooting, S.W., 17th July, 1869.

[We must plead guilty to carelessness in passing the figures quoted by Mr. Freeman. The reading is obviously incorrect; it arose from the usual cause—the evaporation of the spirit, and its condensation in the upper part of the tube. Its detection when there, and its dislodgement (*i. e.*, the restoration of the thermometer by merely swinging it sharply, bulb downwards) have been referred to over and over again, but the present is another proof that the commonest rules of thermometer management cannot be too often repeated. We regret having been led into printing an erroneous return, but if the detection and notification of the error induces observers to watch their spirit thermometers closely, the good may outweigh the evil we regret.—Ed.]

JULY, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which $\frac{1}{4}$ or more fell.	Max.		Min.		
				Dpth.	Date.		Deg.	Date.	Deg.	Date.	
		inches	inches.	in.							
I.	Camden Town	·62	- 1·17	·38	28	5	91·0	22	47·5	29	0
II.	Staplehurst (Linton Park) ...	·32	- 1·66	·15	13	3	89·0	12*	46·0	14	0
III.	Selborne (The Wakes).....	·97	- 1·23	·41	28	4	83·5	17	42·5	11||	0
III.	Hitchen	·60	- 1·30	·53	28	3	85·0	22	46·0	28	0
IV.	Banbury	·34	- 1·72	·12	31	6	86·0	18†	41·0	29	0
IV.	Bury St. Edmunds (Culford).	·46	- 1·53	·25	28	2	86·0	18	...	...	0
V.	Bridport	·41	- 1·70	·13	28	7	81·0	18	42·0	10¶	0
V.	Barnstaple	·90	- 1·96	·36	31	8	...	...	...	...	0
V.	Bodmin	·96	- 2·15	·33	25	10	79·0	17	48·0	3	0
VI.	Cirencester .....	...	...	...	...	...	...	...	...	...	...
VI.	Shifnall (Haughton Hall) ...	·72	- 1·45	·33	26	8	84·0	18	44·0	3	0
VI.	Tenbury (Orleton)	1·00	- 1·38	·38	31	10	89·4	18	38·3	1	0
VII.	Leicester (Wigston)	1·13	- ·97	·43	27	6	93·0	17	42·0	13	0
VII.	Boston	·76	- 1·54	·33	28	6	90·7	22	47·0	29	0
VII.	Grimsby (Killingholme)	·49	...	·20	5	7	82·0	22	45·0	1	0
VII.	Derby.....	·65	- 1·54	·29	27	6	85·0	22	44·0	1	0
VIII.	Manchester	1·13	- 1·56	·35	26	8	89·5	17	45·0	28||	0
IX.	York	1·35	- ·59	·68	6	10	83·0	16	44·0	1**	0
IX.	Skipton (Arncliffe)	1·59	- 1·64	·68	27	7	81·0	19	35·0	1	...
X.	North Shields	·77	- 1·04	·27	26	6	78·8	16	45·2	1	0
X.	Borrowdale (Seathwaite).....	8·30	+ ·16	3·53	31	15	...	...	...	...	...
XI.	Cardiff (Town Hall).....	·89	...	·36	25	7	...	...	...	...	...
XI.	Haverfordwest	2·38	- ·92	1·07	29	8	84·2	17	41·0	27	...
XI.	Rhayader (Cefnfaes).....	·82	- 2·03	·50	26	6	81·0	18‡	40·0	...	...
XI.	Llandudno.....	·50	- 1·79	·32	28	6	82·8	17	41·6	13	...
XI.	Dumfries	1·20	- 1·25	·43	29	9	85·0	17	44·5	29	0
XI.	Hawick (Silverbut Hall).....	·58	...	·18	5	6	...	...	...	...	...
XIV.	Ayr (Auchendrane House) ...	2·39	+ ·23	·42	28	14	78·0	17	42·0	1	0
XV.	Castle Toward	4·01	+ ·87	1·04	29	15	79·0	17	39·0	28	0
XVI.	Leven (Nookton)	1·31	- ·96	·40	29	11	78·0	21	43·0	29	0
XVI.	Stirling (Deanston)	2·19	- 1·21	·52	29	10	77·8	17	37·5	28	0
XVI.	Logierait	1·48	...	·47	29	10	...	...	...	...	...
XVII.	Ballater	·59	...	·15	29	13	79·0	20	34·0	29	0
XVII.	Aberdeen	·94	...	·37	31	11	80·2	21	45·3	1	0
XVIII.	Inverness (Culloden)	·44	...	·18	27	12	74·6	21	48·9	20	0
XVIII.	Fort William .....	...	...	...	...	...	...	...	...	...	...
XVIII.	Portree .....	...	...	...	...	...	...	...	...	...	...
XVIII.	Loch Broom	2·46	...	·50	14	19	...	...	...	...	...
XIX.	Helmsdale	1·09	...	·19	13	16	...	...	...	...	...
XIX.	Sandwick	3·20	+ 1·31	·60	24	19	69·0	8	48·0	19	...
XX.	Cork	2·07	...	·55	25	13	...	...	...	...	...
XX.	Waterford	1·22	- 2·09	·37	25	8	82·0	19	50·0	13	...
XX.	Killaloe	2·80	- ·39	·52	25	15	84·5	20	33·0	11	0
XXI.	Portarlington	1·57	- 1·97	·39	25	14	81·0	16	47·0	12	...
XXI.	Monkstown .....	...	...	...	...	...	...	...	...	...	...
XXII.	Galway	3·87	...	·64	31	15	80·0	2	51·0	5dys	...
XXII.	Bunninadden (Doo Castle) ...	2·23	...	·38	24	17	77·0	3	38·0	27	0
XXIII.	Bawnboy (Owendoon)	2·27	...	·42	29	14	89·0	16	44·0	27**	0
XXIII.	Waringstown	1·56	...	·34	28	11	87·0	16	45·0	19	0
XXIII.	Strabane (Leckpatrick)	3·09	...	·48	3	19	81·5	17§	38·0	1	0

* And 16th. † And 22nd. ‡ And 19th. § And 20th. || And 29th. ¶ And 11th. ** And 28th
 † Shows that the fall was above the average; - that it was below it.

METEOROLOGICAL NOTES ON THE MONTH.

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 dry month, the middle of it often hot; the first and last weeks not so much so; no T; wind mostly S. Bar. high and generally steady; small fall of R, only fell on 13th, 23rd and 29th; the ground very dry and cracking. Harvest not early, everything being so late at the beginning of the month.

SELBORNE, (THE WAKES).—The summer remarkable for the absence of T in this neighbourhood. Had my rain gauge been a few hundred yards to the E. on the 13th June, I should have recorded less than 2·00 in. in the two months; on that day a violent storm of R reached The Wakes, but extended no further eastward; T at 5 p.m. on the 12th July. Rye cut on 22nd, and oats on 23rd.

CULFORD.—See note as to erroneous thermometer, p. 109.

BRIDPORT.—Very fine, dry, and warm month. Harvest just begun at the end of the month.

BODMIN.—The drought has been severely felt here, and the rivers are even lower than they were last year.

SHIFFNAL.—The wind, so long in N. and N.E, changed on the 4th to S.W., when a decided improvement took place in vegetation, but the crops want R after the small supply of last month; a welcome R on 26th, but not enough to reach the roots of the plants; honey dew abundant on trees on 5th; mulberry blossoms, which were abundant, all dropped off on 7th; scarcely a white butterfly seen, and only one wasps' nest found up to the 21st; suddenly cold on 26th.

ORLETON.—Generally cloudy and cool, but dry till the 9th, then very fine, hot and dry to the 25th, when the pastures were very brown and the root crops languishing; after that date light showers every day; the total rainfall only one inch, of which more than one-third fell on the 31st; T heard on 23rd and 26th; temp. about 2°·5 above the average of the month.

WIGSTON.—Temp. above the mean, rainfall below it.

KILLINGHOLME.—Bar. high and steady throughout the month. Abundant crops of excellent hay secured in prime condition; R much needed; the crops of wheat and beans very promising; the pastures having had a good start in spring, have withstood the drought better than might have been expected; wheat generally in flower on the 10th; a little T on 18th; TS at 9 p.m. on 26th, lightning vivid but not near.

DERBY.—Temp. of July about 2° above the mean for July of the past 7 years, and 5° below that of July, 1868; the highest reading in the shade was 85°, against 92° last July; solar radiation 122°, against 135°. The amount of rainfall of June and July together amounted only to 2·06 in., 5·36 in. being the mean of 21 years. Hay all carried, and the most abundant crop ever known.

MANCHESTER.—T and L on 26th.

ARNcliffe.—The early part of the month unusually dry, and of high temp. Up to the 26th little more than half an inch of R.

NORTH SHIELDS.—TS on 26th, T on 25th, and T and L on 28th.

WALES.

HAVERFORDWEST.—A very fine, warm month; temp. above the average; drought very much felt; great scarcity of water, and vegetation entirely burnt up, many parts of the country looking like bare red or yellow rock; R, long wished for, came on the 25th, too late, I fear, to save the turnip crop; every prospect of an early harvest; oats cut on 24th.

CEFNFAES.—A dry, hot month, with much wind, generally S.E.; hay crops light, and fruit and vegetables very scarce.

LLANDUDNO.—Dense fog over the sea on 1st, from 11 a.m. to 12.30, and again at 7.30 p.m.; frequently hazy during the first half of month.

SCOTLAND.

DUMFRIES.—This month very droughty during first week; some R in the

second week, then hot and dry till the 25th, and the rest of the month showery ; pastures burnt up, oats very short of straw ; harvest commenced with oats on 25th ; turnips looking well. Rainfall 1.41 in. below the average ; the drought this year has been more severe in this district than it was last, the rainfall in the spring having been less ; the rainfall in the first seven months of last year was 21.02 in., while in the same period this year it was only 15.65 in., being a decrease of 5.37 in.

HAWICK.—A most remarkably dry and warm month ; pastures nearly burnt up ; the hay crop bulks heavily, and has been got in in splendid condition ; turnips threaten to turn out a failure ; potatoes are small, but as yet clear of disease. Gardener and husbandman are alike crying out for R ; there were one or two claps of T on the 28th, the only T heard here during June and July. Fruit trees, &c., suffered much from the severe storm of wind on the 7th.

AUCHENDRANE.—River very low ; crops suffered from the drought up to the 22nd ; the rains at the end of the month saved our turnip crop ; T and L, but not heavy, on the 5th, 23rd, and 31st.

CASTLE TOWARD.—This month has been mild, with showers and sunshine, so that crops of all kinds are now all that could be desired. A plant of the yucca gloriosa, 7 ft. high, has at present several hundreds of full-blown flowers, and there is also in the same border a strong plant of lillian giganthemum, with 10 large flowers ; both plants are rare to be seen in flower. Mushrooms very abundant.

NOOKTON.—Fine to the 5th, then rather cloudy to 16th, again fine to 23rd, and thence showery to the close.

DEANSTON.—Very dry and parched from the beginning of the month to the 7th, when some R fell ; from 10th to 24th very hot and dry ; distant T and L on evening of 22nd.

LOGHERAIT.—Great heat with much drought ; hay well secured, but not heavy ; corn crops have a fair appearance, and potatoes and turnips look well.

BALLATER.—A dry, warm month throughout, although the max. temp. was not high ; rainfall much below the average, and vegetation consequently suffering.

ABERDEEN.—A very warm, dry, quiet month ; crops looking well on the whole ; bar. 29.49 on 6th, and 30.32 on 11th ; fog on 17th, 18th, and 21st, the latter being the hottest day this year. Strange TS at noon on 31st, T and L distant, for 15 minutes heavy R and ground white with H, for remaining 10 minutes still heavy R but sun shining brightly through it ; during the R the wind veered from S.W. to N.W., N., N.E., E., and round to S.W., blowing fiercely for a few minutes ; R very partial, not any falling 3 miles S. or 12 miles N.

LOCHBROOM.—This has been a beautiful month here, just plenty of both sunshine, and R, and warmth sufficient to make the crops in this district to be considered the best in the north.

SANDWICK.—July has been wet and warm, the R being much above the average ; there were gales of 40 miles per hour on the 6th and 12th, but the copious R and warmth had done much to correct the drought and cold of the previous months, and vegetation has been luxuriant.

I R E L A N D.

DOO CASTLE.—From 1st to 23rd close and oppressive ; cattle suffering from excessive heat and want of water ; crops, except in favoured situations, not progressing ; caterpillars have commenced their ravages on the cabbage tribe ; latter part of month showery.

OWENDOON.—The cattle, the green crops, and the grass are beginning to suffer from the great drought which prevailed till the 21st ; even last year this country did not seem so much burnt up.

WARINGSTOWN.—Fine, bright, and warm ; small rainfall ; T and L on 22nd and 28th.

LECKPATRICK.—Fine month ; plenty of R during the last ten days ; great growth of turnip crop ; harvest will be at least three weeks later than last year.

NOTE.

The concluding portions of "The Indications of the Sky," and of the "Review of the Report of the Tyneside Naturalists' Club," are unavoidably postponed.

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THE BRITISH ASSOCIATION AT EXETER.

ALTHOUGH our expressed hope, that the meteorologists of Exeter would set an example to those "of other cities of the mode of preparing, discussing, and supporting meteorology at the British Association meetings in years to come," has not been fulfilled, we do not think we should be using too strong a phrase if we said that meteorology was very fairly represented in Exeter.

Following our practice in the preceding volume, we annex a list of those present who have more or less contributed to the progress of that branch of science to which these pages are devoted. It will be seen that the number is somewhat in excess of those present at Norwich.

Adams, Prof., F.R.S.	Cambridge.	Main, Rev. R., F.R.S. ...	Oxford.
Amery, F.	Ashburton.	Mann, R. J., M.D.	London.
Atkinson, A. O.	Hull.	Newton, Prof. H. A.,	Newhaven, U.S.
Bateman, J. F., F.R.S.,	C. E. London.	Osler, A. F., F.R.S.	Birmingham
Beardman, N., C.E.	„	Parfitt, E.	Exeter.
Belcher, Admiral Sir E.	„	Pengelly, W., F.R.S.	Torquay.
Birt, W. R., F.R.A.S. ...	„	Phillips, Prof., F.R.S. ..	Oxford.
Brady, A.	„	Robinson, Rev. Dr.,	F.R.S. Armagh.
Brooke, C., F.R.S.	„	Rylands, T. G.	Warrington.
Curley, T.	Hereford.	Shapter, T., M.D. ..	Exeter.
Dymond, E. E.	Wellington.	Smelt, Rev. M. A.	Cheltenham.
Ellacomb, Rev. H. T.,	Clyst St. George	Smith, A.	Scilly Isles.
Ellis, A. J., F.R.S.	London.	Stark, J., M.D.	Edinburgh.
Ellis, W. H.	Exeter.	Stewart, Balfour, F.R.S. ...	Kew
Field, R., C.E.	London.	Stokes, H.	Tiverton.
Fox, G.	Kingsbridge.	Strange, Col., F.R.S.	London.
Gamlen, W. H.	Exeter.	Symons, G. J.	„
Glaisher, J., F.R.S.	Blackheath.	Talmage, C. G.	Leyton.
Heberden, Rev. W.	Honiton.	Tuckwell, Rev. W.	Taunton.
Horner, Rev. J. H.	Frome.	Vivian, E.	Torquay.
Howlett, F., M. A.,	F.R.A.S. Beckenham.	White, Rev. H. Masters.	Rotherham.
Liddell, Capt., R.N.	Bodmin.	Whitley, N.	Turo.
Lowe, E. J., F.R.S.	Nottingham.	Woodward, C. J.	Birmingham.

The report of the Kew Committee, unlike all other reports, is not submitted to any of the Sections, but to the Council of the Association, and is by them passed on to the General Committee, hence it obtains priority of notice. We regret to find from it that the Kew Committee are yearly doing less for meteorology, their attention being devoted to magnetic and photoheliographic work, with a sole but important ex-

ception, viz., the verification of instruments. This action of the Kew Committee need cause neither surprise nor regret—it is in fact the natural result of the action of Government and the Royal Society in organizing the Meteorological Committee, and making Kew *their* central observatory.

REPORT OF THE KEW COMMITTEE OF THE BRITISH ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE FOR 1868-69.

THE Committee of the Kew Observatory submit to the Council of the British Association the following statement of their proceedings during the past year :—

The nature and amount of assistance to be rendered by this Committee to the Meteorological Committee of the Royal Society have now been clearly defined, and the duties undertaken at Kew Observatory may, as in the last Report, for clearness sake, be again considered under the two following heads :—

(A) The work done under the direction of the British Association.

(B) That done at Kew as the Central Observatory of the Meteorological Committee.

This system of division will be adopted in this Report, and it has been thought desirable, for the information of the Association, in the financial statement hereto appended, to include the sums received from the Meteorological Committee as well as those received from the British Association. It will thus be clearly seen that the work done at Kew for the Meteorological Committee has been paid for from funds supplied by that Committee, and not in any way from money subscribed by the British Association.

(A) WORK DONE BY KEW OBSERVATORY UNDER THE DIRECTION OF THE
BRITISH ASSOCIATION.

1. *Magnetic work.*—The Self-recording Magnetographs ordered by the Mauritius Government for Mr. Meldrum, after having been verified at Kew, have been forwarded to their destination.

A Unifilar and Dip-circle for Mr. Meldrum have likewise been verified.

A Unifilar and Dip-circle have been repaired and verified for the Rev. M. Colombel, who has gone to Nankin, where he intends making magnetical observations.

M. Colombel, as well as M. Berg, of the Wilna Observatory, have received magnetical instruction at Kew.

A Dip-circle is in the course of being verified for Lieut. Elagin, of the Russian Navy.

The usual monthly absolute determinations of the magnetic elements continue to be made by Mr. Whipple, magnetic Assistant. During the last year it has been found necessary to replace the wooden pillars of the magnetic house with pillars of Portland stone, which had been previously ascertained to be non-magnetic. It has also been found necessary slightly to repair the Unifilar and Dip-circle hitherto used in these monthly determinations.

The Self-recording Magnetographs are in constant operation as heretofore, also under the charge of Mr. Whipple, and the photographic department connected with these instruments remains under the charge of Mr. Page.

The task of tabulating and reducing the magnetic curves produced at Kew subsequent to January, 1865, is in progress under the direction of Mr. Stewart. Considerable advance has been made in these reductions during the present year, and it is hoped that during the next session of the Royal Society a paper may be communicated to that body by Mr. Stewart, giving certain results of these reductions as well as results of the absolute magnetic observations made every month.

Lieut. Elagin has communicated through Mr. Stewart to the Royal Society an account of observations made at the various European observatories, by means of a Dip-circle, which had been lent to him from the Kew Observatory.

Mr. Stewart has likewise communicated to the Royal Society a short paper by Senhor Capello, "On the reappearance of certain periods of Declination-disturbance during two, three, or several days;" also a joint paper by the Rev. W.

Sidgreaves and himself, embodying the results of a preliminary comparison of the Kew and Stonyhurst declination-curves; also a paper embodying the magnetical results obtained by Lieut. Rokeby at the island of Ascension, reduced by Mr. Whipple, magnetical assistant at Kew. Finally, Mr. Stewart has communicated to the Royal Society a paper containing a preliminary discussion of the peaks and hollows of the Kew magnetic curves for the first two years during which the Magnetographs were in operation.

2. *Meteorological work.*—The meteorological work of the Observatory continues in the charge of Mr. Baker.

Since the Norwich Meeting, 157 Barometers have been verified, and 27 have been rejected; 1153 thermometers have been verified, and 24 have been rejected. Two Standard Thermometers have been constructed for the Standards' Commission,* one for Stonyhurst College and one for Professor Tait. 38 Hydrometers have likewise been verified.

The progressive nature of this department of the Kew work will be seen by the following statement of the numbers of Barometers and Thermometers verified during the last few years :—

	Barometers.	Thermometers.
1863-4	97	389
1864-5	88	420
1865-6	126	395
1866-7	89	608
1867-8	78	1139
1868-9	157	1153

The self-recording meteorological instruments now at work at Kew will be again mentioned in the second division of this Report. These are in the charge of Mr. Baker, the photography being superintended by Mr. Page.

A Self-recording Barograph verified at Kew for Messrs. R. & J. Beck, has been disposed of by these opticians to Mr. Meldrum, of the Mauritius Observatory. A Barograph and Thermograph have been verified at Kew and dispatched to Mr. Ellery, at Melbourne, and a Barograph has recently been verified for Mr. Smalley, of Sydney.

At the request of Mr. G. J. Symons, the old Kew Thermometer frame has been lent to him for certain experiments, which are being carried on by him in conjunction with the Rev. C. H. Griffith, at Strathfield Turgiss.

The attention of meteorologists is directed towards an instrument devised by Mr. Beckley, mechanical assistant at Kew, for the purpose of registering the rainfall automatically. A description of this instrument will be submitted to the Association at Exeter.

Attention is likewise directed to a paper to be communicated by Mr. Balfour Stewart to the Association at the Exeter meeting, entitled "Remarks on Meteorological Reductions, with especial reference to the Element of Vapour;" separate copies of which will be at the disposal of members.

The following revised fees are charged for the verification of meteorological instruments at Kew :—

	s.	d.
Barometers (requiring index and capacity-corrections)	10	0
Ditto (not requiring capacity-correction—inches measured)	5	0
Thermometers (ordinary).....	1	0
Boiling-point Thermometers	2	6
Hydrometers	1	0

3. *Photoheliograph.*—The Kew Heliograph, in charge of Mr. De La Rue, continues to be worked in a satisfactory manner. During the past year 274 negatives have been taken on 168 days: 40 pictures of the Pagoda in Kew Gardens, as a fixed terrestrial object at a known distance, have likewise been taken, with the object of determining, by measurements of these pictures, which

* While this Report is being printed, an application has been received from the Warden of the Standards, through Lieut.-Gen. Sir Edward Sabine, for an Air Thermometer.

are taken in different parts of the field of the telescope, both the optical distortion of the sun-pictures and the angular diameter of the Sun.

A paper communicated to the Royal Society by Messrs. Warren De La Rue, Stewart, and Loewy, entitled "Researches on Solar Physics.—Heliographical Positions and Areas of Sun-spots observed with the Kew Photoheliograph during the years 1862 and 1863," is the first of the series of reductions of the photographic solar records; it is in the course of publication in the 'Transactions,' and will shortly be distributed.

It is hoped that, during next winter, a paper containing the heliographical positions and areas of the spots observed at Kew during the years 1864, 1865, and 1866 may be communicated to the Royal Society, as well as a paper representing, both numerically and graphically, the spotted area of the sun during three complete solar periods, the results being partly derived from Schwabe's and partly from Carrington's observations, in addition to those made with the Kew photoheliograph.

Another paper by the above authors, entitled "Account of some Recent Observations on Sun-spots made at the Kew Observatory," has likewise been ordered to be published in the 'Philosophical Transactions.'

M. Berg, of the Wilna Observatory, has during the past year received instruction at Kew in the method of taking Solar Photographs and in that of measuring the positions and areas of sun-spots, the Director of the Observatory with which he is connected being desirous of working along with Kew, and of following out the same methods of observation as well as the same researches.

The number of sun spots recorded after the manner of Hofrath Schwabe, together with a table exhibiting the monthly groups observed at Dessau and at Kew for the year 1868, have been communicated to the Astronomical Society, and published in their monthly notices.

We regret to mention that Hofrath Schwabe, owing to his great age, has found it necessary to discontinue his observations; but the Committee have satisfaction in stating that arrangements have been made for continuing at Kew, the grouping of sun-observations which has been carried on for some time according to Hofrath Schwabe's plan, and for publishing the results annually.

A minute comparison of the records of Hofrath Schwabe with the simultaneous photographic records at Kew has revealed the great trustworthiness of his drawings, which are at present in the possession of Kew Observatory. The proposed communication already alluded to as representing the spotted area of the sun during three complete solar periods is thus rendered possible; and while it is imagined that by this means a valuable record of the past will be obtained, it is hoped that the interest now displayed in solar research will secure the uninterrupted continuance of such a record for the future.

4. *Miscellaneous work.*—The Superintendent has recently received a grant of £60 from the Government-Grant Committee of the Royal Society for the purpose of continuing certain experiments by Prof. Tait and himself on the rotation of a disc *in vacuo*; and means are in progress for obtaining a nearly perfect vacuum, Mr. Beckley, mechanical assistant at Kew, having devised an apparatus for this purpose.

An account of preliminary observations made with Kater's pendulum by the Superintendent, in conjunction with Mr. B. Loewy, has been communicated to the Royal Society.

The instrument devised by Mr. Broun for the purpose of estimating the magnetic dip by means of soft iron, constructed at the expense of the British Association, remains at present at the Observatory awaiting Mr. Broun's return to England.

The Observatory was honoured on June 25th by a visit from the eminent French chemist, M. Dumas, permanent Secretary of the Imperial Academy of Sciences, Paris, accompanied by M. Hervé-Mangon.

(B) WORK DONE AT KEW AS THE CENTRAL OBSERVATORY OF THE
METEOROLOGICAL COMMITTEE.

The relation between the two Committees, the Kew and the Meteorological, has during the last year been definitely settled.

The Kew Committee have undertaken to maintain the self-recording instruments belonging to the Meteorological Committee in regular operation at Kew, to tabulate from the traces, and to forward the traces and tabulations once a month to the central office of the Meteorological Committee in London, where they will be finally reduced, under the supervision of the Director of that office. They have also sanctioned the employment of such assistance by Mr. Stewart as may be necessary to enable him to examine the records which arrive from the various outlying observatories of the Meteorological Committee, in accordance with a plan which has been approved by that body. Once a week, therefore, documents from these various observatories arrive at Kew, and about the middle of each month the documents for all the observatories (including Kew) for the previous month, after having been well examined, are forwarded to the Meteorological Office with a few remarks, which are printed in the Minutes of the Meteorological Committee.

Besides these duties which they have undertaken, the Kew Committee are glad to render the Meteorological Committee any occasional assistance which it may be in their power to bestow.

1. *Work done at Kew as one of the Observatories of the Meteorological Committee.* This consists in keeping in constant operation the Barograph, Thermograph, and Anemograph furnished by the Meteorological Committee. Mr. Baker is in charge of these instruments. From the first two of these instruments traces in duplicate are obtained, one set being sent to the Meteorological Office and one retained at Kew; as regards the Anemograph, the original records are sent, while a copy by hand of these on tracing-paper is retained. The tabulations from the curves of the Kew instruments are made by Messrs. Baker, Page, and Foster.

2. *Verification of Records.*—In order to maintain uniformity in the system of observation at the various meteorological observatories, it is arranged by the Meteorological Committee that Mr. Stewart shall personally visit all the observatories once every year, in addition to which, when necessary, some one of the Kew assistants will occasionally visit particular stations with a specific object in view. At the request of the Meteorological Committee, a system of checks has been devised by the Kew Committee for testing the accuracy of the observations made at the different Observatories. This system with slight modifications, is now in operation. As this revision takes place at Kew, it has been found necessary to engage an additional assistant for the purpose of undertaking it. Mr. Rigby has been engaged for this duty—Mr. Baker, Meteorological Assistant, having the general superintendence of this department.

3. *Occasional Assistance.*—In addition to devising the system of checks mentioned above, the Kew Committee have also, at the request of the Meteorological Committee, examined the subject of instrumental verifications, and it has been found that, owing to improved construction, a higher standard of excellence in meteorological instruments may be insisted upon without rejecting more than a very small per-centage of those furnished by good makers.

It has therefore been resolved by the Meteorological Committee that in future the following limits of error shall be allowed in the construction of their instruments.

Marine Barometers of the pattern adopted by the Meteorological Office.—Reject all for which the index-error at the ordinary pressure is greater than $\cdot 015$ inch, or the capacity-error greater than $\cdot 004$ inch, or for which the mercury does not fall from $1\frac{1}{2}$ inch to $\frac{1}{2}$ inch above the present pressure in a time between 3 and 6 minutes. But for *barometers purporting to be standards*, reject all for which the index error at the ordinary pressure is greater than $\cdot 010$ inch.

Thermometers (graduated on the stem) of the pattern adopted by the Meteorological Office.—Reject all in which the largest error at any point is greater than $0^{\circ}\cdot 3$, or in which any space of 10° is more than $0^{\circ}\cdot 3$ wrong.

Hydrometers of the pattern adopted by the Meteorological Office.—Reject all in which the largest error at any point is greater than 1 division of the scale (equal to $\cdot 001$ sp. gr.), or in which any space of 10 divisions is more than $0\cdot 6$ division wrong.

Models of Pantagraphic Apparatus, designed by Mr. Galton, have been made and experimentally used at Kew, at the desire of the Meteorological Committee,

to reduce the tracings of the self-registering instruments in any desired proportions, either in length or in breadth, with a view to the ultimate publication by that Committee of all the tracings supplied by the seven Observatories in a compact volume.

It may also be mentioned, under the head of Occasional Assistance, that at the request of the Meteorological Committee, Mr. Beckley, mechanical assistant, was sent to Armagh to examine the Barograph there, and to Sandwick Manse, Orkney, to superintend the erection of an anemometer. The expenses have, on both these occasions, been repaid by the Meteorological Committee.

In conclusion, the Kew Committee desire to bring under the notice of the British Association, that the system of automatic records established and in actual work at the Kew Observatory, comprehends magnetic, barometric, and thermometric observations, as well as those of the direction and velocity of the wind, to which an electric self-recording instrument will soon be added. They think that it would be very advantageous to magnetical and meteorological science if a fully illustrated work were published descriptive of these instruments, and of the method of working them, together with the method of reductions actually employed.

J. P. GASSIOT, *Chairman.*

Kew Observatory, 15th July, 1869.

UNDERGROUND TEMPERATURE.

Mr. G. J. Symons was called upon to read the "Report of the Committee on Underground Temperatures." He stated that he was only one of the members of the committee, but the duty of reading the report fell on him in consequence of the absence of the chairman, Professor Sir William Thomson, and of the secretary, Professor Everett, of Belfast. The report set forth that the committee had tried experiments on underground temperatures at Glasgow, Dundee, and wherever they could get access to very deep wells or borings in the earth. But the chief experiments had been tried in a well made many years ago at Kentish Town by a company formed for the purpose of supplying the district with water. The total depth in this instance was 1,302 feet, 540 feet of which consisted of a bricked well, and the remainder of a boring lined with thin sheet iron. The well was made first, but as the people in the neighbourhood complained of the hardness of the water, the boring was done, the result being that the supply of water fell off, and the company ruined itself after spending £100,000 on the works. The committee had obtained the use of the old well, and fitted up winding apparatus in a hut above it, to let specially-constructed thermometers up and down in the boring. The general result of the experiments hitherto made was to prove an increase of temperature of one degree for every 52·4 feet increase in depth.

Mr. S. J. Mackie, F.G.S., said that he thought the theory of the internal fluidity of the globe to be untenable. Yet if the increase in temperature mentioned by Mr. Symons continued the same at all depths, at about 450 miles below the surface of the earth, the temperature must be equal to that of the surface of the sun. From diagrams on the wall he noticed that the increase of temperature only became regular after the bricked portion of the well was passed and the boring reached. He thought that perhaps the conduction of the iron tube would tend to equalize the temperature, and that if the sides of the

boring had been rock, irregularities in temperature would have been recorded.

Mr. Symons said that the iron tube was thin—only about one-tenth of an inch in thickness, and 8 inches in diameter. It would be a good plan to sink a short length of such a tube in the ground, and to find out whether its conduction of heat influenced the results.

(To be continued.)

SUDDEN FALL OF TEMPERATURE.

THE very rapid change which occurred towards the end of August ought not to pass without notice ; we therefore insert with pleasure a few of the statements we have received. Our readers will find many others in our usual monthly table.

To the Editor of the Meteorological Magazine.

SIR,—We have had a great wave of heat in these parts, followed by a wave of cold.

	max.	min.		max.	min.
August 23...	72·5	53·0	August 28 ...	86·5	64·5
„ 24 ..	70·5	50·0	„ 29 ...	70·0	63·0
„ 25...	80·0	52·5	„ 30 ...	65·0	55·0
„ 26...	85·0	58·0	„ 31 ...	—	43·0
„ 27...	87·0	64·0			

On Sunday, 29th, we had a change of wind from nearly due East to N.W., thence to N., N.E., and E. In less than 24 hours, the wind, which had been coming from the E. as over a heated sand plain, came in from the same quarter as if over an ice field. Our highest temperature in 1868 was only 85°.—Yours, &c.,

I. H. GOSSET.

Northam Vicarage, Bideford, N. Devon, August 31st, 1869.

To the Editor of the Meteorological Magazine.

SIR,—The following is the amount of rainfall which fell at Sellack, near Ross, Herefordshire, in August, 1869 :—August 1st, ·09 ; 3rd, ·30 ; 4th, ·11 ; 8th, ·43 ; 13th, ·07 ; therefore, an appreciable amount fell on only 5 days, and the total fall amounted to 1·00 inch.

A “period of drought” may be said to have commenced on the 9th, (the very day, by the way, on which, or about which, a dry period should have set in according to Mr. Brumham’s prediction in the *Meteorological Magazine* of May last), and since the 13th not a drop of rain has fallen in this neighbourhood.

The past month has been characterized by the absence of thunder and lightning. It is singular that in the month of December last we should have had, at this locality, six days of thunder and lightning, while in the whole three summer months of June, July, and August of the present year I have only noticed thunder on three days, and then extremely distant.

A very remarkable fluctuation of temperature took place on the 28th and 29th. On the 27th (the hottest day of the summer here), my thermometer at 4 ft. rose to 88° in the shade, and on the 28th to

86°·5, only falling to 66° at night. On the morning of the 29th, at 5 a.m., a dense cloud-bank arose in the east, with a fresh E.N.E. breeze, and the thermometer went down, by noon on that day, to 57°, and yesterday morning to 44°·5—a most extraordinary fall in so short a space of time, especially as being unaccompanied (here) by any fall of rain or storm of any description. A fall of the barometer of ·23 in. immediately preceded the change.

Here, as elsewhere, we have been visited by a remarkable swarm of lady-birds; wasps, of which I noticed singularly few in the earlier months, are now unusually numerous.

W. CLEMENT LEY.

Sellack, Hereford.

To the Editor of the Times.

SIR,—On Saturday last the highest shade temperature was exactly 90°; lowest, 53°.

Last night the mercury sank to the freezing point (32°), having during the day risen not higher than 57°.

My instruments hang on a Glaisher stand, and are, I believe, perfectly accurate.—I have the honour to remain, Sir, your obedient servant,

J. BORLASE TIBBITS.

Barton Seagrave, Kettering, Aug. 31.

To the Editor of the Times.

SIR,—The weather here has been unusually hot, and yesterday (Saturday), the 28th, the thermometer reached 94°·6 in the shade, and 110°·2 in sunshine. On the 27th the temperature was 93°·7 in the shade, and 119°·1 in the sun.

Yesterday the temperature at 8.30 p.m. was as high as 75°·7, and at 11 p.m. 70°. Wind, S.S.E.; sky cloudless.

To-day there has been a great diminution of heat. At 12.30 a.m. temperature 64°·3, at 7 a.m. 55°·8, 9 a.m. 58°·0, noon 60°·2, 11 p.m. 52°·1, greatest heat 60°·8, which is 33°·8 lower than that of yesterday. Sky overcast, and the wind N.E. and brisk.

No rain has fallen since the 13th inst.—I have the honour to be, Sir, your obedient servant,

E. J. LOWE.

Highfield House Observatory, August 29.

To the Editor of the Meteorological Magazine.

SIR,—The weather since I have been here has been so extraordinary, that I send a note of it.

	Max.	Min.	Range.	Max. in Sun.
Aug. 24th	78·5	.....	—	..... 133·0
„ 25th ...	86·0	..... 49·5	..... 36·5	..... 130·0
„ 26th	91·1	..... 45·8	..... 45·3	..... 130·0
„ 27th	85·8	..... 53·0	..... 32·8	..... 121·0
„ 28th	88·2	..... 53·7	..... 34·5	..... 123·2
„ 29th	52·0	..... 50·0	..... 2·0	..... 59·5
„ 30th .....	.....	.....	.....	.....
„ 31st	69·0	..... 32·3	..... 36·7	..... 114·8

On the 28th, at 3 p.m., 88°; on the 29th, at 3 p.m., 48°; fall in one day, 40°. The heat on the 26th (91°·1) was 1°·1 higher than the

maximum for last year; the min. on the 31st (32°·3) was lower than I have ever recorded it in August.—Yours, &c.,

F. W. STOW.

Ripon, August, 1869.

To the Editor of the Meteorological Magazine.

SIR,—I send you five days temperatures, as they are rather extraordinary.

DATE.	Max. 4ft. in shade.	Min. on grass	Black Bulb on Grass.	B. Bulb in vacuo, 4 ft.	REMARKS.
August 27 ...	82	50	88	116	80° in shade at 5.30 p.m.
„ 28 ...	89	51	104	134	77° in shade at 9 a.m.
„ 29 ...	69	51	62	69	
„ 30 ...	59	38	70	105	
„ 31 ..	64·5	30	74·5	98	White frost.

Taken at 9 p.m., except min. on grass. Thermometers verified at Kew, but corrections not applied. Max. temp. entered against 29th, occurred at 9 p.m. on 28th.

H. B. C.

Fartown, Huddersfield, August 31, 1869.

To the Editor of the Meteorological Magazine.

SIR,—On the four days mentioned below, my thermometer in shade stood as follows, at 2 p.m. :—

August 26th, 87°

August 28th, 84°

„ 27th, 88°

„ 29th, 52°

Yours respectfully,

P. P. PENNANT.

Brynbell, St. Asaph, Sept. 3rd, 1869.

To the Editor of the Meteorological Magazine.

SIR,—On the 28th of last month the thermometer (not verified) reached a greater height than I ever before knew, 85°. At 2 p.m. a slight E. wind came on, and quickly cooled the air considerably; but it continued very hot till 7 p.m., when a brisk N.W. breeze sprang up, and about 8 p.m. it changed to N., and grew stronger, making it quite cool. The max. on the 29th was only 55°.—Yours truly,

T. W. BACKHOUSE.

West Hendon House, Sunderland, Sept. 2nd, 1869.

To the Editor of the Meteorological Magazine.

SIR,—On the 28th of August last the thermometer stood at 86°·5 in the shade, and on the 29th the maximum was only 52°.

SAMUEL MORRIS.

Norwood Cottage, Casterton, Kirkby Lonsdale.

HEAVY FALL OF RAIN AT GELDESTON, JULY 18TH.

To the Editor of the Meteorological Magazine.

SIR,—There was a very unusual fall of rain here yesterday (Sunday, July 18th); it began a little after 4.30 p.m., and was quite over at

6.15 p.m. There was 1.64 inches in the gauge at 6.30, none of which had fallen before 4.30. It was accompanied by almost incessant thunder and very vivid lightning. Two trees were struck about three-quarters of a mile from here, and at Beccles damage was done to houses and trees. The roads are very much cut up, and several cottages were partially flooded with the quantity of mud and water which rushed into them off the roads, and which, in one instance at least, penetrated into every room on the ground floor, and was deep enough to set small articles afloat. There was not much hail here, but at Beccles some large pieces of ice fell, two of which were immediately taken into a shop and weighed, when each was found to be three-quarters of an ounce in weight. The storm was so violent that no one seems to recollect one equal to it hanging over this parish. The barometer fell very gradually from 30.37 (corrected) at which it stood at 9 a.m. on Thursday, 15th, to 30.12 on Sunday, at 9 p.m.; since then it has risen again to 30.18 this morning, Monday, at 9 a.m.

Yours, &c.,

M. DOWSON.

Geldeston, Beccles, July 19, 1869.

A HAIL STORM.

To the Editor of the Meteorological Magazine.

SIR,—I send you a slip from the *Queensland Times*, perhaps some of your correspondents can match, or even cap, this tale.

Yours &c.,

R. D. BLACKMORE.

“As an instance of the extraordinary size of the hailstones which fell during the storm of Thursday week past, we may mention that a carrier named Hutton, who was coming into town with his team, had one of his horses struck in the forehead with a hailstone, which felled him to the ground as if struck by a bullet. His owner was compelled to leave him lying insensible while he got the remainder of his team safe to town. On the following day the horse was hunted up by Hutton, when it was found that his skull was broken, and he died on the third day after. This is the only instance we have ever heard of where hailstones fell of sufficient weight to break a horse's skull. Fortunately the stones did not fall very thickly, or nothing could have stood before them. The full weight of the storm was felt west and south of the town, and much damage was done by it. Many farmers have had their corn and other growing crops completely ruined, and at Lyndhurst three acres of grapes were almost destroyed. Incredible as it may seem, we have been assured by many who reside in the directions mentioned that the hailstones fell the size of ordinary pine-apples, some of them measuring from nine to eleven inches in circumference.”—*Queensland Times*, Feb. 4th, 1869.

TYNESIDE RAINFALL.

As we expected, the differences between the values printed in *British Rainfall* and in the *Tyneside Report* prove mainly due to indistinct writing, and neglect of decimal points. The following

tabular statement has been drawn up, after reference to the observers concerned, one of whom, however, has not replied to our enquiries. The following are all the cases of differences previously unexplained:—

Station.	Date.	Tyneside Report.	British Rainfall.	Correct Amount.
Sedgefield.....	1868, November	2·21	2·11	2·11
Seaham Hall.	„ February.	0·73	0·63	0·63
Otterburn..	„ August....	3·00	2·00	3·00
„	„ December.	5·51	5·10	5·10
Greta Bridge.	„ January..	3·22	3·21	...
„	„ April . . .	3·29	3·19	...
„	„ May.....	1·10	1·01	...

Consequently, the values for Sedgefield and Seaham Hall are correctly given in *British Rainfall*, but Otterburn should be 33·64 instead of 32·64. We hope the trouble these errors give to all parties will induce observers to be very careful in keeping their books clearly and distinctly written if they desire able and industrious men, like Mr. Wheeler, to devote time to tabulating and publishing their observations. It is quite enough that he should have the trouble of working up the returns, it is too much that, through illegibility, his work should be doubled and its value impaired.

DROUGHT IN THE WEST OF SCOTLAND.

The past summer has been an unusually dry one in the West of Scotland, and in consequence several of the towns on the estuary of the Clyde are beginning to suffer from want of sufficient water. In Greenock—where the rainfall from the 1st of March to the present date has been less than 13in., or about half the usual quantity—the supply has been reduced to about 34 days for domestic purposes, and it has been resolved, at very considerable inconvenience to trade, to discontinue the supply to the chief public works, and to limit the quantity given to private consumers. At Dumbarton and other places a similar scarcity prevails. As yet there is no prospect of rain in the district.—*The Times*.

A FIERY WIND.

Out in Cheatham county about noon on Wednesday—a remarkably hot day—on the farm of Ed. Sharp, five miles from Ashland, a sort of whirlwind came along over the neighbouring woods, taking up small branches and leaves of trees and burning them in a sort of flaming cylinder that travelled at the rate of about five miles an hour, developing size as it travelled. It passed directly over the spot where a team of horses were feeding and singed their manes and tails up to the roots; it then swept towards the house, taking a stack of hay in its course. It seemed to increase in heat as it went, and by the time it reached the house it immediately fired the shingles from end to end of the building, so that in ten minutes the whole dwelling was wrapped in flames. The tall column of travelling caloric then continued its course

over a wheat field that had been recently cradled, setting fire to all the stacks that happened to be in its course. Passing from the field, its path lay over a stretch of woods which reached the river. The green leaves on the trees were crisped to a cinder for a breadth of 20 yards, in a straight line to the Cumberland. When the "pillar of fire" reached the water, it suddenly changed its route down the river, raising a column of steam which went up to the clouds for about half-a-mile, when it finally died out. Not less than 200 people witnessed this strangest of strange phenomena, and all of them tell substantially the same story about it. The farmer, Sharp, was left houseless by the devouring element, and his two horses were so affected that no good is expected to be got out of them in future. Several withered trees in the woods through which it passed were set on fire, and continue burning still.—*Nashville (Tennessee) Press.*

A TOWN DESTROYED BY A HURRICANE.

The *St. Lawrence Journal* gives the following account of a terrible hurricane which happened recently in that neighbourhood:—Messrs. Thomas Thompson and S. N. Beman, who reached this city on July 28th from the West, inform us that they stopped at Detroit, a small town about six miles east of Abilene, on the Kansas Pacific road, and about nine o'clock the storm burst upon that devoted village in all its fury. The thunder and lightning were terrific, and the wind swept past, a perfect hurricane. The station is known on the railroad map as Lamb's Point, but a town had just started up which was named Detroit. Every house in the village, with one exception, was entirely destroyed. Furniture, bed, and bedding were scattered over the prairie and lost and destroyed. Fortunately no one received serious injury, within the knowledge of our informants, although a number were slightly injured. People were compelled to stand out on the prairie after the buildings were blown away, and endure the terrors of the hurricane and the pitiless pelting of the rain and hail. Only two families had secured anything like a shelter from the storm, and one of these did so by taking refuge in a cellar after the building had been demolished, and by this means secured a partial shelter from the fury of the elements. Those in the tents fared better than those in houses. Although the tents blew down, yet they fell upon the occupants, and thus saved them from a severe pelting. In many cases the corn has been completely riddled by the hail, and wheat that had been harvested and shocked in the field was scattered in every direction. Telegraph poles were blown down, the wires lying on the ground. The hurricane struck the fated village from the north-west, and the work of destruction was quick and terrible. It is, indeed, a miracle that no lives were lost, or more serious results followed such a storm; and, as it is, we may yet hear of the loss of life from other places near by.—*York Herald.*

August 28th, 1869.

AUGUST, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which ≥ 0.1 or more fell.	Max.		Min.		
				Dpth	Date		Deg.	Date.	Deg.	Date	
		inches	inches.	in.							
I.	Camden Town	1.26	— .38	.28	3	8	89.0	28	42.0	31	0
II.	Staplehurst (Linton Park) ...	1.16	— 1.55	.34	3	10	88.0	28	45.0	31	0
III.	Selborne (The Wakes).....	1.49	— 1.69	.35	3	9	83.0	26*	34.4	31	1
IV.	Hitchen .....	.87	— 1.48	.43	3	8	80.0	27+	38.0	30§	0
V.	Banbury .....	.91	— 1.22	.33	7	11	85.0	27	33.0	31	0
VI.	Bury St. Edmunds (Culford)...	2.25	— .19	.60	7	15	83.0	28	32.0	3	2
VII.	Bridport .....	.25	— 2.19	.12	12	3	86.0	27	40.0	12	0
VIII.	Barnstaple	1.43	— 2.76	.53	13	10	89.0	27+	51.0	30	...
IX.	Bodmin .....	.78	— 3.08	.22	12	10	84.0	26	42.0	31	0
X.	Cirencester	1.51	— 1.33	.85	4	4	...	...	...	...	...
XI.	Shifhall (Haughton Hall) ...	1.41	— 1.46	.36	7	10	79.0	27+	37.0	31	1
XII.	Tenbury (Orleton)	1.20	— 1.68	.36	7	7	89.5	28	31.2	31	1
XIII.	Leicester (Wigston)	1.21	— .98	.30	7	10	95.0	28	31.0	30	1
XIV.	Boston	1.57	— .72	.68	7	10	85.8	27	39.0	31	0
XV.	Grimsby (Killingholme)	2.32	...	.62	9	11	81.0	28	40.0	31	1
XVI.	Derby .....	.99	— 1.61	.25	7, 12	11	86.0	28	36.0	31	1
XVII.	Manchester	2.63	— .87	.81	7	10	...	...	...	...	0
XVIII.	York	1.66	— 1.05	.52	7	14	85.0	28	37.0	31	0
XIX.	Skipton (Arneliffe)	2.48	— 3.46	.67	7	10	91.0	29	30.0	31	1
XX.	North Shields	1.29	— 1.56	.32	2	9	81.0	28	40.3	31	0
XXI.	Borrowdale (Seathwaite).....	4.51	— 9.57	1.59	8	16	...	...	...	...	...
XXII.	Cardiff (Town Hall).....	1.38	...	.43	12	8	...	...	...	...	...
XXIII.	Haverfordwest	2.20	— 2.68	1.00	12	6	84.5	26	37.0	30	...
XXIV.	Rhayader (Cefnfaes).....	1.49	— 3.17	.52	1	7	86.0	...	33.0	...	...
XXV.	Llandudno	1.66	— 4.28	.95	7	9	85.2	27	44.0	31	...
XXVI.	Dumfries .....	.86	— 3.02	.32	3	8	84.5	27	36.0	30	1
XXVII.	Hawick (Silverbut Hall) ...	1.01	...	.34	3	9	...	...	...	...	2
XXVIII.	Ayr (Auchendrane House) ...	1.47	— 2.49	.41	7	10	74.0	25*	28.0	30	1
XXIX.	Castle Toward	1.18	— 5.12	.45	2	6	79.0	28	29.0	30	2
XXX.	Leven (Nookton) .....	.86	— 2.13	.27	13	11	83.0	28	33.0	30	0
XXXI.	Stirling (Deanston) .....	.76	— 3.87	.18	1, 12	8	79.8	28	25.7	30	2
XXXII.	Logierait .....	.88	...	.25	1	9	...	...	...	...	...
XXXIII.	Ballater	1.68	...	.51	1	11	80.0	25	29.5	30	1
XXXIV.	Aberdeen	1.33	...	.57	7	10	81.5	25	36.9	30	1
XXXV.	Inverness (Culloden)	1.49	...	.35	2	13	69.4	25	41.6	30	0
XXXVI.	Fort William .....	...	...	...	...	...	...	...	...	...	...
XXXVII.	Portree	4.01	— 3.44	.87	6	18	...	...	...	...	...
XXXVIII.	Loch Broom	1.74	...	.91	9	16	...	...	...	...	...
XXXIX.	Helmsdale	1.84	...	.65	7	16	...	...	...	...	...
XL.	Sandwick	2.37	— 1.34	.50	6	23	64.1	25	42.8	13	...
XLI.	Cork .....	.87	...	.42	12	7	...	...	...	...	...
XLII.	Waterford	1.22	— 2.73	.80	12	5	81.0	27	46.0	31	...
XLIII.	Killaloe	1.02	— 3.91	.30	12	12	86.0	28	39.0	12§	0
XLIV.	Portarlington	1.23	— 3.27	.26	30	12	83.5	28	37.0	30	...
XLV.	Monkstown	1.23	— 1.98	.22	13	10	...	...	...	...	...
XLVI.	Galway	1.47	...	.26	2	11	84.0	28	38.0	30	...
XLVII.	Bunninadden (Doo Castle) ...	1.34	...	.54	2	13	81.0	28	29.0	31	2
XLVIII.	Bawnboy (Owendoon)	1.24	...	.41	3	9	92.0	28	41.0	19||	0
XLIX.	Waringstown	1.88	...	.36	1	8	83.0	26	31.0	29	1
L.	Strabane (Leekpatrick)	1.68	...	.36	1	13	78.0	27	29.0	30	1

* And 27th. + And 28th. † And 28th & 29th. § And 31st. || And 30th.
 + Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON THE MONTH.

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 fourteen days showery, but no heavy R, the remainder quite dry; very hot from the 20th to the 28th; distant T on night of 5th, and L on night of 11th; bar. high and steady the latter part of the month, the winds N.E. and E. during that time. On the whole, a dry favourable month for the harvest, which, however, is late; the last two days much cooler.

SELBORNE.—The weather during the month extremely favourable for the harvest, which has been got in in excellent order. Faint T heard at 4 p.m. on 1st, 5 p.m. on 3rd, and on the 14th; bar. 29·84 without the slightest variation during the five days, 19th to 23rd; average max. temp., five days, 24th to 28th, 81°; dense fog on 28th; frost on the ground on the 31st; wheat harvest began in some places on the 6th, harvest general on the 9th.

CULFORD.—T on 5th; very hot from the 25th to the 29th, when a sudden change took place, max. temp. being, on 28th, 83°, and on the 29th only 61°; on the 3rd the temp. fell to 32°, and on the 30th to 33°, and on each occasion ice was found on the grass, &c.

BRIDPORT.—Harvest entirely completed in the neighbourhood with a fair average crop; a good deal of sea fog early in the month, otherwise very fine, and cloudless sky on several days.

BODMIN.—The drought is most severely felt, and the streams are not more than one-third the size of a summer average.

CIRENCESTER.—The rains saved the turnips from destruction, but the intense dryness and great heat of the last week must have suspended their growth as it has that of grass; temp. 84° on 28th, on 29th about 60°, and on 31st ice on the grass.

SHIFFNAL.—The month began with genial showers, which lasted almost daily to the 14th, when the dry weather again set in and continued through the month. The harvest was well secured, the R being sufficient to refresh the grass and turnips without in the least injuring the grain; about the 20th vast numbers of lady-birds appeared, which did great service by clearing off the aphides which greatly infested vegetation, and also the American blight on the apple trees; they were the seven-spot species chiefly, but all *yellow*, with few exceptions, instead of bright red as they were in the early year. The heat of the 27th and 28th most oppressive; a sudden change on the 29th with a strong N.E. wind; slight ice on the morning of the 31st, when the potatoes were cut down, though the ther. was not near freezing point; a difference of 20° between the max. temp. of the 28th and 30th.

ORLETON.—A fine harvest month; cool till the 21st, when it became very hot and brilliant with four days of cloudless sky; on the 28th, ther. in shade 89°·5; on 29th, cloudy sky, with cold N.E. wind and a fall in max. temp. of nearly 29°; on the morning of the 31st a severe frost on grass 28°·2, which cut down the tender plants and flowers and the potatoe tops; pastures very brown for want of R; T heard on 1st at 4.30 p.m., but no L seen.

WIGSTON.—An unusually dry month; the mean of the max. of the seven days ending on the 28th was 87°·3, the max. on 28th was 95°, that on the 29th, 60°; French beans, potatoes, dahlias, &c., were cut off by the frost of the 29th.

GRIMSBY.—High bar.; very refreshing rains in the former half of the month, which helped to fill the ears of corn and revive the pastures; the latter half dry, splendid harvest weather; hot from the 23rd to 28th, on the last named day the temp. was 81° in the shade; a great change followed, the max. temp. of the 29th being 58° and the 30th the same; rooks wheeling aloft, and "playing at football" on the 28th, seemed to foretell the atmospheric change that was impending. Rime on the morning of the 31st; distant T on the 1st; TS on 4th at 4 p.m., when a foal was killed, another TS at 6.30 p.m. on 10th; high tide in the Humber on 10th; first wheat cut in this parish on the 13th, the general harvest began on the 16th; much gossamer on 20th, 27th, and 28th. Distant L on 5th.

DERBY.—The paucity of R and high temp. of a portion of the month have

favourably influenced the harvest operations, which in this neighbourhood are nearly finished; the pastures present a dreary aspect, and gardens are parched up; the temp. of the month was $1\frac{1}{2}^{\circ}$ above the mean, but it was 1° below August, 1868; on the 28th it rose to 86° , and the highest point reached on the 29th was 59° . A severe ground frost on the night of the 30th, doing some damage.

ARNcliffe.—Unusually dry after the 7th.

NORTH SHIELDS.—Rainbow on night of the 1st; T on the 2nd.

W A L E S.

HAVERFORDWEST.—The month commenced cool, with northerly air, and wet up to the 12th; after which the weather was fine, continuing cool with N.E. wind till the 22nd; up to that date the ther. did not once reach 70° in the shade; from that time the heat daily increased, until it reached a higher point than on any day either in this or last summer. Very splendid harvest weather, remarkably clear sky, with some very cold nights and heavy dews; water remarkably low everywhere.

CEFNFAES.—Generally hot and dry; prevailing wind N.W.; grain harvest good; average crops of barley and wheat, oats indifferent and very short in straw; a premature autumn, trees and hedges losing their foliage; want of water severely felt.

LLANDUDNO.—Commenced cutting barley and peas on the 1st, wheat cut on the 9th, oats on the 16th; a thick haze on the hills at 7 p.m. on 25th; hazy over the sea on the 26th; hazy on 27th; L on 27th at 8.45; shooting stars on 27th; on Saturday, the 28th, the temp. was $80^{\circ}\cdot4$ at 9 a.m., and on 29th, 59° , a difference of $21^{\circ}\cdot4$ in 24 hours.

S C O T L A N D.

DUMFRIES.—There were refreshing showers the first half of the month, but the latter half was very droughty; streams very low, and water scarce; the rainfall more than 3.00 below the average of previous five years; the max. temp. $2^{\circ}\cdot65$ higher than in August, 1868, but the min. $5^{\circ}\cdot47$ less, and the mean of day and night $2^{\circ}\cdot82$ lower. Harvest nearly concluded by the end of the month; wheat excellent, oats and barley rather light; potatoes blackened by frost on 30th and 31st, and turnips suffering from mildew.

HAWICK.—The rains at the beginning of the month saved the turnip crop from destruction, and although they look as if they were in want of R, no fears are now entertained of their safety. Traces of slight frost were seen in the flower border on the morning of the 7th; keen frost on the 29th and 30th, which blackened the potatoe tops, dahlias, and other tender flowers. The month has been very dry and warm, and everything is now suffering from lack of moisture.

AUCHENDRANE.—The drought continues very severe; no remembrance of the springs, locks, and rivers in this district having been so low for so long a time; many of the mills almost entirely stopped, and many of the towns usually well supplied by their existing water works are now nearly without water, such as Greenock, &c., where the mean rainfall is usually very large. Fine weather for harvesting; great heat from 22nd to 28th, and very cold during the night and early morning of 30th, when the exposed ther. on grass fell to 24° .

CASTLE TOWARD.—A month of fine harvest weather; grain crops about all cut, and are now being secured in good condition. Springs are again very low, but grass quite fresh. The low temp. at night and great heat during the day for a week past is causing mildew on roses, peaches, late peas and sweetish turnips.

DEANSTON.—Exceedingly dry month, very bright and warm; T on 1st; severe frost, $25^{\circ}\cdot7$ during the night of 29th; potatoe leaves cut down to the ground, and many flowering plants ruined for the season; great want of water felt in the neighbourhood.

LOGIERAIT.—The light rainfall of the month was almost wholly confined to its commencement. With a deficient rainfall since February, the ground is in a very dry condition, and the crops light, but fine harvest weather; keen frost on the night of the 26th, which completely blackened the potatoe crops.

BALLATER.—The first half of the month rather wet; from the 14th to the end only 0.10 in. fell; grass much burnt up, and turnips suffering from want of moisture. A very violent gale during the night of the 10th; highest temp. of the season on 25th; a sharp frost on morning of the 30th, potatoe stems blighted.

ABERDEEN.—A fine harvest month, but too dry for the grass and green crops, both of which are suffering; the temp. would have been below the average, but for the remarkable heat from the 20th to the 28th, but particularly 24th to 28th; sudden fall of temp. on the 28th, a fall of 27° between noon and 9 p.m.; 25th hottest day (but one) during 13 years.

PORTREE.—This month has been a very dry August for this part of the country; although dark, dull, and generally very foggy, which has been the means of spreading the potatoe disease with great rapidity, the harvest has just commenced, and the crops are extremely heavy. A fine lunar rainbow at 8.30 p.m. on 24th, visible for an hour.

LOCHBROOM.—Cold and dry; a doleful month for the angler, but splendid for the deer stalker. Gale from N. on 10th.

SANDWICK.—August has been drier than the mean; the temp. has been 2°·15 below the mean, owing to the prevalence of northerly winds during the first 12 and last four days, but the crops have made much progress, and harvest operations are beginning. Aurora on 8th.

I R E L A N D.

KILLALOE.—The smallest rainfall in 24 years in August; max. on 27th 85°, on 28th 86°, and on 29th 56°.

DOO CASTLE.—An exceedingly dry month; a burning sun and total absence of R from 14th to the end of the month, coupled with the drought of the two preceding months, have left their marks upon the face of the country; pasture land burnt up, corn crop in a majority of cases only a half crop, potatoes small and turnips poor; a sharp frost on two succeeding nights, 30th and 31st, has seriously affected the potatoe stalks, and stripped off the luxuriant appearance they generally maintained till then. Springs are dried up, but despite all this sad detail the hay crop is heavier than last year, and is saved without a drop of R, and in excellent condition.

OWENDOO.—Bar. high throughout the month, and the great heat has brought in the harvest rapidly; the temp. fell 31° on the 29th, *i.e.* the maximum.

LECKPATRICK.—Very fine month; all the R fell in the first fortnight, with the exception of three-tenths [*sic*, but three-hundredths as shown by the daily entries, 00·3 in. is doubtless correct. Ed.] Sharp frosts on morning of 30th, 27° on the grass. Potatoes, where not damaged by the blight which made its appearance in the middle of the month, have been prostrated by the frost. Less R than in any month this year, nearly as much, 1·65 in., fell in one day in August, 1868.

SOLAR RADIATION.

To the Editor of the Meteorological Magazine.

SIR,—You will perhaps expect a few words from me about the two plans of fixing thermometers *in vacuo*. I speak with diffidence, as I have not tried fig. 2 stand, but I am told by one observer that there is some fear of the thermometer mounted on it being shaken by the wind. Fig. 1 stand is quite secure against this, nor could the wind push it out, though it might not be amiss to put on the stem a couple of thick india-rubber rings, such as those now used with umbrellas, one by each of the wooden collars. This would prevent the instrument being pushed out by accident, and also prevent the globular part being pushed too close to the collar.

With regard to the readings of the instruments, I do not think there can be any difference between the two stands. While, therefore, I am disposed to think fig. 1 more convenient, I am confident that the returns will in either case be equally trustworthy. I may safely leave observers to see that their instruments are not shaken by the wind.

Yours, &c.,

F. W. STOW.

Ripon, September 2nd.

SYMONS'S
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XLV.]

OCTOBER, 1869.

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THE INDICATIONS OF THE SKY.

(Continued from page 84.)

In two previous articles we have urged the advisability of meteorological observers paying more attention to the colour and configuration of the clouds and to the tint of the sky than they have hitherto. The former requires nothing but a little of that patient continuance of observation which shepherds and nautical men find it to their interest to devote to it; the latter requires a good eye for colour, and, perhaps, the construction of a cyanometer by the method described on page 82.

Our last article concluded by pointing out that in that wonderfully powerful assistant of modern progress, the spectroscope, we probably have the successor to the cyanometer, and a key to stores of weather knowledge of which we at present know nothing. Spectroscopic observers have, hitherto, been mostly occupied with such fascinating subjects as the chemical constitution of the sun, the fixed stars, with occasional notes of meteors, lightning, and auroræ, so that the numerous absorption bands produced by the atmosphere have been looked upon simply as intruders. It is known that these bands vary with the sun's altitude, and an American writer has pointed out their connection with atmospheric moisture. This last matter, however, must not pass without attention being drawn to the fact that the bands are evidently the result of all the strata of the atmosphere from the earth's surface to its uttermost, indefinable, imponderable limit. Our transatlantic friend will, therefore, surely find that his hygrometric observation at the bottom of the atmosphere will not always agree with his spectroscopic determination of the water present throughout it.

The following abstract is so suggestive that we are sure our readers will approve its extraction from the *British Association Report* for 1868:—

OBSERVATIONS ON THE ATMOSPHERIC LINES OF THE SOLAR SPECTRUM IN HIGH LATITUDES. By GEORGE GLADSTONE, F.C.S., F.R.G.S.

“This paper was explanatory of some diagrams which the author had prepared of the atmospheric lines in the solar spectrum, from observations taken by him during a recent voyage along the north-west coast of Norway. The author stated that what are known by observers of the solar spectrum as the ‘atmospheric lines,’ are certain dark lines or bands, which make their appearance under certain conditions, and sometimes even attain a considerable development. These lines or

bands appear to be due to the presence of some substances in the earth's atmosphere, as they are always most prominent when observing the sun through a long reach of air (as at sunrise or sunset), while they are scarcely visible when the sun is high above the horizon. The observations, of which drawings were exhibited, were taken in the months of June and July last, from the deck of the vessel when off the coast near Stavanger, and at the entrances to the Trondhjem and Namsen fjords, the latter being in $64^{\circ} 30'$ north latitude, in which parallel the sun skirts the horizon for a long time, thus affording very favourable opportunities for observation. It appears that in those regions the red end of the spectrum is very brilliant, so that with the small portable spectroscope he distinctly recognized, on two occasions, the remarkable line A. The observations went to show that the atmospheric band grows in width and intensity as the sun approaches the horizon, and that what, in certain states of light, or of the atmosphere, appear to be bands of shade, are, under other circumstances, broken up into lines. Under some conditions the red rays suffer very little diminution of light up to a certain point, when they are suddenly cut off, while under others the obscuration takes place more gradually, and the visible spectrum is much longer. The length of the spectrum, however, in no case affects the width between the respective lines, which remains always the same, but is entirely due to more or less of the extremities being altogether lost in darkness."

When a subject is new there are generally two obstacles to its successful pursuit.

(1) The information upon it is entirely fragmentary, most difficult to obtain, and, usually, incomplete.

(2) The apparatus is difficult to obtain, costly, and liable to derangement.

Neither of these obstacles attend spectroscopic observations; the former is entirely removed by Professor Roscoe's excellent and copiously illustrated work,* and the latter by the snug little apparatus represented below, the name on which is sufficient recommendation to all acquainted with the subject.



No one can tell what secrets lie hid in these atmospheric lines, but to us it seems that, by their careful and systematic observation, the "message from the stars," which has taught us all so much, may be rivalled in practical importance by a "message from the sky."

THE BRITISH ASSOCIATION AT EXETER.

(Continued from page 119.)

Admiral Sir E. BELCHER read a long communication "*On the distribution of Heat on the Sea Surface throughout the Globe.*" The paper gave the results of certain observations taken by the gallant Admiral

* "Spectrum Analysis," by Professor H. E. Roscoe. London: 1869.

over a long period of years, and over every part of the Atlantic Ocean. He urged that notice should not be taken of the observations made by ignorant and irresponsible persons, and upon which the belief in the heat of the Gulf Stream had been founded. The object of his paper was to point out that the temperatures which prevail in the Atlantic equatorial currents do not differ much from those in the other or Pacific portion of the ocean, and that north or south, in the Pacific, Arctic, or Antarctic, we find the warmer temperatures prevail more than they do in those regions on our European course in the seas washing Norway and towards Nova Zembla. Taking certain squares similarly situated in various parts of the world, he thought that geographers had given too much importance to supposed warm currents, deduced too from the equatorial one running to the north-east into the Arctic seas.

Mr. A. G. FINDLAY next submitted a paper "*Upon the Supposed Influence of the Gulf Stream upon the Climate of N.W. Europe,*" in which he contended that to attribute the higher temperature of the West of England to the Gulf Stream would be to ignore the statistics thereof. The actual bulk of water which passes through the Florida Channel is from 294 to 330 cubic miles per day, and it receives no accession from the tropics. Fully one half of the stream passes eastward and southward from the banks of Newfoundland, and the northern half, cooled down and neutralized by the Arctic current, has, according to the ordinary theory, to cover the whole ocean, to raise its temperature, and that of this country. The known bulk of this stream will only give six inches per diem over this area. How was it possible then that such a minute film had any influence; and this, too, at from one or two years after it has left the Gulf of Florida as the true Gulf Stream. The further progress of this warmer water to and beyond Spitzbergen, and its effect on the north polar basin, are totally and absolutely incompatible with the now well known particulars of the Gulf Stream proper. How could they then account for our warmer winter climate? The reason seemed to him to be simple and obvious. The great belt of south-west winds, called the anti-trades or passage winds passes over the North Atlantic throughout its breadth, and drives slowly the whole surface of the water to the northward of an easterly course or towards the north-west shores of Europe. From the particular configuration of the land this north-east drift is allowed to pass into the polar area. This south-west wind infuses into high latitudes the temperature and moisture of much lower parallels, and by its greater rate of travelling passes over the warmer water to the southward, and thus brings to Exeter in one day the warmth of the centre of France. By its variation from westward to eastward of a southerly direction we find all the variations and moisture which were induced by this wind passing over land or sea. In conclusion, he hoped that the subject would receive much more attention than it had hitherto done. The excellent observations made in the expedition from the Royal Society, under Dr. Carpenter and Dr. Wyville Thompson, will,

he had no doubt, throw great light on this obscure N.E. current, which should not be called the Gulf Stream, but possess a specific term.

Mr. TRELAWNY SAUNDERS hoped that the study of meteorological subjects would receive greater attention. The effect of the sun on the earth had not received sufficient study, and he questioned whether the zone of the greatest heat was at the equator.

"On the best means of determining the true Evaporation from a Surface of Water," by G. J. Symons and R. Field. The authors commence by pointing out the very inconsistent statements of even able meteorologists, and quoted returns in proof of their position; thus, for the same year one observer gives the evaporation as 11 inches and another gives it as 48 inches. They then quoted the meteorological essays of the late Professor Daniell, to show how strongly he condemned the existing form of evaporators, and proceeded to criticize the mode proposed by Professor Daniell of computing the quantity of evaporation from hygrometric observations, as a substitute for quantitative measurement. After a few words on what the authors believe to be the great source of error in all existing forms of evaporators—namely, undue heating of the water experimented upon—they described a series of experiments at Dijon and other places on the canal of Burgundy, in which the evaporation was measured in large tanks, and was found to be only about half what was generally assumed to be the amount. Reference was then made to a very ingenious and accurate instrument used by the authors for measuring the depth of water, and this instrument (called a Hook gauge) was exhibited. Large drawings illustrated the apparatus that Messrs. Symons and Field have hitherto employed, and a number of tables were "taken as read." The authors epitomized the results of their experiments, showing what very erroneous measurements (even to the extent of 100 per cent. of error) were yielded by the best of ordinary evaporators; and concluded with a strong plea for further investigation by quoting the words of M. Vallés (the French engineer who first called attention to the great inconsistency of existing experiments):—"We do not understand how in a country like ours, and with reference to one of the most important hydraulic data, we can rest content with only knowing that the numerical value to be assigned to this datum lies between two limits, one of which is double the other."

"On a Self-setting Type Machine recording the Horizontal Motion of the Air," by C. J. Woodward.—The author called attention to the uncertainty arising from the present mode of reading off the traces of self-recording anemometers, and exhibited two tables, containing the velocity as read off from one record sheet by two separate persons. There were several instances in which the values assigned by them differed by one or two miles, but in the aggregate the difference was inconsiderable—not one per cent. Mr. Woodward proposed to remove this liability to error by attaching to the spindle of Robinson's cup anemometer a self-setting type machine, which would print off the

exact hourly values, and exhibited a model which apparently proved the practicability of the plan. It was questioned whether the additional labour thrown upon the cups, by having to drive this apparatus, would not lead to error in their indications, but Mr. Woodward thought not.

“*Description of a new Self-recording Aneroid Barometer,*” by J. Martin. This instrument consists of an eight-day clock, a large aneroid with an eight-inch dial, and a paper-covered cylinder 4 inches in diameter. The vacuum box of the aneroid, in addition to turning the hand in the usual way, has to move a chain, which passes over three or four pulleys to the recording pencil. The clock turns the before-mentioned cylinder at such a rate that one paper lasts a week. Mr. Symons called attention to the fact, that similar instruments had long been in use by Admiral FitzRoy and others, with the exception that a mercurial column was used instead of the aneroid, the former giving by far the most accurate results. Mr. Follet Osler concurred in the superiority of the mercurial column as the motive power, and added some remarks on the desirability of dealing with simultaneous observations over very large areas. A gentleman present pointed out that the aneroid was more portable than the mercurial column.

“*On the Best Form of Numerical Figures for Scientific Instruments, and on a proposed mode of Engraving them,*” by Col. Strange, F.R.S. Colonel Strange called attention to certain tables of numerals hanging on the wall, and to certain others which he placed in juxtaposition; the space occupied by the two varieties being equal, the superior clearness of those suggested by the Colonel was immediately evident. The two following lines will give an *idea* of the comparison instituted, but the figures drawn and exhibited by Colonel Strange are far clearer than even the Egyptian ones we have taken as an illustration. Any one who is aware of the frequency with which several pairs of figures (such as 1 and 4, 3 and 8) are confounded, will welcome and wish good speed to Colonel Strange’s suggestion :—

1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9

The “*Report of the Rainfall Committee,*” read by Mr. Symons, the Secretary, stated that the attention of the Committee, during last year, had been to a great extent devoted to various details calculated to secure increased accuracy among the observers; the personal inspection of the gauges at work having proved very beneficial, has been extended as far as possible, and a code of rules has been drawn up to ensure uniformity of practice among the observers. A very simple instrument, made by Pastorelli of Piccadilly, called a Storm Rain Gauge, was exhibited, the object of which is to enable observers to determine accurately and without inconvenience the rate at which rain falls minute by minute, or indeed, every ten seconds if required. Then followed a series of elaborate tables, containing the results of experiments made during the last six years to determine the relative indications of rain gauges of different sizes; the result appears to be that

the difference does not exceed one per cent., unless the gauge is unusually large or small, all of the usual sizes, 5, 6, 8, or 12 inches in diameter, seem to give nearly identical results.

The Committee then proceed to report the results of a careful examination of the positions of the rain gauges now at work, and point out that there are many important districts in which the observations are insufficient, and the Committee earnestly desire to rectify this state of things. As an illustration, a large map of the south-west of England was exhibited, and it was pointed out that though populous places, like Exeter, Bath, &c., had several observers, large tracts of land, like Dartmoor and Exmoor, are almost wholly neglected. It was further requested that anyone who might be observing, or intend to do so, would communicate with Mr. Symons.

THE PREDICTED DROUGHT OF THE PAST SUMMER.

To the Editor of the Meteorological Magazine.

SIR,—Without re-opening the discussion on lunar influence, may I say a few words with regard to the summer drought which I predicted should commence at the end of May, 1869? From the end of that month to the beginning of September the weather was drier than during the corresponding period of any other year this century, except 1818 and 1864. Between May 28 and July 28 the rainfall at Greenwich was 1·29 in., and between August 10 and Sept. 10 it was 0·76 in. In each case it was considerably less than half the average. In many places, after August 13 not a drop of rain fell for more than three weeks. This was in accordance with my prediction of “fine weather for harvest to set in a few days after the 9th of August.”

I am, &c.,

G. D. BRUMHAM.

P.S.—When the moon's positions in declination have been the same as they will be in the coming *winter*, we have *always* had an unusually low temperature. I have, however, no “pet theories” about lunar influence; I believe in the laws, because, so far as I have been able to ascertain, they have never failed, but if remarkably severe frost does not occur, I shall be the first to give up the notion of lunar influence on temperature.

THE THUNDERSTORM OF SEPTEMBER 10TH.

To the Editor of the Meteorological Magazine.

SIR,—We were visited on Friday morning last, the 10th of September, by one of the severest thunderstorms that has occurred in this neighbourhood during the whole of the summer. Throughout the night, from 11 p.m. of the 9th, there was constant and unusually brilliant sheet lightning, but no thunder was heard until about 5 o'clock in the morning of the 10th, and the storm was at its height at 6 o'clock, at which hour the lightning was incessant and very vivid and the claps of thunder remarkably loud, accompanied by a deluge of rain. Thunder occurred at intervals during the rest of the morning, and in the afternoon it cleared up and blew a gale of wind from the S.S.W. Since the above storm, which came up from the S.E., the weather has

become unsettled, with rain and high winds. We had a slight thunderstorm here in the afternoon of Sunday, September 5th, which I see was very severe in Yorkshire and other northern counties.

I am, Sir, yours very truly,

ARCHDALL E. BUTTEMER.

Sydenham, S.E., Sept. 13th, 1869.

To the Editor of the Meteorological Magazine.

SIR,—A very violent thunderstorm occurred here during last night and this morning. Lightning was first seen about 10.30 p.m., and by 11 p.m. was almost incessant in S., S.E., and E., with distant thunder; the storm passed to the westward soon after midnight, though distant lightning was seen throughout the night. 5.30 a.m., frequent flashes of lightning and incessant thunder in S. From 5.45 to 6.30 a.m. the storm was right overhead, the lightning being very vivid and frequent and the thunder incessant. Very heavy falls of rain at 5.50 and 6.30 a.m., total fall .44 inch; the thunder ceased about 7.30.

Another heavy storm passed to the eastward between 10.30 a.m. and mid-day. The thunder was loud and frequent, though never very near. The barometer stood at 29.58 at 9 a.m., having fallen three-tenths during the night.—Yours truly,

THOMAS PAULIN.

Winchmore Hill, 10th Sept., 1869.

THUNDERSTORMS OF SEPTEMBER 29TH AND 30TH, AS SEEN AT CIRENCESTER.

There had been distant thunder heard early in the morning of the 29th, and the day broke with thunder heat; temperature at 8 a.m., 59°. It was cold the previous day, and a stream of heated air, charged with electricity, had come from the S.E. during the night of the 28th, but no appearance of a storm until 5 p.m. on the 29th, when heavy clouds gathered in the S. horizon; at 5.45 lightning was first seen, and at 6 thunder was heard. In this, *the first* storm, the lightning was clearly defined, looped and forked, at considerable intervals, and the thunder heavy, rolling, and long continued. It passed away to the N., and we thought all was over. In less than an hour heavy clouds were again seen in the S., and in this second storm its character was totally altered. It apparently took the same course as the first storm, from S. to N., being distant, but the thunder was rumbling and constant, and the lightning was in sheets of great brilliancy; it might be called almost constant—"one" could not always be counted between the flashes—it might be called a stream of electricity made visible. In each of these storms, a quarter of an inch only of rain fell, but about 20 miles E. of this place, the focus of both storms, there was not only rain, but hail and a violent wind. The third storm was on Thursday, the 30th; the day broke as on Wednesday with thunder heat, and a temperature of 59° at 8 a.m., the wind S.E., and the storm began at 2.30 with torrents of rain without thunder; we concluded the electricity had been exhausted in the previous storms, and that we should have rain only, but at 3 p.m. lightning was seen and distant

thunder heard, and at length became low, rumbling, and constant, whilst the lightning was faint and seldom. It might be supposed that the electrical discharges in this storm were above the clouds, and therefore indistinctly seen or heard. The rain was steady and heavy, 1.30 in. falling in about an hour, and 2.10 in. altogether from 4 p.m. to about midnight. The barometer was little or nothing affected by these storms. The course of the storms was almost exactly alike, commencing in the south and passing to the north. Those of Wednesday did not occur in London.

THOMAS C. BROWN.

Further Barton, Cirencester.

HERSCHELL'S WEATHER TABLE.

To the Editor of the Meteorological Magazine.

SIR,—I have come upon the enclosed table, and should be very glad to have a competent opinion upon its value; also to know whose authority it has, and the probable date of its first appearance. It cannot, I suppose, have ever been intended to be true of any country beyond Great Britain.—Yours, &c.,

R. H. FAWCETT.

Portsmouth, August 18th, 1869.

If the new moon, the first quarter, the full moon, or the last quarter happens	In Summer.	In Winter.
Between mid. and 2 in morning	Fair	Hard frost unless wind be S. or W.
" 2 " 4 "	Cold, frequent showers	Snow and stormy.
" 4 " 6 "	Rain	Rain.
" 6 " 8 "	Wind and Rain	Stormy.
" 8 " 10 "	Changeable	Cold rain if wind be W. snow if E.
" 10 " 12 "	Frequent showers.	Cold and high wind.
" 12 noon " 2 p.m.	Very rainy	Snow or rain.
" 2 " 4 p.m.	Changeable	Fair and mild.
" 4 " 6 p.m.	Fair	Fair.
" 6 " 8 p.m.	{ Fair if wind N. W.	Fair & frosty if wind N. or N. E.
" 8 " 10 p.m.	{ Rainy if S. or S. W.	Rain or snow if S. or S. W.
" 10 " midnight.	Ditto	Ditto.
	Fair	Fair and frosty.

OBSERVATIONS.—The nearer the time of the moon's change to noon or midnight the more nearly will the result accord with the prediction.

It is also said that less dependence is to be placed on the table in winter than in summer.

[The table is rather old, but we cannot give its precise origin. A copy (almost verbatim) of the above is given in the *European Magazine* for 1803, vol. lx., page 24. It is generally known as "Dr. Herschell's Weather Table," but it has been publicly disavowed by his son, Sir John Herschell. We do not know whether it was ever submitted to careful examination by an unprejudiced person. It seems to us impossible that *any* words in the second and third columns can be correct except by accident, but if any of our readers like to test it, we shall be glad to hear the result.—Ed.]

HEAVY RAIN AT TRENT.

To the Editor of the Meteorological Magazine.

SIR,—I write to mention to you what I conceive to be a most unusual fall of rain for the Midlands. Rain commenced to fall at 4.5 p.m. on the 18th, and ceased about 6 a.m. on the 19th. At 9 a.m. on the latter day I found 1.87 in. in the gauge. This is double the amount of any previous one day's rain since September last, in which month I commenced to record here. September this year has given so far 3.35 inches on 13 days. I dare say many other correspondents will write to you of the fall on the 18th.

Believe me, yours sincerely, C. U. TRIPP.

Trent College, Nottingham, Sept. 20th, 1869.

Rainfall at Trent College, 1869.

January	2.68 in. on 16 days.	June	1.06 in. on 10 days.
February	1.73 in. ,, 16 ,,	July	0.41 in. ,, 5 ,,
March	2.29 in. ,, 17 ,,	August	1.34 in. ,, 14 ,,
April	1.77 in. ,, 12 ,,	Sept. (to 20th)...	3.35 in. ,, 13 ,,
May	4.08 in. ,, 17 ,,		

A METEORIC STONE SHOWER AT WOLVERHAMPTON?

At the conclusion of the thunderstorm at Wolverhampton on Tuesday evening, several persons noticed a large number of small dark stones lying upon the streets and roads, the drive of the London and North-Western Railway Station, Queen Street, Queen Square, and Waterloo Road being especially strewn with them. From the peculiar character of the stones, bearing resemblance to nothing with which the roads are paved, or any stones found in the district, it was concluded, even by the uninitiated, that they were meteoric stones, and must have fallen in a shower during the heaviest and most alarming period of the storm. A considerable number was gathered that night, and more the next morning. Our correspondent has some in his possession, and has shown them to several gentlemen, one of whom saw the last shower of meteoric stones that fell at Birmingham in June last, and stated that those that have fallen at Wolverhampton were precisely of the same character. They appear, however, to have been a little larger, for the record states that those which fell in Birmingham were from one-eighth of an inch to three-eighths of an inch, and about half those dimensions in thickness, while some of those picked up in Wolverhampton were three-quarters of an inch in length, and five-eighths of an inch in thickness. Like the stones in Birmingham, too, they have something like the appearance of Rowley rag, but on breaking them up the difference of character is at once apparent. A chemist in the town found that, by judging from mere surface examination, they resembled iron pyrites. The matter is exciting a very general attention, and there are a great many searchers gathering up the remains of this strange shower from the heavens. It is believed that they fell towards the close of the storm, when it was peculiarly heavy, and in some places the lightning

was seen to rebound from the earth like the glare from the bursting of a shell. The rain was so heavy that many low-lying places in the suburbs were quickly under water, and the water rushed with such force from the racecourse through an opening in the wall into Clifford Street, Whitmore Reans, as to wash away part of the footpath. In addition to the house struck in Monmore Green, and slightly damaged, the chimney of a house situate in Little Berry Street was struck by the lightning and knocked down, and rendered the rest of the house in a dangerous state.—*Birmingham Gazette*.

[We regret that the above, which appeared in the *Morning Advertiser* of May 28th, has only just come to our notice. We hope it is not too late for our Wolverhampton correspondents to explain this mysterious story.—Ed.]

REVIEWS.

Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, in the year 1866, under the superintendence of the REV. R. MAIN, M.A., Radcliffe Observer.—Oxford: J. Parker & Co., 8vo, 67 pages.

IN most respects this is similar to several preceding annual volumes; one noticeable departure therefrom is the insertion of an account of some experiments with ozone papers during the latter half of the year 1866. The only details given are as under:—

“On May 5th, 1866, experiments were commenced, and continued till September 30th, to test the quantity near the ground with that at the top of the tower (105 feet) by exposing a paper for 24 hours in both positions, in addition to the ordinary paper exposed for 12 hours only. The amount of discoloration was the same in both positions in nearly every instance.

“From September 1st to September 30th, a paper was placed in a glass tube painted black on the outside and exposed for 24 hours, and compared with that in the unblackened tube exposed for the same length of time, to test the effect of light upon the paper. In the majority of cases, that protected from the light was less discolored than the other, some times considerably so.

“On October 1st, the glass tubes containing the papers were placed inside leaden tubes, blackened inside and outside.

“On October 2nd, a fresh supply of paper was obtained from Negretti and Zambra, and a more systematic series of experiments commenced, and continued till the end of the year.”

Then follow the daily values during two months, whereof the averages are as under:—

Glass tube in lead	1·3
Lead tube blackened	1·4
Open plain glass tube	6·0
Closed „ „ „	6·7
Wire gauze cage, Schonbein	2·4
„ „ „ Moffat ...	2·3
Black tube on the tower ...	2·1

“It appearing from these experiments that the paper was considerably more acted upon by light than by ozone, it was returned, and a fresh supply, *in boxes*, obtained from Negretti and Zambra on December 2nd, with much more satisfactory results as the following comparison will show. The closed glass tube was discontinued from this time.”

The means of this second series are :—

Glass tube in lead tube	2·2
Lead tube blackened	3·1
Open plain glass tube	4·5
Wire gauze cage, Schonbein	4·3
" " " Moffat ...	3·7

We think the general utility of these experiments would have been increased had they been described in greater detail ; *e.g.*, the "closed" glass tube, was it corked, stoppered, or hermetically sealed? Again, the papers in both series were more discolored in the "Lead tube blackened" than in the "Glass tube in lead tube;" were both lead tubes of the same diameter? because if so, the internal addition of the glass tube would diminish the volume of air passing over the paper, and thus perhaps explain the cause of the difference recorded. Of the chemistry of the atmosphere as indicated by the discoloration of these test papers hardly anything is known ; everyone, therefore, who clearly demonstrates a single fact in connection therewith is a benefactor, but demonstration can only be accepted when accompanied by the most copious details and the most ample proof. If we can at present get no further than the determination of the circumstances under which most discoloration takes place, we shall have advanced one important step, and by that time perhaps the chemists will be able to tell us to what the discoloration is due.

As in previous years, the rainfall measurements are succinctly tabulated, the actual fall at four elevations being given, and the ratio of the amount collected in each gauge to that collected on the ground. We hope on a future occasion to give an abstract of these values for several years.

Notes on the Summer of 1868, particularly of the Temperature as observed in Bath, and compared with that of Greenwich and some other places. By REV. L. JENYNS, M.A., F.L.S., F.G.S.—[Proceedings of the Bath Naturalists' Field Club.]—Bath: Hayward, 8vo, 28 pages.

THOSE of our readers who are versed in the literature of meteorology, will gladly recognize in the writer of the above the able author of "Observations in Meteorology," and they will comprehend the difficulty of giving in a few lines any fair idea of what it requires 28 pages for Mr. Jenyns to state. He opens with a judicious protest against hasty determinations of meteorological elements, passes on to the influence of wind on the seasons, thence to careful comparison of temperatures in 1868 (wherein a little more detailed description of the position and mounting of the instruments would have been expedient), thence to the irregular distribution of rainfall, the paucity of thunderstorms, the influence of icebergs, and Mr. Glaisher's investigations of the secular variation of temperature, concluding with the following paragraph, which may be taken as a type of the whole :—

"Whether this slight secular change is due to the same causes continuing slowly to operate which brought about such far greater changes of climate

formerly, or to some independent agency not yet discoverable, the circumstance is not one that need much alarm us. Geologists tell us that climates were very different ages back; that land and sea have perhaps more than once changed places, causing, by their altered relative position, a dis-arrangement of the meteorological conditions of whole latitudes. In this way countries once arctic have become warmer, those that were once tropical have become temperate. But these changes date back to a period very remote, probably long before the appearance of man on this earth. If the same changes are still going on, they advance by such slow degrees as to be only perceptible after the closest looking into all the phenomena by which they are accompanied. Before our climate can again experience a complete reversal of its present character man may have run his course. He must not fear, therefore, any interruption of those operations in the field which he looks to as the main sources, not merely of his daily sustenance, but of his health and prosperity. He may continue to 'plough in hope.' If now and then he has a bad season to contend with, he has a good one another year to set against it; or if the yield be deficient in one country it is met by more abundant supplies elsewhere. He may trust the existing order of things. He has the promise that 'while the earth remaineth,' so long at least as it is needed for man in his present state and circumstances, 'seed-time and harvest, and cold and heat, and summer and winter, and day and night shall not cease.'

Meteorological Tables for 1868. Edited by DR. BARHAM.—*Catalogue of Natural Periodic Phenomena kept at Bodmin.* By T. Q. COUCH. [From Journal Royal Inst., Cornwall.]—8vo, 11 and 5 pages.

THE observations at the Royal Institution of Truro have (although we believe the position of the instruments is not what could be wished), long held a high rank as trustworthy standards. Long may they remain so. We hope, however, that the observer will be careful with his 9 p.m. barometer observations, for either he has an indifferent light, and consequently makes a constant slight error in the readings, or the diurnal range is different there to what it is in other places. The photographic records from Falmouth will soon decide which is the true explanation. We are sorry to miss the rain returns from Scilly, for which we have generally had to fall back upon the tables under notice. Surely some one in those Isles could be induced to keep a record. We have not noticed one misprint or error in these tables, but the return of rainfall at St. Agnes differs by 0.10 in. from that published by Mr. Symons; he gives 42.37, Dr. Barham gives 42.27—this must be cleared up.

The Naturalists' Calendar is a good one, and ably introduced by the following paragraph:—

"Each step in the development of the meanest insect is dependent on the vital processes of the plant which feeds it, and the latter in its turn is influenced by solar and atmospheric agencies. Indeed it is impossible strictly to say how far the mutual co-relation extends. This inter-dependence, which is observable throughout nature, furnishes us with an ever-changing and never-ending object of study. We must not be restrained from the pursuit because the causes of the palpable oscillations of the balance of natural order seem, to the isolated observer, far to seek, and even impossible to find. In course of time, a circle of students may amass such a number of facts as to permit some great generalizer to educe from effects their certain causes. It is for this reason that I record any marked plenty or scarcity of certain animals and plants, and, indeed, any noticeable departure from the general order and due proportion in the manifestations of organic life,"

SEPTEMBER, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 901 or more fell.	TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.				
				Dpth	Date	Deg.		Date.	Deg.	Date		
I.	Camden Town	inches 3·56	+ 1·30	in. ·84	18	14	76·0	29	41·2	21	0	
II.	Staplehurst (Linton Park) ...	3·81	+ 1·59	·80	10	13	77·0	4	43·0	21	0	
III.	Selborne (The Wakes).....	6·39	+ 3·95	1·09	18	15	73·0	5	34·6	1	2	
IV.	Hitchen	3·12	+ 1·26	·74	9	13	72·0	5	43·0	1, 20	0	
V.	Banbury	3·87	+ 1·60	·71	11	17	72·0	5	35·5	1	0	
VI.	Bury St. Edmunds (Culford). 3·58	+ 1·97	·73	10	11	77·0	5	37·0	2	0		
VII.	Bridport	3·92	+ 1·60	·50	11*	17	72·0	4	38·0	2	0	
VIII.	Barnstaple	6·75	+ 2·99	1·12	19	25	73·0	6	43·0	2	...	
IX.	Bodmin	5·87	+ 2·20	1·13	11	23	70·0	6	46·0	1	0	
X.	Cirencester	6·55	+ 3·69	2·05	30	19	...	...	...	...	...
XI.	Shifnall (Haughton Hall) ...	4·76	+ 2·81	1·06	10	17	73·0	6	39·0	1	0	
XII.	Tenbury (Orleton)	5·51	+ 2·83	1·45	18	17	72·3	8	35·0	2	0	
XIII.	Leicester (Wigston)	2·43	+ ·22	·49	19	13	78·0	4 & 8	39·0	1, 20	0	
XIV.	Boston	3·22	+ 1·65	·65	10	16	75·4	8	44·0	2, 21	0	
XV.	Grimsby (Killingholme)	3·18	...	·88	18	21	70·5	9	44·0	22	0	
XVI.	Derby.....	5·31	+ 2·97	1·61	18	20	73·0	8	40·0	1	0	
XVII.	Manchester	6·32	+ 2·63	·77	29	26	75·0	5	35·0	1	0	
XVIII.	York	3·91	+ 1·58	·62	5	21	72·0	8	40·0	30	0	
XIX.	Skipton (Arncliffe)	11·64	+ 6·68	1·55	15	27	69·0	1	37·0	22	0	
XX.	North Shields	2·82	+ 1·12	·53	12	21	69·5	25	43·0	22	0	
XXI.	Borrowdale (Seathwaite).....	24·09	+10·88	3·75	20	27	...	...	...	...	...
XXII.	Cardiff (Town Hall).....	6·82	...	1·24	18	23	...	...	...	...	...
XXIII.	Haverfordwest	8·52	+ 4·81	2·01	11	17	71·8	5	41·0	2	...	
XXIV.	Rhayader (Cefnfaes).....	7·52	+ 3·68	1·03	30	22	72·0	...	38·0	...	...
XXV.	Llandudno.....	6·50	+ 4·16	1·55	11	21	79·4	5	45·6	4	...	
XXVI.	Dumfries	5·87	+ 3·14	·87	14	21	69·0	5	41·0	13	0	
XXVII.	Hawick (Silverbut Hall) ...	5·28	...	1·08	10	23	...	...	...	...	0
XXVIII.	Ayr (Auchendrane House) ...	6·38	+ 2·65	1·34	22	23	74·0	26	35·0	3	2	
XXIX.	Castle Toward	7·73	+ 3·11	1·39	22	26	70·0	5	32·0	2	1	
XXX.	Leven (Nookton)	5·09	+ 2·61	1·26	12	18	66·0	4 & 9	36·0	13	0	
XXXI.	Stirling (Deanston)	6·90	+ 3·75	·91	22	23	68·0	9	33·8	13	0	
XXXII.	Logierait	4·12	...	·64	12	19	...	...	...	...	...
XXXIII.	Ballater	3·43	...	·90	12	18	70·0	5	32·0	13	1	
XXXIV.	Aberdeen	5·24	...	1·57	12	21	71·6	6	38·2	27	1	
XXXV.	Inverness (Culloden)	3·77	...	·73	29	...	67·2	9	42·2	13	0	
XXXVI.	Fort William .....	...	...	...	...	...	...	...	...	...	...
XXXVII.	Portree	10·32	- ·45	1·52	25	20	...	...	...	...	...
XXXVIII.	Loch Broom	6·17	...	1·10	19	23	...	...	...	...	...
XXXIX.	Helmsdale	5·12	...	·97	24	23	...	...	...	...	...
XL.	Sandwick	6·60	+ 2·94	·96	12	23	62·1	9	40·6	17	...	
XLI.	Cork	5·05	...	·64	17+	20	...	...	...	...	...
XLII.	Waterford	5·98	+ 2·85	1·57	28	20	65·0	9	46·0	3, 20	...	
XLIII.	Killaloe	8·88	+ 4·71	1·39	30	26	72·5	5	38·0	20	0	
XLIV.	Portarlington	3·88	+ ·60	·67	29	26	70·0	24	40·0	19	...	
XLV.	Monkstown	4·73	+ 2·74	1·21	30	20	74·0	25	37·0	3	...	
XLVI.	Galway	8·46	...	1·25	13	26	70·0	4	37·0	20+	...	
XLVII.	Bunninadden (Doo Castle) ...	4·07	...	·38	7	26	66·0	9	35·0	14	0	
XLVIII.	Bawnboy (Owendoon).....	5·59	...	·73	7	25	71·0	4 & 9	39·0	18§	0	
XLIX.	Waringstown	3·57	...	·65	11	19	72·0	6	40·0	2	0	
L.	Strabane (Leckpatrick)	4·49	...	·73	7	26	71·0	9	33·0	20	0	

* And 12th. † And 28th. ‡ And 22nd & 30th. § And 19th.

+ 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.

CAMDEN TOWN.—TS 11.30 p.m. 9th and 5.45 a.m. on 10th. L from dusk till 9 p.m. on 29th.

LINTON PARK.—High, destructive wind on 12th and 13th; distant T on 5th and 30th, and more near on 10th; prevailing winds S. and S.W. Bar. very low on morning of 12th (28.39 at 7 a.m.) and unsteady for some time. Heavy R on 10th, 12th, and 30th; but except for the wind alluded to, damaging the crops and fruit, the month may be considered a favorable one.

SELBORNE.—T at 3 a.m. on 6th, and at 10 p.m. on 11th with violent wind S.E. to S.W. and rain; the storm continued during the 11th, 12th, and till evening of 13th; several trees were blown down; TS from 6 till 10 a.m. on 10th, and another TS beginning at 6 p.m. on 29th in W., and passing on to N., the T a continuous roar and continuing faintly till the morning of the 30th; L in evening of 30th. The max. temp. on the 20th was as low as the min. of the 18th, 56°. Bar. on the whole very equable; lowest on the 12th, 28.73, highest on 1st, 29.91.

CULFORD.—Very high winds prevailed about the middle of the month; quite a gale on the 13th, which did considerable damage in many instances, such as blowing down park trees, unroofing buildings, &c., and in very many instances entirely divesting fruit trees, such as apples and pears, of their crop. The latter part of the month, however, was remarkably fine, even warmer than the average. T on 5th, 6th, and 10th.

BRIDPORT.—Heavy westerly gale on 11th and 14th, on each of which days there was a fall of .50 in. of R. Bar. on 11th at 10 p.m., 29.10. T and L on 11th, 28th, 29th.

BODMIN.—The unexampled drought of fifteen weeks ceased on the 3rd; a tremendous gale on the 11th; bar. on 11th, 28.65.

CIRENCESTER.—L on night of 9th; gale on 12th from W., and of extreme violence on 13th. The rainfall on the 30th two-thirds of the average for the whole month; TSS on 29th and 30th.

SHIFFNAL.—Wasps and butterflies so scarce before now (3rd) increase. 7th, potatoes "ackerspriet" as last year, but not so badly. The R which came with T on the 8th continued daily till the 19th; turnips, which were greatly mildewed, benefitted and grow again; mushrooms most abundant on 16th. The lady-birds, which were very numerous, have gradually disappeared; they were evidently bred here, their pupæ being found on the garden herbs. Potatoes cut down by the cold of the 1st. TS at 2 p.m. on 5th; TS with heavy rain at 6 p.m. on 10th; gale from N.W. on 12th, from S.W. on 13th, and again from S.W. on 19th; T with heavy R and incessant L on night of 29th. Unusually warm from the 24th to the end of the month.

ORLETON.—On evening of 18th 1.45 in. of R fell, without T or L. On 29th, at night, a grand display of vivid L, with distant T, passed to the E. of us from S. to N., the flashes being continuous and generally white, frequently four or five in a minute. About 5 p.m. on 30th another heavy TS passed to the S.W. of us from S.E. to W., when 1.28 in. of R fell between 4 p.m. and midnight. On 5th, L in N. in evening. Violent wind on 12th and 13th.

WIGSTON.—An extraordinary discharge of electricity on the evening of the 29th, which continued from 7 p.m. until after midnight, keeping the heavens one continued blaze of light; no T heard here.

KILLINGHOLME.—The wheat is reported to yield badly in most places; we have not much reason to complain in this respect. The month was remarkable for a succession of high winds from the S. and S.W., and they could not be called "ill winds," inasmuch as they allowed the farmers to get in their corn in good condition, although 2.86 in. of R fell in ten successive days from the 9th to the 18th. L on 5th, 8th, 9th, 29th, and 30th. TS at 9.30 a.m. on 10th; heavy TS at 4.30 p.m. on 13th. Aurora on 16th. Redbreast whistling on 17th; first woodcock seen on 27th.

DERBY.—Equinoctial gales unusually early and violent ; both temp. and rainfall above the average, the latter more than double ; grass and all vegetation growing, notwithstanding the time of the year.

MANCHESTER.—T S on 10th and 29th ; stormy on 16th and 18th.

ARNCLIFFE.—Rainfall considerably more than double the average ; E on every day after the 3rd.

SEATHWAITE.—Nine days on which there fell more than one inch of rain ; four on which more than 2 in. fell, and one on which the fall was 3·75 ; the total for the month being 24·09 in. (about the same as the *annual* fall in London.)

NORTH SHIELDS.—T S on 5th.

W A L E S.

HAVERFORDWEST.—The month commenced fine, with high bar. and cool temp., but changed on 3rd, and rain began on 5th, from which time to the end of the month, with some intermissions, rain, wind, and weather of the wildest and stormiest character prevailed ; one of the wettest and stormiest months for the last 20 years ; never very warm, but mild throughout ; the late harvest much damaged by the great storm of the 13th, literally scattering the stacks to the winds and blowing the ricks in the hay yards to the ground. A gale commenced before midnight on the 11th, and continued to increase in violence till 2 a.m. on 13th, when it raged with awful fury, uprooting trees and unroofing houses, accompanied by dashing rain ; seldom has such a storm swept over this locality.

CEFNFAES.—The month has been generally cold and wet ; high winds with heavy rain (chiefly from S.W.) from 13th to 19th. On 29th a fearful storm of T and L, most violent between 7 and 8 p.m.

LLANDUDNO.—15th, stormy day with L in evening. 26th, a beautiful meteor at 7 p.m. in N.E., color a light straw ; 27th, a slight appearance of aurora at 8.30 ; sea slightly phosphorescent ; shooting stars ; T S from 8 to 9 p.m. on 29th.

S C O T L A N D.

DUMFRIES.—The first three days dry, and from the 4th to the close E nearly every day ; at the beginning of the month the soil dry and parched, and although the rainfall was heavy, it was near the close of the month before the streams were much increased by the rains, as the thirsty earth retained nearly all the rain that fell for two weeks ; the total fall in the month is more than double the average. The max. day temp. was lower than that of August, but the night temp. 1^o·3 higher.

HAWICK.—After the first three days, which were hot and droughty, rain fell copiously and it has given all the green crops a most luxuriant appearance. Potatoes keep almost clear of the rancid enemy, and the cereals have been (for the most part) secured under "thack and rope" in the very best order. There was one very loud thunder clap, with much L, on the night of the 27th. The latter half of the month generally squally, and on the 19th, 25th, and 26th, there were perfect hurricanes.

AUCHENDRANE.—This September has been a month of severe equinoctial gales, surcharged with heat and vapour, which was rapidly condensed by the greater cold of our northern latitudes ; the rains began on the 6th, but such was the dryness of the soil and exhausted state of the springs, that not before the 20th (after an almost continuous rain of 14 days, amounting to more than 3 inches) did the water rise to the standard height on the gauge on the river. No observer could have witnessed this September overflowing of the rivers, and the dried-up state of the river-beds throughout the summer, without coming to the conclusion that the sequel of the extensive agricultural drainage must be the formation of reservoirs at the sources of our rivers, as the only method of mitigating those severe "water famines," which deprive both towns and rural districts of their proper supply of one of the greatest necessities of civilized life.

CASTLE TOWARD.—Warm and dry to the 5th, and has since been mild but wet, E falling on every day to the close. The rain came just in time to save the turnip crop (which is now good) ; still some grain out ; potatoes getting diseased ; peas, kidney beans, and cauliflowers plentiful ; flower garden and ribbon borders quite gay, being safe as yet from frost.

DEANSTON.—Bright and fine first week, but very wet and mild the rest of the month. Gales of wind on 19th and 25th from S.W. T and vivid L at 7 p.m. on 29th; R more than double the average.

LOGIERAIT.—Very heavy rainfall almost daily from the 7th. Strong gales, with occasional T.

ABERDEEN.—A mild but wet month (both temp. and rainfall above the average, the latter nearly double), very unfavourable for the harvest, much of the grain being still "out" in the upland districts. Auroræ on 2nd, 8th, 11th, 14th, 16th, 26th and 27th.

PORTREE.—Very wet and stormy from the 8th to the end, which has greatly retarded the harvest operations; the crops are mostly uncut, so that we are again at the mercy of the Highlanders' harvest, October. L during the whole of the night of the 17th. A fine lunar rainbow on 21st, visible from 10 to 12 p.m.

LOCHBROOM.—It was beautiful harvest weather till the 10th, after which date until the end of the month, we have had the most wretched weather imaginable; not one dry day to the 30th; it has injured all manner of crops, and rendered harvesting very late.

SANDWICK.—This is the wettest September during the whole time of observation (29 years); this has retarded the ripening and reaping of the grain, so that only about half of it is cut down yet. Auroræ on 2nd, 8th (lasting all night, with coruscations reaching to the zenith), 9th, 11th, 14th, 15th, 27th (covering the N. and part of the S. hemisphere), and on 30th.

I R E L A N D.

KILLALOE.—As August had the smallest rainfall in 24 years, September had the largest fall in the same period, the nearest to this being Sept. 1861, 7·57 in.

DOO CASTLE.—Inclement month; R on every day from the 4th. Equinoctial gales set in early this month, and as a rule continued to the end; they were particularly fierce on the 10th, 14th, 18th, and 19th. Oats which had not been secured were seriously injured. T on 5th, the commencement of the "break."

OWENDOON.—Only one dry day after the 4th; much of the hay still left out, and it is a pity to see the loss it has sustained, and some of the oats in the mountain district have been damaged.

WARINGSTOWN.—This month was remarkable chiefly for the continuous S. to W. winds and frequent heavy gales, during which the wind occasionally veered to N.W. R heavy and pretty equally distributed over the latter weeks, but fell principally at night. Potatoe crop very fine, showing no disease.

LECKPATRICK.—Very stormy, wet month, the latter part of it most unfavourable for the harvest; much damage done to the oats on mountainous and late lands. Wettest September for the last seven years, except 1863, 5·46 in.

THE HEAT IN AUGUST.

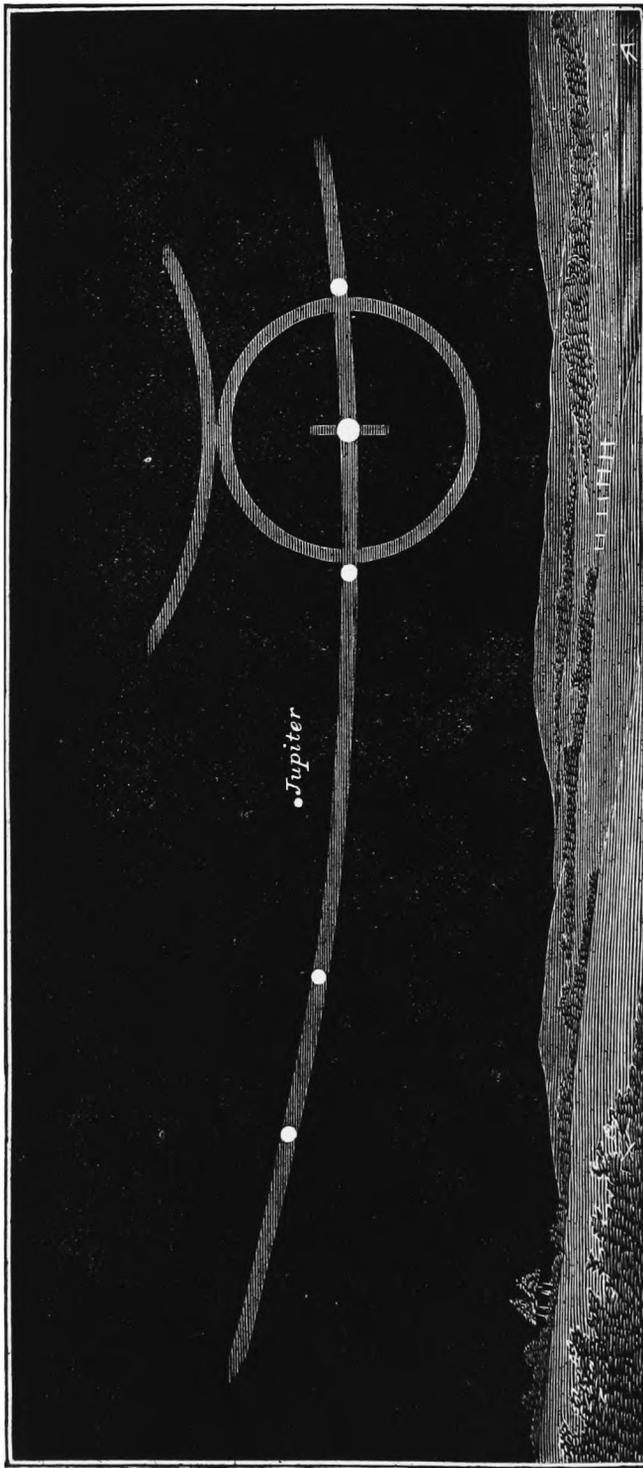
To the Editor of the Meteorological Magazine.

SIR,—At page 120 of the *Meteorological Magazine* for this month, I find it stated by Mr. E. J. Lowe that the thermometer on 28th Aug. at the Highfield House Observatory, reached 94°·6 in the shade and 110°·2 in sunshine. I presume this solar thermometer did not fulfil the requirements of that class of instrument in having *the bulb and one inch of the stem blackened*, and being placed *in vacuo* in a glass tube—the tube being situated *on grass*. On the same day, at Malvern, the maximum shade temperature was 90°, the solar 145°; at my own residence, 87°·8 and 132°·7, these solar thermometers fulfilling the conditions stated. On 29th August the maximum shade temperature by my own thermometer was 62°, a difference in 24 hours of 25°·3.

Faithfully yours,

C. S. BARTER, M.B.

27, *The Paragon*, Bath, 17th Sept., 1869.



PARASELENÆ AND HALOS SEEN AT HAWSKER, NEAR WHITBY, YORKSHIRE, AT 9.45. P.M. OCTOBER 17TH, 1869.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

XLVI.]

NOVEMBER, 1869.

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LUNAR HALO AND PARASELENÆ.

To the Editor of the Meteorological Magazine.

SIR,—The enclosed sketch is a representation of the remarkable halo and mock-moons seen at Hawsker, near Whitby, between 9 and 10 p.m. on Sunday, October 17th. The sketch was taken at about 9.45 p.m. The altitude of the moon was then about 33° above the visible horizon, and of the bright spots on the left of the picture about 38° . The long line appeared to be an arc of an enormous circle, and extended to the left round to the N.E. On the west side it was prolonged but little beyond the halo. The angular distance between the moon and the paraselenæ was $22\frac{1}{2}^\circ$; between the moon and the nearest of the bright spots on the left, 100° . An arc of a larger circle touched the halo above, but was less exactly defined. Exactly twenty-four hours after the appearance of this halo, a fearful gale began to blow, which destroyed my anemometer (Robinson's), and raised one of the heaviest seas known on this coast. In a potatoe field on the cliff edge the rows of earth were completely levelled, as if they had been drifting sand.—I am, Sir, &c.,

F. W. STOW.

Hawsker, Whitby.

To the Editor of the Meteorological Magazine.

SIR,—On Sunday evening, Oct. 17th, at about 8 o'clock, I observed a halo of about 30° diameter round the moon, and on its edge, due west from the moon, a mock moon exactly resembling the full moon when seen through a thin cloud. I have since been told that soon after a similar image of the moon formed at four points on the halo, one at each quadrant. About half-past nine, being abroad again, I saw two such, east and west of the moon; the western paraselene was then fainter than at first, but the eastern one was exceedingly bright and coloured with the prismatic colours; from it a long stream of very white cloud extended eastward as far as, and passing about 5° below, the planet Jupiter. At about half-past 9, the halo and mock moons vanished suddenly and completely; the halo had formed again at half-past 10, but without any remarkable features about it. On Monday

night, about midnight, a very violent storm broke out from the north and north-west.—Yours, &c.,

BENJAMIN STREET.

The Vicarage, Barnetby, Ulooby.

[The lunar phenomena above referred to, and so carefully observed by Mr. Stow, were seen in many parts of the country, but nowhere so well as in Lincolnshire and East Yorkshire.—Ed.]

THE STORM OF WEDNESDAY, SEPTEMBER 29TH.

[For much of the following information we are indebted to cuttings obligingly forwarded by the Rev. T. A. Preston. Such extracts are always most acceptable.—Ed.]

RAMSBURY.—Soon after 9 o'clock in the evening, suddenly, without a moment's warning, and with a peculiar roar, the fury of the storm broke over Ramsbury, against which windows were as nothing. Fragments of glass were borne to the farthest corners of the rooms, and hail-stones of extraordinary size leaped and danced about the floors as though in fiendish glee at the distress of the inhabitants, who, blinded by the lurid glare of the incessant lightning, and deafened by the loud reverberations of the thunder, the crashing of glass, the swift rush of hail on roofs and windows, and the unaccountable roar which resounded above the unearthly din, passed a night which they would fain banish as a dream on the succeeding morning, but which broken windows and flooded houses testified to be only too real. We would mention Crowood (the residence of H. R. Seymour, Esq.), where many hundreds of panes were destroyed, and windows having a southern aspect were riddled as though by swan-shot, as amply demonstrated in Ramsbury Street. It is estimated that 3,000 panes of glass were smashed in Ramsbury alone, and damage done in this way to the extent of £400. Four large elms barred the way on the Marlborough Road, and the destruction to smaller animal life was immense. Additional details will be found in the following graphic letter of A. Batson, Esq.

To the Editor of the Marlborough Times.

SIR,—The series of storms which traversed England on the 29th September from the central south to the north-west, exhibited an intensity of electrical force quite uncommon in these latitudes. The hailstorm at Ramsbury, which broke nearly every pane of glass in its direct line of advance, was preceded by an amount of lightning so frequent and so vivid that it appeared to divide equally the light and the darkness.

The first phenomenon worthy of record was a display of parhelia, seen from Baydon Hill, at a quarter-past 4 p.m. A rather small halo surrounded the sun, containing on each side a mock sun, well defined, and with prismatic colours; these were visible for about twenty minutes. A spot of light which I had previously observed in the north then assumed the same form and colours, and remained for about half-an-hour. At 6 o'clock a portentous cloud, which had rapidly gathered over the sun, began to emit flashes of forked lightning, some of which I estimated to be two miles in length, and the thunder resembled the roar of artillery. Just as the cloud appeared quite close, it receded, and another approached from the east and a third from the south; these also showed the same

remarkable rotatory movements, and all the numerous storms that evening were distinct from each other, and had a peculiar cyclonic action, which showed itself in the fantastic forms of the cloud edges.

At half-past 8 masses of horizontal stratus were predominant; the sheet lightning especially from several centres was quite incessant, and at 9 o'clock the hail broke over Ramsbury without warning and with a peculiar roar, carrying glass and hailstones all over the rooms, in some cases breaking open the shutters. As an instance, out of five consecutive windows in a south front, seven panes only out of sixty remained unbroken. Partridges and small birds were picked up in the fields. The turnips, as well as pears and apples, are much injured.

The hail tract was about a mile and a half broad, passing between Littlecote House and Ramsbury Manor, without doing harm to either, though it tore up four large elms in a space of forty-five yards in the road near the latter, leaving intact close by, a row of white poplars, which would have yielded to half the pressure. Some say the hailstones were as large as pigeon's eggs or penny pieces; the largest show indications of being jagged, and were quite an inch through.

I am your obedient servant,

ALFRED BATSON.

Ramsbury, 5th October, 1869.

LAMBORNE.—This neighbourhood was visited by a severe storm on the evening of Michaelmas Day. The lightning was of the most vivid kind; for a time the flashes were almost continuous, the sky being brilliantly illuminated. There was comparatively little thunder, but several heavy showers fell, including a hailstorm of unusual violence. The latter was remarkably severe at Ashdown Park, killing scores of partridges, a fox, and several hares, though, strange to say, nearly all the glass in Lord Craven's greenhouses escaped damage. As an instance of the extraordinary force of the storm we may mention that a heavy zinc shepherd's house on wheels, in one of Mr. Tilly's fields, was blown right over. Several windows at Park Farm, the residence of Mr. Reading, were smashed to atoms.

MARLBOROUGH.—Before daybreak on Wednesday (Sept. 29th) heavy peals of thunder and vivid lightning, accompanied by rain, passed over the town. The day throughout was sultry, and in the evening there was much lightning, flash following flash with exceeding rapidity, as many as 38 being counted in a minute. The violence of the storm, however, passed by, rather than over the town; no farther distant than Ramsbury Manor, large quantities of glass are broken by the hail, near the Manor gate on the Ramsbury side, two fine elms are thrown and stop the road. In Ramsbury nearly every pane of glass in the direction of the storm is broken, in fact there is hardly a house without broken panes, some houses having scores smashed. This extended to Marrison Hill, where Mr. Waldron lost large quantities of glass. On the 29th there was a storm from 5.5 a.m. till 5.20 a.m., and a second one at 5.30 p.m. This latter was passing over the town till about 6.30 p.m., but the lightning continued almost without intermission till about 11 p.m.—T. A. PRESTON.

DEVIZES.—In Devizes the storm recurred again and again at intervals from six till ten with increasing force, and created great alarm, but no report of loss of life has reached us, though at Chippenham a horse took fright from the lightning, throwing out three children and fracturing the thigh of one of them, a boy of 13. At Calne the thunder and lightning were excessively heavy. At Savernake Station

there was a deluge, the water sweeping through like a mill stream. A dray horse was knocked down while standing in Devizes Green, and laid motionless very nearly half-an-hour. Birmingham, Liverpool, London, Portsmouth, and other places, report fearful storms. At Abingdon 65 flashes were counted in a minute.

ALDBOURNE.—No one who witnessed the terrific storm of thunder, lightning, and hail, which occurred here on Wednesday (Sept. 29th), is ever likely to forget it. The thunder, which was really awful, continued almost uninterruptedly from 6 o'clock till half-past 9; the lightning also was fearful, and the hailstorm, which came on about 9 o'clock, was truly something terrible; people could not hear each other speak for the terrific rush and the noise it made beating on roofs, walls, and windows. Many people had several windows smashed to atoms. Mr. E. Wentworth's house was so flooded that the household were kept up a portion of the night to get rid of the water. The hailstones were immense pieces of ice, rather than the small globules we are accustomed to see, and laid on the ground for hours after in large heaps of ice.

HUNGERFORD.—The tempest of Sept. 29th visited Hopgrass Marsh with great severity. The windows of the cottages, the property of F. L. Popham, Esq., were completely smashed in by the hail, and at Hopgrass Farm great damage was done. The greens were perfectly cut off eight acres of turnips, and the windows of Mr. Booth's house were wrecked on the south side. A chimney was also blown off on to the tiled roof, and a quantity of tiles broken, letting the water completely through the house.

To the Editor of the Meteorological Magazine.

SIR,—On Wednesday, Sept. 29th, our district was visited by a lightning storm of remarkable intensity and duration. I use the somewhat new-fangled term "lightning-storm" advisedly, inasmuch as the frequency and intensity of the lightning was the prominent feature in the storm, while the thunder, even when the storm was passing overhead, was not as loud as I have heard it on many previous occasions.

There was a short storm in the morning, about 8.30 a.m., which passed off in about a quarter of an hour, with a heavy shower of rain, and the day turned out remarkably warm and sultry. At 8.20 p.m. thunder was again heard, and on going out into the open air, I found that the lightning was flashing in S., with distant thunder. This continued for about half-an-hour, when a temporary lull occurred in the storm, and the rain, which had been falling more or less since 8.20, gradually ceased. Soon after 9 o'clock, however, it began to be apparent from the rapidly increasing display of distant lightning in S., that another and more considerable detachment of the storm was coming up from that direction, and the scene from this high elevation soon became one of the most magnificent conceivable. It is scarcely an exaggeration to say, that for two hours, viz., from 9.30 to 11.30 p.m., the lightning was *almost incessant*—frequently more than at the rate

of a flash a second for many consecutive seconds, and with an unusually large proportion of intensely brilliant flashes. Something of the unusual grandeur of the scene may have been due to our high elevation enabling us to take in at one view the discharges from many separate centres of disturbance; but after every allowance for our advantage in this respect, the frequency and intensity of the electric discharges was something astonishing, and reminded me of some of the great storms of 1858 and 1859.

The warmth and calmness of the air, notwithstanding the rain that had fallen in the early part of the evening, contributed much to our enjoyment of this magnificent display. It was not till nearly 11 o'clock, when the weight of the storm passed overhead here, that rain began to fall, and by 11.30 the storm may be considered to have been over, as regards this locality, though lightning was still flashing occasionally in N.E. at midnight.

As regards the direction and course of the storm, it is not very easy to speak decisively. The principal centre of discharge in this district seemed to come up in a S.E. current and to pass off in a S.W. one—thus describing a kind of curve, possibly the result of a conflict between a S.E. and a S.W. current.

There was thunder and lightning again on Thursday, Sept. 30th, about 8 p.m.; some half-a-dozen flashes, with very heavy rain; also, on Sunday, October 2nd, a thunderstorm in W., which lasted about an hour—viz., from 1.30 p.m. to 2.30, and was followed by about an hour's moderate rain. This last storm came up in a W. current, the direction of the wind on the earth being E., as indicated by the weather-cocks, but no movement of air perceptible. From the above account you will see that we have been passing through a period of unusual electrical disturbance, and I have thought you might like to have these few notes to compare with those you will doubtless receive from other quarters.—I am, Sir, yours truly,

GEORGE T. RYVES.

Hollington, Uttoxeter, Oct. 6th, 1869.

THE BRITISH ASSOCIATION AT EXETER.

(Continued from page 134.)

"On New Mean Self-registering Hygrometers," by E. Vivian, F.M.S. The author said that mean results in meteorology were ordinarily deduced from one or more daily observations, but in the rain gauge, evaporation vessel, and certain forms of anemometer, the aggregate elements, however fluctuating, were obtained by cumulative action. The latter of those methods was most certain, and admitted of being more readily reduced into a tabular form for the comparison of the general averages. At a former meeting of the British Association he exhibited a self-registering instrument on the cumulative principle, recording the mean values of the difference between the wet and dry bulb thermometers, and a self-registering maximum and minimum hygrometer. He now produced an improved form of the former instrument, and a

series of curves showing the comparative results of Leslie's hygrometer. It would be seen that the curves differed very widely as regarded each period of 24 hours, but their monthly means were sufficiently uniform to show the approximate accuracy of the old methods during long continuance of observations. That was still more evident from a second table, which extended over the greater portion of two years. The action of the mean self-registering hygrometer depended upon the condensation of the vapour of alcohol in the wet bulb. He had applied this principle to recording the aggregate difference of solar heat in sun and shade, to the duration of rain, the wet bulb being supplied by a funnel into which the rain was received. He now proposed to apply it, in conjunction with an evaporating vessel, to the recording of the actual mean temperature and also as an anemometer and eudiometer.

Mr. Symons well remembered the first exhibition of this instrument at Oxford, and rejoiced to see it in its improved form. He would like such an one to be used at every watering place, and, indeed, it was his earnest wish that the authorities of all the health resorts of this country should erect in clear open spaces similar thermometer stands, mount therein identical instruments, this being one, and record their observations on a uniform system. He was now engaged in conducting certain hygrometric experiments, and, if Mr. Vivian had no objection, he thought the new instrument should be tested. Mr. Vivian said he should be most happy to supply one for the purpose.

"*On the Physical Causes which have produced the Unequal Distribution of Land and Water between the Hemispheres,*" by J. W. Reid. The author endeavoured to show that the cause of the ocean being so much deeper in the southern hemisphere than in the northern is the less atmospheric pressure in the former than in the latter. This was the reason why there was less land in the southern than in the northern, only the mountain tops of the former being visible above the sea as small islands. Mr. Godwin-Austen said he did not think that there was anything novel about the author's theory. Most of the facts had been gone over again and again. The supposed *cause* might really be the *effect*. The Rev. O. Fisher said that there was a similar theory advanced by Adhemar many years since.

"*Experiments with the Captive Balloon,*" by J. Glaisher, F.R.S. The author explained the unavoidable difficulty in ordinary ascents of obtaining satisfactory observations at small altitudes—the balloon darting upwards, so that a height of one or two thousand feet was often reached almost before observations were commenced. He then pointed out that the rate of ascent of the captive balloon and its perfect equability of motion, offered special facilities for supplying the deficient data; so that by employing it he had been enabled materially to complete the investigations continued by the Association during so many years. Various and copious tables of the results of trips with M. Giffard's balloon, formed the basis of the paper, which we believe is to be printed *in extenso* in the volume of the Association. Among other points, reference was made to the strength of wind at great

heights, as compared with that at the earth's surface. Prof. Newton suggested that the curvature generally noticed in the tails of meteors some minutes after their first appearance, was a proof of violent currents at great altitudes.

Mr. Glaisher read the report on "*Luminous Meteors.*" This was the tenth annual report of the Association's Committee appointed to promote the observation of meteors and fire-balls over England and Europe, and for collecting those observations for scientific purposes. It owed its existence to the interest taken in the subject by the late Rev. Baden Powell. Great accession to the knowledge now possessed might be obtained in the course of a few years by more extensive arrangements for this purpose. The great obstacle in this country to the study of these bodies was the frequent intervention of clouds, which was not the case in many parts of the Continent and in America. Large numbers of meteors had been seen during the past year—last November. The observations at Greenwich were much interrupted by the sky being overcast; there were several seen in April and May. The report gave an account of an extraordinary meteor seen in France, in October, which exploded with a detonation louder than any artillery, at, it was considered, a height of sixty miles. Much was said of the extensive observations made in America by Professor Newton and others. The report contained catalogues of all the meteors and aerolites observed. The radiant of the November meteors was well ascertained, but of the August meteors the radiant was not certain. Mr. Glaisher expected much from the body of well-educated observers at Cambridge University, under the training of Mr. Adams. A hope was expressed also that the Association would continue the grant for promoting the observations of the meteors, and gathering facts concerning them.

Dr. A. Neumayer, of Munich, read a paper "*On the recent Fall of an Aerolite at Krähenberg, in the Palatinate.*" On the 5th of May last, at 6.32 p.m., the inhabitants of this village were startled by a terrible noise, like the discharge of heavy ordnance from some point high up in the air, which at the time was perfectly clear. It lasted about two minutes and was followed by a rolling sound like thunder, which ended with a sort of whirring, whistling sound. The people were greatly frightened, and nobody could explain the cause; they saw at length the trees moved by some unaccountable agency, though not a breath of wind was stirring. Two men working in the fields near the village, however, could not be at a loss for an explanation, for they saw a mass of stone fall to the ground, shaking it for a considerable distance. It was found the stone had penetrated the ground to a depth of two feet, which they soon unearthed. It was still warm, but not dangerous to touch. The walls of the hole were perfectly perpendicular. The sound could be heard over a district whose radius was thirty miles. The meteorolite, for such it was soon recognised to be, was carefully removed, and its weight found to be $31\frac{1}{2}$ lbs. Several pieces had been knocked off. It was of a grey colour, small specks of a metallic nature being everywhere visible, and likewise small dis-

coloured particles of a globular form. Subsequent analysis gave the specific gravity, 3.446. It was composed of chromiron, 0.94; magnetic pyrites, 5.72; silica, 43.29; alumina, 0.63; magnesia, 2.01; protoxide of iron, 21.06; soda, 1.03. It is of the class of meteors termed chondrites. This fiery rushing body, though broad daylight, was seen flying through the zenith of a place thirty-five miles south-east of the locality where it fell. The learned professor gave other trigonometrical and astronomical particulars showing the height at which it was seen. When passing through the atmosphere it showed a blueish light, leaving a bright stripe of light long after the body had disappeared. What made the fall of this aërolite specially interesting is the fact that it was possible to determine the radiant point of the shower of meteors to which it evidently belonged. The learned professor said the radiant point of this system was described in the tables of the British Association as being "well defined." He also hoped that some day "we should succeed in finding the comet whose orbit will exhibit elements identical with that of the meteors, placing us in the proud position of being able to state that we have already a particle of that comet in our possession."

Dr. Mann spoke of an aërolite which passed over the colony of Natal, quickly followed by a noise resembling the discharge of a heavy gun; the same aërolite when seen at another place 120 miles from the first, was also and as quickly heard to produce the same noise; the two reports, therefore, he thought, were not explosions, but sounds quickly produced and lost in consequence of the velocity of the mass.

Professor Newton thought the probability was that it gave two separate explosions.

Dr. R. J. Mann, in a communication "*On the Rainfall of Natal*," said that Natal is, practically speaking, a great inclined plane, with low marshes near the coast, and more and more mountainous as the inland parts are reached. The result of this is that, when the warm, steady winds of the summer months reach Natal, laden with vapour from the Indian Ocean, the inclined plane forces the moisture-laden air up into colder regions, where it is condensed, and falls again in heavy rains. Floods often occur near the coast, but not in the interior. On the hills the climate of temperate regions is experienced, and lower down the rich vegetation of sub-tropical climates is found. In consequence of its rich vegetation and its fertility, it is a good place for settlers.

Mr. G. J. Symons pointed out some resemblances between the meteorological phenomena of Britain and Natal.

"*Remarks on Meteorological Reductions, with especial reference to the Element of Vapour.*" Communicated to the Kew Committee, by Balfour Stewart, LL.D., F.R.S.

"It will be desirable to preface the method of reduction herein proposed by a few remarks on the objects contemplated in such reductions. These objects are twofold. In the first place, meteorological reductions may be pursued with the immediate object of acquiring information as to the climate of a place; or, secondly, they may be pursued with the immediate object of extending our

knowledge of meteorology, regarded as a physical science. Thus, for instance, a certain kind of reduction might be imagined to be of immediate practical benefit in determining whether a certain place might suit a certain class of persons or a certain class of plants, but yet it might not materially advance our knowledge of meteorology regarded as a physical science. But, on the other hand, all observations tending to advance our knowledge of meteorology are of undoubted practical benefit. The amount of vapour present in the air is, without doubt, a very important element of climate, inasmuch as this affects in a marked manner the skin of the human body and the leaves of plants; but I am not aware that it has yet been determined by the joint action of naturalists and meteorologists what is the precise physical function which expresses proportionally the effect of moisture upon animal and vegetable life. Is it simply relative humidity? or does not a given relative humidity at a high temperature have a different effect from that which it has when the temperature is low? There is, in fact, an absence of information as to the precise physical formula which is wished by physiologists as expressing the effect of moisture upon organic life. On the other hand, physicists may be presumed to confine themselves to meteorology regarded as a physical science. It is in this latter aspect that I proceed to discuss the question."

"Regarding meteorology, therefore, as a physical science, it is one of our objects to ascertain the distribution and laws of motion of the dry and wet components of our atmosphere; and it cannot be denied that we are at the present moment in very great ignorance of these laws. With respect to the motion of our atmosphere, it cannot be anticipated that we shall ever possess the same sort of knowledge which astronomy gives us regarding the motions of the heavenly bodies; for in the latter case the identity of the object is not lost sight of, while in the former case it is clearly impossible to ascertain the motions of individual particles of air. Our inquiries into the distribution and motion of the elements of our atmosphere must therefore be pursued by that method which enables us to ascertain the distribution and motion of any other substance or product with the individual components of which we find it impracticable to deal. Suppose, for instance, we wish to ascertain the wealth of our country in grain or in spirits, and the distribution of this commodity over the earth's surface. We should, first of all, begin by taking the stock of the commodity corresponding to a given date; we should next keep a strict account of all the imports and exports of the material, as well as of its home production and home consumption. Now, if we have taken stock properly at first, and if our account of the imports, the exports, the production, and the consumption of our material is accurate and properly kept, it will obviously be unnecessary to take stock a second time. But if these accounts are not kept with sufficient accuracy, or if we suspect that our material leaves us by some secret channel, which we wish to trace, it will clearly be necessary to take stock frequently; and thus a comparison of our various accounts may enable us to detect the place and circumstances of that secret transit which has hitherto escaped our observation. Applying these principles to the vapour of our atmosphere, what we wish to know is the amount of the material present at any one station at any moment, and also the laws of its motion. It would appear that the best way of measuring the amount present at any moment is by ascertaining the mass of vapour present in a cubic foot of air, mass and volume being fundamental physical conceptions.

"Next, with regard to the motion of the atmosphere, including its vaporous constituent, the method of co-ordinates suggested by Dr. Robinson would appear to be the natural way of arriving at this. Let us set up at a station two imaginary apertures, one facing north and south, and the other east and west, and gauge the mass of dry air and the mass of moisture that pass these openings in one hour; we shall by this means get the nearest attainable approach to the elements of motion of the atmospheric constituents from hour to hour. We shall not, however, obtain by this means a complete account of this motion, for we have at present no means of measuring its vertical component. This vertical component corresponds in fact to the secret channel in the illustration given above, which we must endeavour to detect by some indirect method. Another

thing that ought to be determined is the production or consumption of the vaporous element of our atmosphere as it passes from place to place. This might be done could we keep an accurate account of the evaporation and the precipitation, the two processes by which this element is recruited and consumed. This would, however, be a very difficult observation.

“Let us now recapitulate what information regarding moisture we can obtain from such complete meteorological observations as are at present made. We have—1.—The mass of vapour actually present at a station from hour to hour. 2.—The mass that passes a station in one hour, going east and west. 3.—The mass that passes a station in one hour, going north and south. There is wanting: 4.—The vertical component of the motion of vapour. 5.—Its production or consumption as it passes from place to place. These deficiencies may, however, be to some extent overcome by the following considerations: First, the atmosphere moves as a whole when it moves, the dry and moist air moving together, *secondly*, dry air is neither capable of production or of consumption, but always remains constant in amount. To illustrate this part of the subject, let it be supposed we wish to investigate the vertical motion of the atmosphere at a certain station. Make this station the imaginary centre of a circle, the circumference of which may be supposed to be studded with other stations at sufficiently frequent intervals, so that we can tell hour by hour, how much dry air passes in towards the centre of the circle through its circumference, and also how much passes out. Let us suppose that more is passing in than is passing out, or that the imports into the area of the circle are greater than the exports out of it. Now the dry air that passes in is incapable of production or of consumption and hence the stock of the material at the central station, and in the area generally, ought to be on the increase, since we have imagined the imports to be greater than the exports. If, however, we ascertain from actual observation that the stock of dry air is diminishing, instead of increasing, we may be sure that some is carried off by an upper current, which of course carries the moisture with the dry air. So much for the vertical component; and in the next place, with regard to the production or consumption of aqueous vapour as it passes from place to place.

“Our consideration has hitherto been confined to *quantity*; let us now define what is meant by the *hygrometric quality* of the air. It may be represented by the following quotient:—

$$\frac{\text{mass of vapour in a cubic foot}}{\text{mass of dry air in a cubic foot}}$$

Now this quotient can only alter by evaporation, by precipitation, or by mixture. This hygrometric quality of the air may perhaps be considered as a quality sufficiently constant to aid us in tracing the actual motion of air, just as we may make use of the element of saltiness to trace the actual path of an oceanic current. But besides this aid, we may make use of it to enable us to tell the precipitation or evaporation. For instance, a very damp air, in passing over a very dry country may be supposed to emerge less damp, having its hygrometric quality changed; or a very dry air, in passing over a very damp country, may be supposed to emerge less dry, having its quality changed in the opposite direction. Thus, by actual observation of the quality of the air at the time of its reaching some particular tract of land or ocean, and at the time of its leaving it, we may possibly get much better observations of what goes on in the country, as far as this particular research is concerned, than if it were studded with gauges.

“I should therefore suggest that meteorological observations should, by a system of reduction, be made to show—(1) The mass of dry air and of moisture in one cubic foot actually present at each station from hour to hour. (2) The mass of dry air and of moisture that passes each station, hour by hour, in two lines of direction at right angles to each other, namely, north and south and east and west. When these hourly elements are obtained, they might for seasonal changes be reduced after the method of five-day means, or for the investigation of abrupt changes of weather, such as storms, they might be utilized in some other way. Retaining the belief that meteorology ought to be treated as much as

possible with the view, in the first place, of determining the actual motion of our atmosphere, and, in the next place, of assigning the cause of these, it is no doubt the greater movements of the atmosphere that will be indicated by five-day means. It ought, however, to be remarked that the observations at any station are subject to the influence of locality, none probably more so than those of wind. It would appear that this influence ought to be eliminated before we can make any trustworthy *quantitative* deductions regarding the greater movements of our atmosphere. I should however imagine that the *quality* of the air, as herein indicated, may be made of immediate use, in the study of storms. It has been suggested by Mr. Meldrum, who expresses his concurrence with the above remarks, that in addition to the five-day means indicated above, there might be given a brief epitome of the weather. Thus, for instance:—‘The wind blew from the N.E. at Kew from January 1st, 1 A.M., to January 4th, 3 P.M., in all 86 hours, at the average velocity of 16 miles an hour, with an average pressure of 30 inches, a temperature of 40 deg. F., and an average hygrometric quality represented by .075.’ The same remarks had previously occurred to myself, and Mr. Airy also has recently suggested the study of the meteorological phenomena of those periods during which the wind blows in the same direction.”

FINE METEOR ON OCTOBER 11TH.

To the Editor of the Meteorological Magazine.

SIR,—On the evening of the 11th inst., at 5.39 p.m., I saw, with a friend of mine, a brilliant meteor, at Lyneham, near Calne, Wilts. It was due north from us and radiated from the zenith. Its motion was slow, and it descended almost perpendicularly having a slight inclination westward, and disappeared at an altitude of about 30°. The daylight, no doubt, detracted from its brilliancy, but it left behind it a train of about 10° in length, and it appeared to burst—remaining stationary for a second—and then continued its course for about a degree (but considerably diminishing in size and leaving but a short train) when it disappeared.

My friend and I thought it could not be far distant, as it appeared to pass between us and a distant cloud, but as I see in the *Times* it was seen at Darlington and Sheffield at the same moment, I conclude we were mistaken.

The colour of the meteor was a pale yellow, and its size nearly equal to three times that of Jupiter at his greatest brilliancy. I hope others of your correspondents have witnessed it and will give us their account of it.—Faithfully yours,

M. F. W.

[This meteor was also observed at Killingholme and Llandudno—see p. 159.—Ed.]

METEORIC STONE SHOWER AT WOLVERHAMPTON (?)

To the Editor of the Meteorological Magazine.

SIR,—In your last number you asked for an explanation of a reported fall of meteoric stones at Wolverhampton in May last. I remember seeing the report in the local newspapers, but my great repugnance to everything “sensational” connected with scientific observation prevented my making any particular investigation of the matter, especially as that was by no means the first phenomenon of the kind *reported* to have occurred in this locality. The fact is that the “black country” is infested with those pests of meteorological science commonly called weather prophets, and as they have not been

very successful in their predictions of late, they would appear to have turned their attention to the discovery of meteorites, large hailstones, and such like wonderful phenomena. This is the only explanation I, at least, can offer of the reported fall of meteorites referred to by you, and I am confirmed in my view of the case by the fact that I have, for a long period set "traps" of various kinds, such as a sheet and a large tin pan constantly exposed in my garden, for the express purpose of catching stray meteorites, but hitherto without success. The fact of the so-called meteorites being found *only* on paved roads, and never, so far as I am aware, in private grounds or yards at the back of houses certainly affords conclusive evidence to my mind that their origin is *not* an aerial one.

JOHN THRUSTANS, F.M.S.

Wolverhampton, Oct. 20th, 1869.

THE HEAT IN AUGUST.

To the Editor of the Meteorological Magazine.

SIR,—Your correspondent, Mr. Barter, has raised a question about the heat-wave of August 25—28. It may interest some of your readers to know the heat at 4 ft. in sun and air, kindly communicated to me by the observers at several stations, who have adopted the system of observing the solar heat which I have ventured to recommend. The close coincidence in the temperatures registered at stations very widely separated is remarkable. The extremes registered in sun varied only from 137° to 127° and in air from 77°·2 to 91°·1. The stations are arranged according to latitude, and the three hottest days at each station selected.—Yours, &c.,

F. W. STOW.

Hawsker, Whitby.

	Aug.	Sun.	Mean ditto.	Air.	Mean ditto.	Amount of Solar Radiation.	Mean ditto.
Worthing	26	123·5	...	74·5	...	49·0	} 49·1
	27	125·3	125·3	77·2	76·2	48·1	
	28	127·0	...	76·7	...	50·3	
Strathfield Turgiss	26	133·9	...	88·7	...	45·2	} 45·6
	27	132·2	133·5	87·2	87·9	45·0	
	28	134·5	...	87·8	...	46·7	
Bannerdown House, nr. Bath	26	135·0	...	87·0	...	48·0	} 49·0
	27	137·0	136·3	88·0	87·3	49·0	
	28	137·0	...	87·0	...	50·0	
Camden Square	26	124·0	...	87·5	...	36·5	} 35·3
	27	117·0	122·7	85·7	87·4	31·3	
	28	127·0	...	89·0	...	38·0	
Malvern	26	129·0	...	87·8	...	41·2	} 42·3
	27	133·0	131·6	90·0	89·3	43·0	
	28	132·8	...	90·0	...	42·8	
Wisbech	26	129·0	...	86·3	...	42·7	} 43·9
	27	131·2	130·6	86·2	86·7	45·0	
	28	131·6	...	87·5	..	44·1	
Huddersfield ...	25	116·0	...	82·0	...	34·0	} 37·7
	27	116·0	122·0	82·0	84·3	34·0	
	28	134·0	...	89·0	...	45·0	
Ripon	25	130·0	...	86·0	...	44·0	} 39·6
	26	131·0	128·0	91·1	88·4	39·9	
	28	123·2	...	88·2	...	35·0	

OCTOBER, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which $\frac{1}{4}$ or more fell.	Max.		Min.		
				Dpth	Date		Deg.	Date	Deg.	Date	
		inches	inches.	in.							
I.	Camden Town	1·87	— ·72	·71	18	14	74·6	8	26·6	28	7
II.	Staplehurst (Linton Park) ...	2·79	— ·31	·83	16	12	69·0	9	25·0	28	6
III.	Selborne (The Wakes).....	2·21	— 2·00	·98	22	9	70·0	8 & 9	27·0	28	8
IV.	Hitchin	1·07	— 1·48	·51	18	10	66·0	9*	29·0	27	3
V.	Banbury	1·24	— 1·19	·32	18	10	70·0	9	27·0	28	7
VI.	Bury St. Edmunds (Culford). ..	2·78	+ ·07	·75	2	13	69·0	9	26·0	26†	5
VII.	Bridport	2·03	— 2·00	·44	18	13	75·5	9	26·0	20	3
VIII.	Barnstaple	4·76	+ ·64	·82	17	20	...	...	...	...	...
IX.	Bodmin	3·76	— 1·56	·68	17	23	75·0	22	38·0	20‡	1
X.	Cirencester	2·00	— 1·49	·77	18	11	...	...	...	...	...
XI.	Shifnall (Haughton Hall) ...	1·59	— ·65	·39	29	14	68·0	10	25·0	20	3
XII.	Tenbury (Orleton)	2·06	— 1·17	·46	1	15	73·2	9	29·8	20	3
XIII.	Leicester (Wigston)	·75	— 1·95	·22	30	7	75·0	9, 11	25·0	27	4
XIV.	Boston	1·38	— ·74	·48	18	16	70·6	11	29·0	27	3
XV.	Grimsbury (Killingholme) ...	2·09	— ..	·41	18	22	68·0	11	30·0	27§	2
XVI.	Derby	1·10	— 1·74	·27	17	12	71·0	9, 11	29·0	27§	3
XVII.	Manchester	3·12	— ·69	·47	14	19	75·0	9	29·0	20†	6
XVIII.	York	1·50	— 1·02	·23	28	19	70·0	9	28·0	29	4
XIX.	Skipton (Arncliffe)	3·31	— 3·35	·91	17	14	69·0	10	24·0	27	9
XX.	North Shields	2·81	— ·47	·86	28	18	69·0	9	29·0	27	3
XXI.	Borrowdale (Seathwaite).....	9·95	— 6·37	2·19	13	19	...	...	...	...	...
XXII.	Cardiff (Town Hall).....	3·22	— ..	·70	17	16	...	...	...	...	...
XXIII.	Haverfordwest	3·73	— 1·46	·62	17	14	71·0	9	36·5	26†	...
XXIV.	Rhayader (Cefnfaes).....	2·70	— 2·90	·95	17	14	74·0	...	29·0	26†	...
XXV.	Llandudno	2·75	— 1·21	·47	16	15	75·3	9	36·0	27	...
XXVI.	Dumfries	1·86	— 3·06	·25	3	18	65·5	10	26·0	20	4
XXVII.	Hawick (Silverbut Hall)	1·94	— ..	·65	1	15	...	...	...	...	0
XXVIII.	Ayr (Auchendrane House) ...	2·95	— 2·00	·36	25	20	71·0	10	26·0	20	8
XXIX.	Castle Toward	2·03	— 3·72	·39	15	17	67·0	10	27·0	28	7
XXX.	Leven (Nookton)	2·26	— 1·49	·57	1	15	67·0	9	29·0	20†	7
XXXI.	Stirling (Deanston)	2·72	— 2·19	1·08	1	13	65·2	9	25·7	20	8
XXXII.	Logierait	3·29	— ..	1·44	1	10	...	...	...	...	...
XXXIII.	Ballater	5·65	— ..	1·80	16	18	74·3	10	26·5	27	7
XXXIV.	Aberdeen	6·16	— ..	1·77	16	23	69·6	8	29·9	27	7
XXXV.	Inverness (Culloden)	3·31	— ..	1·25	16	13	67·7	10	29·8	27	3
XXXVI.	Fort William .....	...	— ..	...	...	...	...	...	...	...	...
XXXVII.	Portree	7·52	— 3·26	1·62	15	25	...	...	...	...	...
XXXVIII.	Loch Broom	5·65	— ..	·90	15	23	...	...	...	...	...
XXXIX.	Helmsdale	4·16	— ..	...	...	...	...	...	...	...	...
XL.	Sandwick	3·33	— 1·59	·80	29	24	62·9	10	28·3	27	4
XLI.	Cork	·67	— ..	·20	18	12	...	...	...	...	...
XLII.	Waterford	·84	— 3·56	·17	1	16	65·0	9, 10	36·0	20	...
XLIII.	Killaloe	1·52	— 3·50	·39	15	18	72·0	9	33·0	20	0
XLIV.	Portarlington	2·68	— 2·45	1·32	1	23	71·0	9	34·5	16	...
XLV.	Monkstown	1·31	— 2·61	·40	7	10	72·0	8	34·0	17	...
XLVI.	Galway	1·67	— ..	·38	11	12	65·0	9	32·0	19	...
XLVII.	Bunninadden (Doo Castle) ...	2·34	— ..	·51	17	23	65·0	8	33·0	18	0
XLVIII.	Bawnboy (Owendoon)	1·45	— ..	·35	17	17	73·0	9	34·0	16||	0
XLIX.	Waringstown	1·46	— ..	·23	17	15	74·0	10	33·0	19	0
L.	Strabane (Leckpatrick)	2·36	— ..	·50	17	24	71·0	9	30·0	17¶	7

* And 11 & 12. † And 27. ‡ And 29. § And 28. || And 19, 26, & 27. ¶ And 19, 27, & 28.
 + 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 Hail; S for Snow.

ENGLAND.

CAMDEN TOWN.—Ice nearly a quarter of an inch thick on 20th; S at 3.5 p.m. on 27th.

LINTON PARK, STAPLEHURST.—First half of month very mild and fine, with heavy R but no T on the 16th; the latter part changeable, with sharp frosts on the 27th and 28th, and a fall of S (not sleet) amounting to .03 in. of R on the last named day, gave a wintry appearance to the landscape; fogs frequent; no high winds, those most prevalent were W. and N.

SELBORNE.—Fogs on 4th, 6th, 9th, and 12th; ground covered with S on the 27th, a little also on the morning of 28th; sleet on 29th; bright aurora at 9 p.m. on 6th, and a faint one on 30th N. to W.; very stormy with high wind from S.W. on 16th; much wind, S.W. to N.W., on 17th, and the same on 18th. Mean max. of the month 55.4, mean min. 41.3; average min. of last five days only 30.4.

HITCHIN.—The highest and lowest temps. in October since 1859.

BANBURY.—Fog on 4th, 5th, 9th, and 10th; slight H on 17th; S on 26th.

CULFORD.—Heavy fogs on 5th and 6th; very high winds on the 18th and 19th accompanied by R and, on the latter day, by S; S to the depth of four or five ins. fell on the 27th and 28th, and on the nights of 26th and 27th the ther. fell to 26°, this depression, with a large amount of atmospheric moisture, has, as might have been expected, made sad havoc with vegetation in any degree tender, and the apple trees and even many forest trees and hedgerows present the unusual appearance of brown and withered foliage adhering firmly to the branches—the result of the foliage being destroyed by frost before the ripening process had been completed.

BRIDPORT.—Ten days early in the month very fine and unusually hot; bar. did not alter from 4th to 12th, inclusive; northerly gale on 18th, and on 27th and 28th slight S storms. Saw the last of the swallows on the 26th.

BODMIN.—The greatest heat ever registered here in October on the 9th, viz., 75°. Max. difference of wet and dry bulb 9° on 9th; average difference 2°7.

CIRENCESTER.—A very dry month; great heat (59° at 8 a.m. on 11th and 12th) following the copious rains of September has produced much spring-like grass and some spring flowers; ground covered with S on 27th, which melted, and was again covered by S on the 28th.

HAUGHTON HALL, SHIFFNAL.—A month of extremes of temp.; fog almost every morning till the 11th with high temp.; average of day=55°8, average of night 42°0. The wind, up to 12th, from S.E., to 16th, S.W., and the rest of month N. and N.W.; stormy on 16th, 19th, and 27th; S on night of 26th, and bitterly cold wind from N.W. on 27th and 28th—the leaves fell without attaining their autumnal tints; dahlias, at length, cut down on the 20th by the severe frost of the previous night. Fine iridescent double *halo* round the moon on the night of the 15th; red admiral butterflies abound, 20 at a time, and a few tortoiseshell, but no white ones on 8th; flocks of fieldfares seen on 21st, and swallows (*H. rustica*) still seen at the end of month; fungi of great varieties about on 13th. Damsons an average crop, apples moderate, pears more abundant, and holly loaded with berries.

WIGSTON.—The dryness of the month has been very remarkable, being little more than a quarter of the average; the temp. of the first 12 days was greater than I have any record of for so long a period in October, the mean max. being 68°; the latter part of the month the mean max. was only 50°, this low temp. was accompanied by very high searching winds; no S in this locality.

BOSTON.—The month was ushered in by fine weather, with autumnal mists in the early mornings; a fierce gale from the N. set in on the 16th, and continued during the 17th and 18th; there was serious loss of life occasioned by shipwrecks along the Lincolnshire coast, and many fine old trees uprooted by the violence of the wind; the cold was very intense; a vessel of water on my lawn was frozen over on the mornings of the 17th and 18th with ice of an inch in thickness. A heavy fall of S on the night of the 19th, and, in the Wold district, this was

drifted in some places to the depth of two or three feet ; S also fell on the 27th and 28th ; vivid L was seen on the 26th and 27th.

KILLINGHOLME.—The weather very mild till the 13th, when a decided change took place ; many vessels on shore in the Humber and at its mouth on the 19th. A few days of fine weather occurred between the 20th and 25th ; on the last named day very severe weather set in, heralded by loud roaring of the German Ocean on the night of the 24th. More woodcocks than usual this season ; does this arise from severe weather in the north of Europe ? thrush singing on the 11th ; golden plover seen on same day ; grey crows seen on 13th, and sea gulls inland ; peewits flying inland, which I take to be a sign of fine weather, on 22nd ; fieldfares arrived on the 25th ; stormy night on 25th. Ball of fire fell in N. W. at 5.30 p.m. on 11th ; paraselenæ seen in this neighbourhood on 17th ; radiant cirri like auroræ in N. E. at noon on 31st.

DERBY.—The first half of the month was unusually warm, reaching 71° on several occasions, and on one not going below 59° at night ; the wind changed about the 19th from W. to northerly direction, and was followed by a temp. lower than is at all usual at this time of the year.

MANCHESTER.—T S on 3rd.

ARNcliffe.—Last half of month unusually cold and stormy ; wind, E. and N. E.

NORTH SHIELDS.—S on 19th, 27th and 28th ; auroræ on 14th, 23rd, and 25th.

W A L E S.

HAVERFORDWEST.—Mild and damp the first 3 days ; very fine calm weather till the 14th, the weather then became stormy, squally, and wet the remainder of the month, with the exception of a few days which were cold and stormy, with H, T, and sheet L ; wind during the latter half of month from N. N. W.

CEFNFAES.—The month generally fine ; prevailing winds N. W. ; heavy S on the hills on the 26th and 27th.

LIANDUDNO.—S on the distant hills on 17th to 20th, and again 27th to 29th ; on 11th at 5.40 p.m. (being daylight) a beautiful meteor of an orange colour tinged with green was seen in N. E., its direction was from the zenith towards the horizon slanting from E. to N., and it disappeared behind a few clouds ; no explosion or noise heard.

S C O T L A N D.

DUMFRIES.—The weather has been variable, and the latter half frequently cold, with keen frost on several nights and bitter cold N. winds. In the beginning of the month the country looked very fresh and green ; to the close the woods getting divested of their foliage by frost and keen blasts ; S on hills on 14th, 18th, and 26th.

HAWICK.—With the exception of the 19th, 25th, 26th, 27th, and 28th, which were rendered bitterly cold by the strong and very keen frosty winds, the month has been a most remarkably mild one ; on the morning of the 9th the shrubs and trees were clothed all over with a very pretty network of spiders' webs, which soon disappeared when the sun rose ; on the 20th great flocks of fieldfares were seen flying in a westerly direction. The pastures which looked so very green up to the 19th have now a winter-like appearance.

AUCHENDRANE.—The bar. both as to pressure and range was high, but highest in the latter half of October ; on the other hand, the heat, rainfall, and evaporation were all greatest in the first half of the month. An atmosphere with a temp. above the mean of October and generally near saturation increased the number of rainy days by drizzling R, but left the rainfall much below the average, and although the equatorial winds equalled in frequency the polar winds and calms both together, and several severe gales passed over this district, particularly about the 16th and 23rd from N., the force of the wind per square foot did not much exceed the mean ; splendid auroral arch on evening of 25th.

CASTLE TOWARD.—On 22nd, fine meteor at 8.10 p.m. ; on 25th, a fine luminous arch from E. to W. along the galaxy or milky way, which continued from 8 to 9.15 p.m. Month mild, with comparatively high temp. up to the 12th, when we had H showers with slight frost ; S appeared on the hills on the 15th, but it was not till the 19th that bedding-out plants in the flower garden and ribbon borders were killed by the frost.

DEANSTON.—On the 1st a severe gale from the N.E. and much R; fair till the 11th; some T and L on 10th; S on hills on 16th, with gale from N; hard frosts on 17th and 25th, with fine auroral arch N.E. to S.W.; severe cold gale of wind with S on the hills on the 26th, 27th, and 28th; very mild on 29th.

LOGIERAIT.—On the whole a fine month; several strong gales, keen frosts, and a slight covering of S on 24th and 25th; brilliant aurora on night of 25th.

BALLATER.—The early part of month dry and fine, remainder stormy and wet, the total rainfall being 2 inches above the mean of 9 years; two distinct S storms, commencing on the 17th and the 26th; aurora on 6th, and luminous belt from W. to E. on 25th; temp. 1° above the mean of the month during last 6 years.

ABERDEEN.—A month of extraordinary weather; not so severe a storm in October for many years. From the 16th to the end of the month the weather was terribly severe; great floods on the 16th. Still some grain out in the upland districts. Frequent aurora; rainfall 3·17 above the mean of previous 13 years; 3 inches of S on grass at 9 p.m. on 27th; 16th was a terrible day—gale from N.E., T and L, and very heavy R, 2·83 fell between 0 a.m. and 5 p.m.

PORTREE.—From the 1st to 11th calm and mild, and very backward for gathering in the crops; from the 11th to the close of the month very stormy, squalls, frost, sleet, S, R, and very heavy gales, which have retarded the harvest. This month, contrary to expectation, has been very unfavorable for the husbandman, and the consequence is that a great portion of the corn crop is still out and in bad condition; this month has not, as usual, proved itself the Highlander's harvest friend.

LOCHBROOM.—The first week in October continued fine like the last two days of September, but on the 7th we had a change, then two nice days, but from the 10th to the end, without intermission or mitigation, it has been the most stormy, wild, wintry, and disastrous October ever remembered in this county; a large portion of the crop is yet out, and much of what is ingathered is in an unsafe state; all the potatoes remain in the ground.

SANDWICK.—As last month was the wettest September during the whole time of my observations, so this has been the most stormy and severe October; the anemometer marked 17,560 miles, or 4,718 more than the average of the last 8 years; the ground was covered with S from 16th to 19th and 26th to 28th, much injury was thus done to the grain crop, which was not cut and is not yet gathered in, while most of the potatoes are still in the ground. Frequent aurora. Although we were excepted from the violent gales that swept over England in September, we have been amply compensated by those in October, being very heavy on 13th, 14th, 17th, and 25th to 28th, about N.W. each time, and being 50 or more miles an hour during part of each day.

I R E L A N D.

KILLALOE.—Hardly any sun. Last August had the least rainfall of any August in 24 years, last September the greatest fall for September, and this October the least for October in the same period, the nearest to it being 1·89 in October, 1856.

DOO CASTLE.—A prevalence of northerly winds lowered the temp., and more or less R during their continuance has been the consequence; it rained on every day from the 9th; a gale with heavy R on the 16th. Potatoe digging has progressed but slowly and large tracts are yet unlifted; it is computed that at least one-third the produce has rotted.

OWENDOON.—Frosts on 25th and 26th, and S on mountains on 16th, 18th, & 26th.

WARINGSTOWN.—This month has been dry, and favourable to the farmer; we had a week of intensely cold weather from the 23rd, but on the whole the temp. was high as usual, and we have had no frost sufficient to kill the dahlias, though there was hoar frost on the grass on several nights.

LECKPATRICK.—Fine till 13th, when it became cold and wet. On 10th max. and min. in shade=71° and 53°, on the 14th only 50° and 34°, the means being respectively 62° and 42°, or 20° difference in 3 days.

NOTE.

Several important articles are crowded out of this number; that for next month will be twice the usual size, but will be issued at the regular price.

SYMONS'S
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XLVII.]

DECEMBER, 1869.

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TRUE TIME: HOW TO GET IT AND HOW TO KEEP IT.

THE extreme inconsistency exhibited by the numerous accounts of the meteor, which we publish and comment upon elsewhere, must plead our excuse, if any be needed, for referring to horological matters in a publication devoted to meteorology; but many cases will occur to observers in which correctness of time is of the first importance; rate of progress of earthquake shocks, and particular gusts of wind, identity of luminous meteors, and a score of other facts lose all their value if some clocks are right and some are wrong—and the majority are wrong, more or less. Nor is this much to be wondered at, for there is hardly a town in England in which two watchmakers (*watch-menders* is a more proper term) have shops with so called “regulators” conspicuously placed therein and marked on the dial “Greenwich Mean Time,” which said regulators will not differ by *several minutes*. We willingly exclude some few, who, by the equipment of small observatories and other means, secure accuracy worthy of high praise, and where one such firm exists in a town, the class of shops to which we refer generally copy them, and oftentimes secure the credit. We write of the majority, and recognise a few honourable exceptions. Even in London, where several clocks are actually controlled from Greenwich, errors of many minutes are by no means rare; and in country towns matters are worse. Hence it is clear, either that there is some great difficulty in “keeping the clock right,” or that the very people whose business character ought to be imperilled by themselves, of all people, not knowing “what’s o’clock,” must be excessively negligent. We incline to the latter opinion because telegraphic communication has now been extended to most towns, and an approximation to true time may generally be obtained from the telegraph clerks. If therefore the provincial tradesmen neglect so simple a mode of keeping near the mark, we cannot acquit them of negligence. But with private observers living at a distance from telegraph stations, and communication with centres of population, the case is different; they must fall back upon the time-piece in the sky, but how are they to read it—by the sun alone? or by any of the glittering host which may be convenient? surely by the latter—but how?

Here we cross the Rubicon from meteorology to astronomy, and in our further consideration of the question, we shall doubtless exhibit want of familiarity with astronomical matters, but if by so doing we induce those who are therewith connected to come to the help of those who need it, our notice will not be in vain. Let us premise that what we conceive to be required is some apparatus which shall be (1) very simple (both in construction, and in the mode of observing), (2) very durable, (3) low in price, £2. or £3., (4) which shall give results, not liable to greater error than 10 seconds, (5) which shall be available for taking time from sun, moon, or stars. From the above it will be evident that we by no means contemplate advising our meteorological readers to engage in costly or difficult astronomical observations, or that we wish for extreme accuracy, and we venture to think the object is one not utterly beneath the notice of our astronomical readers.

What means at present exist? The sun-dial, oldest of all chronometers, and one which well made, well and firmly fixed, is not to be despised. Price lists before us indicate that a first-rate sun-dial is charged several guineas, and we never saw one which could be read to anything like the accuracy we mention. Then come dipteroscopes, a considerable improvement on sun-dials, but in their best and only accurate form also dear. Transit circles have hitherto never been quoted under £10. or £20., so they too must be very much simplified, or excluded from consideration. Jupiter's Satellites are very handy, and as ordinary telescopes, such as most observers possess, will show their phenomena, they involve no outlay, but for several months in each year they are not available.

What, then, is anyone to do who wishes to keep his clock right? We fear Mr. Warner's book*, recently published, will not tell him, for he expressly states that he has not yet decided on the best form of telescope, but he proposes when that is determined, that it should be rigidly fixed to a perfectly solid pillar, and that it should have wires somewhat like Cary's Portable Transit, but with an improvement, viz., two vertical wires instead of one, a wooden case to shut over and protect it from weather. There is no intimation of cost, and we venture to think the instrument is inferior to the portable transit. The author has evidently taken very great pains in preparing the tables appended to the work, which are designed as a substitute for the Nautical Almanack, but we confess we prefer our old friend, the Nautical.

In conclusion, we venture to hope that some of our astronomical readers, some optician, or some horologist, will tell us how simply, easily, and cheaply to get true time and to keep it.

* *How to keep the Clock right.* By T. WARNER. Cloth, 8vo, 77 pages. Williams and Norgate.

THE FINE METEOR OF NOVEMBER 6TH, 1869.

ON the present occasion we give an unusually long series of accounts of this meteor, together with a few remarks on the time of its appearance, on its colour, and on its tail; in a subsequent number we hope to give details of its path. The extracts are mostly from *The Times*, *Standard*, *Nature*, *Scientific Opinion*, and the *Western Morning News*.

First as to its time:—fifteen reports employ terms of latitude, twelve say “about,” and three “a few minutes before,” &c.; the average of these is not of much importance, but assuming “a few minutes” to be 5 minutes, it gives 6.52. Those stated with some precision, and we give the authorities, are—

- 6.45—*Bristol*. (The Secretary of the Observing Astronomical Society.)
Torquay. (Newspaper par.)
 ” *La Morna*. (“G. M. T.,” and W. Pengelly, F.R.S.)
 6.50—*Wimborne*. (Station clock.)
Chacewater. (Newspaper par.)
 6.50 or 6.51—*Wincanton*. (Station clock.)
 6.55—*Penzance*, *Falmouth*, and *Redruth*. (Newspaper pars.)
Flax Bourton, Bristol. (J. A. Caley, C.E.)
Rothbury, Northumberland. (Sir W. G. Armstrong, F.R.S.,
 and “G. M. T.” within one minute.)

After rejecting all the most discordant reports, and selecting eleven out of twenty-seven, we have still *ten minutes* between those of Fellows of the Royal Society. Our readers will see by reference to the letters the evidence in support of the several statements, which afford a striking proof of the want we have stated on another page.

There is no uncertainty as to the colour of the meteor; it was a vivid bluish white; the only noteworthy fact is the discordant report from Birmingham, evidently due to the “murky atmosphere” there prevailing.

- Jersey*—Dazzling white.
Helston—Intense blue.
Penzance—Splendid blue.
Chacewater—Almost white, but slightly blue.
Padstow—Pale blue.
Wimborne—Dazzling purple, and blueish.]
Highclere—Blue.
Ashley Road, Bristol—Blue.
Narberth—Beautiful white.
Birmingham—Yellowish red, then lurid red, then vivid green,
 violet, and orange.
Rothbury—Blueish white.
Anstruther—Blue.

As to the tail or trail, the best indication is afforded by the various letters, supplemented by the annexed sketches, for which we are indebted to Mr. Townshend Hall, F.G.S., of Barnstaple.

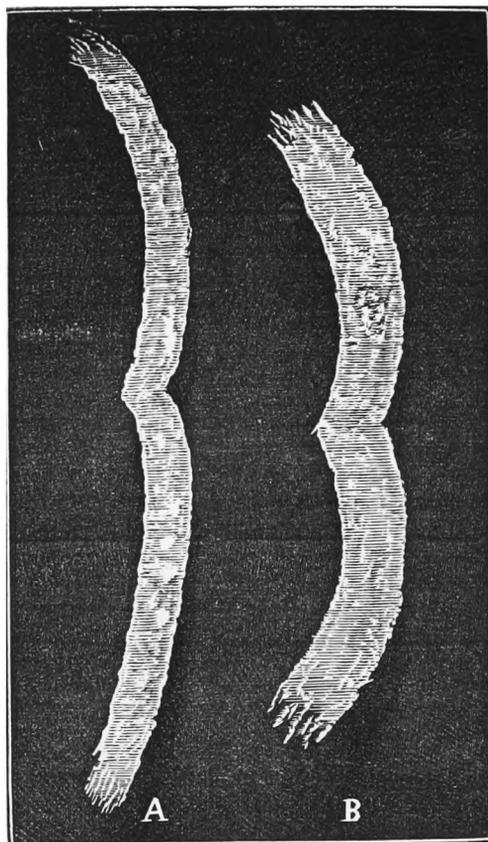


Fig. A.—The tail of the meteor, as seen three minutes after its descent.

Fig. B.—The same as it appeared after the lapse of eight minutes, having gradually decreased in length and increased in breadth.

JERSEY.—In returning from town (St. Heliers), last Saturday evening, I saw a brilliant phenomenon near the constellation of Ursa Major. A shooting star shot forth from the sky, and, in exploding, a sheet of flame of dazzling whiteness illuminated the heavens for a few seconds; the result of it was a streak of white light, apparently about a dozen feet long by a few inches in breadth, remained in the heavens for several hours during the night. As to the sheet of flame I can only compare it to the effect which the magnesium light would suddenly produce on a person, so vivid and so bright did it look! The sky was cloudless, and the time of occurrence was 6h. 42m.—**JOHN LE BAS.**

SCILLY ISLES.—A very remarkable meteor was seen here on Saturday the 6th, at about 7 o'clock p.m., local time. It travelled from E.S.E. to W.N.W., and gave a most brilliant light, startling many whose backs were towards it, but the most peculiar phenomenon connected with it was the tail or cloud it left behind. This was in the form of an exceedingly bright luminous cloud, serpentine in form, well-defined in shape, extending from the star ϵ in Cassiopea to α in Perseus, and about 2° in width. It remained visible for nearly half-an-hour—having gradually faded or dissolved. The oldest inhabitant here, I believe, never saw such a tail from a meteor.—**JOHN BANFIELD, Agent for Lloyd's.**

HELSTON.—A splendid meteor was observed at Helston on Saturday evening shortly before seven o'clock. At first it appeared as a brilliant coruscation somewhat similar to an explosion of gunpowder, only of an intense blue colour,

lighting up the whole firmament. For several minutes a long, light, nebulous wavy train, extending east and west, was perfectly visible to the naked eye. It being market evening, hundreds of people stood in the street gazing at the wonderful phenomenon. The atmosphere was remarkably clear, and the stars shining brightly. Many persons spoke positively as to hearing an explosive sound when the meteor first showed itself.

PENZANCE.—During several evenings of the past week numerous meteors have been seen in different parts of the heavens stretching over West Cornwall. On Friday from 9.30 to 11 p.m. they were exceedingly numerous, and appeared to fall almost perpendicularly from the sky. Persons watched them with deep interest as they fell and exploded, apparently but a short distance from the roofs of the houses at Penzance. But the most striking phenomenon was at five minutes before seven on Saturday evening. A magnificent meteor struck out from the north-eastern part of the heavens, between 70 and 80 degrees above the horizon, and travelled over the zenith of the heavens in a north-westerly direction for several seconds. It then burst, leaving behind through its entire course a wide-spread trail of light. It had the appearance of an immense rocket shedding a splendid blue light as sudden and as brilliant as a flash of lightning. Scores of witnesses state that the roads were so brilliantly lighted up that a pin might have been picked up. Its tail was first a broad belt of bluish light, fading into a yellow dust-like appearance, then assuming a zig zag serpentine form. In its broader parts this belt spread over half a degree of space. It was witnessed from Truro to the Land's End, and all agree that it was without exception the most striking and brilliant meteor they had ever seen. Some state that when it burst it broke into fragments of red, white and blue.

FALMOUTH, Nov. 6.—"At 6h. 55m. p.m., a very brilliant meteor was observed taking a northerly direction until appearing to be just over this town, when it exploded with a noise as of a rocket, lighting instantaneously, by the flash and jets of light therefrom, the town. A line of many lights appeared in the heavens, denoting the course it had taken."

REDRUTH.—An extraordinary astronomic phenomenon was observed at Redruth on Saturday evening. A splendid light, in which the colours of the rainbow were curiously blended, suddenly issued from the centre of a small dark cloud, and gradually assuming the form of a large serpent, it glided across the milky way, between the stars of the constellations Cygnus, Pegasus, Andromeda, and Perseus, and finally remained stationary for about seven minutes in the constellation Cassiopeia. This phenomenon was observed three times successively. The first appearance was at 6.55, and an interval of about four minutes elapsed between each appearance. The light was so brilliant at the first appearance that the usually bright planet Jupiter in the south-east, and the well-known Capella in Auriga in the north-east sank into utter insignificance, while terrestrial objects were nearly as visible as in the day time.

CHACEWATER.—On Saturday, at ten minutes to seven p.m., a large and beautiful meteor appeared in the sky a few degrees east of the zenith, and passing directly west, disappeared about 30 degrees from the horizon. The time of its transit was about six seconds. It left in its course a broad band of light, like a stream of molten lava, which was visible for some twenty minutes after the disappearance of the meteor. The light emitted, which was very brilliant, was almost white and slightly tinged with blue. A distinct sound was heard as of the rush of a rocket near at hand.

MEVAGISSEY.—Mr. Duncalf writes:—"A most brilliant meteor was seen here on Saturday evening about 6.50. The sky was very clear, and so intense was the light emitted from it that the streets were suddenly lit up as by a vivid flash of lightning. The light gradually disappeared, but the trace of the meteor in the heavens could be seen for twenty minutes after its appearance. Its course was about east half-south, and at first was taken by some persons to be a sky-rocket, which it resembled. All agreed in pronouncing it the most striking and beautiful object of the kind they had ever seen."

LANHYDROCK, BODMIN.—Mr. T. Grylls writes :—“ On Saturday evening I was standing in the garden about seven o'clock, when the most brilliant and dazzling light suddenly burst out from a small cloud above my head, and in about five seconds was followed by a splendid ball of fire, which, however, soon burst, and left all in darkness again. As a proof of its intensity and vividness it left behind it a broad stream of phosphoric light which lasted at least a quarter of an hour. Its course was from about the constellation Delphinus due west.”

WADEBRIDGE.—About seven o'clock on Saturday evening the inhabitants of this place were astonished at the sudden appearance of a most brilliant light from the clouds. So great was the light that the men who were unloading the barges on the river (though the evening was very dark), could be seen as plainly as if it had been open daylight, and this appearance continued for several seconds. After the disappearance of the great light a train of beautiful light could be seen travelling in a zigzag or serpent form from west towards the east, and this appeared to be of great length, and visible to the eye for many minutes.

PADSTOW.—A splendid meteor was seen at Padstow on Saturday evening about a quarter to seven. It seemed like a globe of fire falling in a south-west to north-east direction. A pale blue light was emitted from it, so brilliant that small objects on the ground could be seen plainly. It burst in four or five pieces without noise. The track left by it could be distinctly seen for a quarter of an hour.

CALLINGTON.—An unusual meteoric phenomenon was seen at Callington on Saturday evening a few minutes before seven. An aërolite appeared in the heavens, with a brilliant light, which seemed as bright as the electric light. It lit up the surrounding country, and the distant hills of the Caradons could be seen. It appeared to pass from the zenith to the horizon in a northerly or north-westerly direction, leaving a long streak of fire behind, which continued for about four minutes, after which it gradually became fainter and tortuous, and lasted thirty minutes as a faint fleecy light, equal in intensity to the diffused light of the milky-way.

KINGSBRIDGE.—An extraordinary meteor was seen in the sky here Saturday evening about seven o'clock. It appeared first passing along the sky at a rapid rate, then it suddenly burst, causing an intense light. A streak of light, its trail, was seen for some time afterwards.

PLYMOUTH.—On Saturday a few minutes before 7 p.m., a meteor, which is admitted on all hands to have been of unparalleled magnificence and unexampled in its duration and the light shed by it, appeared in the western heavens. Its course, as seen at Plymouth, is described as being from E.S.E. to W.N.W., but of course the direction as seen from different points would vary. It was probably the most marvellous celestial phenomenon which has been witnessed for many years in the west. It is popularly described as a ball of fire shooting upwards, leaving at its tail a broad band of golden light, the head appearing to descend a short distance from its extreme altitude, and then remaining fixed for a period of at least four minutes, evolving a light almost equal to that of day. The meteor so exactly resembled a rocket of superlative beauty that it was mistaken by many persons for a manufactured firework. We have accounts of it from almost every district of Cornwall, and from Devonshire towns as far east as Torquay. Probably it was obscured higher up by heavy clouds, which had passed over Plymouth eastwards an hour or two before. Whether it was observed in the north of Devon or not we are unable to state, as the train arrangements between antagonistic railway companies effectually shut off Plymouth on Sundays from the northern part of the county. On both Friday and Saturday evenings many meteors, some of them of much beauty, were seen, but not at all comparable with the one described. We give extracts from the descriptions received from some of our correspondents, as not only being the independent testimony of many persons to the extraordinary character of the display, but also as furnishing varied descriptions of that of which it is utterly out of the power of any one to convey an adequate idea.

BRIXHAM.—A magnificent meteor, or aërolite, made its appearance about 7 p.m. on Saturday. It was first seen about south-east, and took a north-west descent. Its appearance was similar to a fine bright sky-rocket, and for the space of about two minutes it shed quite a brilliant light, and minute objects on the ground might have been discovered. After it appeared to have exploded, it left a long luminous line visible for nearly a quarter of an hour.

LAMORNA, TORQUAY.—This evening, at 6.50, Greenwich time, I was called to my door by the letter carrier, who pointed out a serpentine band in the sky, having a brightness rather above that of the Milky Way. It was about 3° in greatest breadth, and 20° in length. Its longest axis was in the line from the north-west point of the horizon to the pole star, from which, where nearest, it was about 20° distant. Its other extremity was very near the Milky Way, and surpassed every other part in brightness. Its poleward termination was faint, filmy, and bifurcated.

The postman said, "About five minutes ago," *i.e.* 6.45 p.m., "whilst waiting at another house, I suddenly became aware of a great light, but on looking up, instead of a shooting star as I expected, I saw a fixed crooked line, as broad as my finger, and quite as bright as that star" (pointing to Jupiter.) It gradually became broader and fainter, but not longer, and I came on here as fast as I could to let you know about it."

I observed it at intervals of five minutes, and observed that it gradually grew fainter and straiter, and moved slowly towards the north-east, its axis remaining apparently parallel to itself throughout. I saw it distinctly at 7.35, but was not satisfied that I did so at 7.40. It must have remained visible from 50 to 55 minutes.—**W. PENGELLY.**

[It is to be hoped that advantage was taken of this almost unprecedented opportunity to bring the spectroscope to bear upon a meteor cloud. From other accounts the meteor itself appears to have been exceptionally brilliant, and to have burst with noise as of a rocket (Falmouth); to have changed its colour from yellowish red and lurid red to brilliant green at the moment of explosion, and then from violet to orange (Birmingham). Another account (Wimborne) states, that at the moment of explosion the colour was dazzling purple and blueish, fading into white at its upper extremity. The cloud was observed to assume a serpentine form both at Bristol and Stokesay. Mr. Pengelly's 50 or 55 minutes' duration was most nearly equalled at the latter place, where it was observed for half-an-hour. There are ample elements for the determination of the meteor's path.—**ED., Nature.**]

TORQUAY.—A splendid meteor was observed on Saturday night at a quarter to seven o'clock; it traversed the heavens from east to west, and it left a luminous train behind that was perceptible for six minutes afterwards.

BARNSTAPLE.—On the evening of Saturday, 6th inst., a large and most brilliant meteor was seen in the western parts of England; and, as we have numerous observations from places situated within the large triangle, the corners of which are formed by Shropshire on the north, Hampshire on the south, and the Scilly Isles on the west, we may be able to form some conception, not only of the height of the meteor above the earth, but also of its great size.

The exact time of its descent, as recorded by different observers, shows the usual amount of discrepancy, owing to confusion between local and Greenwich time, and the more serious errors due to clocks and watches. The range of 20 observations varies from 6.30 to 7 o'clock, but the majority give the time at "about 7," or a few minutes before 7. The meteor, which was of a blue colour, descended in a westerly direction, and shed so intense a light that even small objects could be distinctly seen for several seconds. One observer, writing from Wincanton, describes a slight crackling noise as accompanying the descent, but the object which appears to have attracted universal attention was the remarkable luminous train, which remained visible in a well-defined form for about 15 minutes, and as a patch of nebulous matter for nearly double that time. When first my attention was directed to this train it was about 15° in length, and about two-thirds the diameter of the full moon. In three minutes the tail, which had been

only slightly curved, gradually became indented in the centre, so as to form a double curve. During the next five minutes the train slowly became more and more diffused, and increased in apparent breadth as it diminished in length. After all the definite shape of the train had passed away, the luminous matter remained in the form of a broad belt of subdued light, which appeared to be attached to the western extremity of the Milky Way.—TOWNSHEND M. HALL, F.G.S.

WIMBORNE, DORSET.—This evening, at 6.50 p.m., a magnificent meteor fell from the zenith towards the west, through a cloudless sky, passing through an arc of some 15° with amazing brilliancy, and bursting in a globule of dazzling purple and blueish light, fading into white at its upper periphery, and leaving a trail of light in the sky which remained for at least 25 minutes, varying in intensity, and undulating as though influenced by conflicting wind currents.—E. J. G.

SALISBURY.—Your correspondents who saw the brilliant meteor all speak as to having seen it on Saturday; it may, therefore, interest them to know that myself and a friend, who were driving into Salisbury both on Friday and Saturday, observed and kept it in view for full ten minutes, the hour being 5.40 p.m. on both days. In shape and size it seemed to us to resemble an ostrich's egg.—C. B. K. [Surely not the meteor at all.—Ed. *Meteorological Magazine*.]

WINCANTON.—Respecting the meteor of Saturday evening, I was standing on the railway platform here, and the time I believe to have been as nearly as possible 6.50 or 6.51. I mention a circumstance which is not noticed in any of your correspondents' letters—viz., that at its bursting a slight crackling noise was distinctly heard. From the point at which I first saw it, it fell about three times the length of the streak of light left at its bursting.—THOMAS RICHARDS.

HIGHCLERE.—“This (Saturday) evening, November 6, at about 7 o'clock, two friends and myself were driving along the road adjoining Pen Wood, Highclere, Hants, within a short distance of Lord Carnarvon's park, when we were startled by the appearance of a most brilliant meteor in the south-west. It was of a blue colour, and, to our vision, seemed to be of the size of a man's head. Unlike many previous meteors, it did not traverse the heavens, but appeared to descend immediately, leaving behind it a long tail of pale blue light, serpent-like in shape. Such was its illuminating power that for a moment or two we might have seen to have picked up a pin in the road. The meteor appeared to descend in the direction of Facombe.”

FLAX BOURTON, BRISTOL.—Last evening, at 5 minutes to 7 p.m., when walking towards my house, I observed it to be suddenly illuminated, as brightly as if the full moon had been shining.

I turned, after some thought, and looked at the southern sky, where I observed a bright streak of light, extending from near the zenith to a point about 20° above the western horizon.

It was so beautiful and unusual that I ran to my house and called to three members of my family to come out and look at the phenomenon.

By the time they had reached the garden, the meteoric matter had sunk or disappeared gradually until it had assumed a serpentine form extending over a length of about 10°, and in this state it remained until about ten minutes past 7, when it had so far disappeared that it could not be distinguished from the Milky Way in the western sky.

After looking at this beautiful and suggestive sight for some time, I went back to a group of people whom I had passed previously, and ascertained, what I had not doubted, that they had seen its origin, which was a very large meteor. I mention this to you because of the very unusual time the meteoric matter remained in view, which was fully 15 minutes.—J. A. CALEY, C.E., F.G.S.

ASHLEY ROAD, BRISTOL.—On Saturday evening last, at 6.45 p.m., I observed a meteor of great brilliancy. At the time of its appearance I was not looking towards the sky, but did so on finding there was a sudden illumination—which I at first thought was caused by the bursting of a rocket—when I immediately perceived a very large meteor gliding swiftly down the sky. Its duration could

not have exceeded two seconds, during which time the whole of the sky was brilliantly illuminated. I did not witness its disappearance, that portion of the heavens to which it diverged being obscured by trees and buildings; judging, however, from the length and position of the train, I imagine that the disappearance occurred very near R. A. 18h. and S. declination 10° . The meteor passed about $1\frac{1}{2}^{\circ}$ to the east of the star Eta Serpentis, and was of a blue colour. It left a train of light, which remained visible to the unassisted eye about 15 minutes after the meteor had disappeared. This train, which was at least 7° in length at first, gradually became shorter and broader, and drifted towards the star Eta Serpentis. At 6.52 it presented the appearance of an ill-defined cometary patch, and was apparently attached to the above-mentioned star. At this time it appeared to be very similar to a large comet, the star being the nucleus, while the nebulous matter, which was directed to the north, constituted the tail. At 7 it became invisible, having slowly drifted into the Milky Way, near the head of Taurus Poniatowski.

I have since heard that several other meteors were observed on the same evening, and Mr. T. W. Backhouse, of Sunderland, informs me that he saw ten on the preceding night.

These facts lead us to hope that a brilliant display may occur on the night of the 13th inst., and I should, therefore, advise your readers to maintain a careful watch if the weather is sufficiently favourable.—WILLIAM F. DENNING, *Hon. Sec., Observing Astronomical Society.*

STOKESAY VICARAGE, SHROPSHIRE.—A brilliant meteor was seen here this evening at about 6.30. I am sorry to say I did not myself witness its actual flight, but my attention was called immediately afterwards to the very remarkable trail which it left. This was, when I first saw it, a narrow luminous streak of about 15° long, extending in a nearly direct line between α Capricorni and ϵ Sagitarii, and situated half-way between these stars. Its brightness was considerably greater than that of the Milky Way, and I imagined I detected a kind of flickering light along it similar to that which appears from a streak of phosphorus. Within five minutes it bent in a double curve, and slowly moved northwards in an opposite direction to the slight wind which was blowing from that quarter. I am told by those who were so fortunate as to see the meteor, that it was considerably brighter than Jupiter, which was shining brilliantly at the time in the opposite quarter of the sky, and that at its disappearance it burst into fragments. The trail was distinctly visible for nearly half-an-hour.—J. D. LA TOUCHE.

WIREWOODS GREEN, CHEPSTOW.—The 6th November meteor was seen here about 6.50 p.m. London time. A shopman from the town arrived, evidently frightened; he described it as appearing as large as a man's head, leaving, as it were, quite a hole in the sky; a blue trail to the south-west, and leaving a light after its disappearance.—R. PEAKE.

NARBERTH.—I beg to confirm the description given by "F. L. E. I." of the meteor seen on Saturday last. I was returning from the country on horseback, and was in the act of watering the animal at a small brook when I was suddenly surprised by a light, which became so intensely brilliant as to cause the horse to shy on account of seeing his shadow in the water. The trail was of a beautiful violet colour. While riding along my attention was constantly drawn to that part of the sky where the meteor appeared, by a band of light extending in an oblique direction from east to west, which lasted for some 15 or 20 minutes.—MAURICE G. EVANS, M.D.

BIRMINGHAM.—Mr. D. Smith, F.R.A.S., writes to the *Daily Post* as follows:—"With a risk of trenching on the marvellous, I venture to give you a description of a meteor which appeared in the heavens at about a quarter to 7 o'clock to-night (Nov. 6). The meteor appeared in the south-west, elevated about midway between the horizon and the zenith, and passed at an angle with the horizon of about 43 degrees, and with a very slight curve, in a northerly direction, or nearly parallel with the plane of the Equator. So far as a murky atmosphere prevailing

over Birmingham, and somewhat intercepting the view, permitted observation upon the few stars visible, it appeared to rise in the constellation Pegasus, about the star Markab, and to disappear in Vulpecula. As Jupiter was shining at the time, it was easy to compute the size as being about double that of this planet. From its rise a brilliant streak accompanied it, and remained visible in 12° or 15° of its length for about three seconds. In its first appearance the meteor was of a yellowish-red colour, deepening rapidly into a lurid red, and, when within some 5° or 6° of its disappearance, changed to the most brilliant green, and again rapidly into violet and orange, when the mass disappeared, apparently without noise and with an expanded phosphorescent glare. The circular outline of the edge did not appear at any time so well defined as in many of the large class of November. For a moment only, being so near to Guy Fawkes, a rocket was suspected, but the direction and general aspect gave instant proof that the object was a meteor of great splendour and interest."

ROTHBURY.—Meteors being in season just now, all facts respecting them will, I presume, be acceptable. The public have lately been treated to a great number of letters in newspapers descriptive of the remarkable meteor of Saturday, Nov. 6th—perhaps I should rather say *a* instead of *the* remarkable meteor, because, from the discrepancies as to the time of the appearance and the differences in the description, I am inclined to believe that more than one meteor of unusual splendour was seen on that evening. I need hardly say how important it is to have observations of the visual direction of these bodies as viewed from stations widely separated from each other, because it is only observations of this kind which can afford data for judging of the distance of a meteor. In the hope of contributing information which may assist in clearing up this interesting question, I venture to add another letter to the many which have already appeared.

At five minutes before 7 on Saturday evening, November 6th, while walking with my back towards the south, near the village of Rothbury in Northumberland, I was startled by a brilliant light behind me, and on turning I saw a magnificent meteor descending from the eastward at an angle of about 45° to the southern horizon. Its colour was a bluish-white, and it left a train which looked exactly like that of a large rocket, but which did not remain visible to my view for more than about 15 seconds. The meteor did not appear to me to burst, although pieces seemed to separate from it before it expired. At the moment of extinction it was about 12° or 14° above the horizon, and its direction was then S.S.W. I am quite sure as to the time of the occurrence to within a minute, because, although I could not see to read my watch at the moment—a chronometer on which I can depend, and which I know was right—I hastened to the nearest light, about 400 yards distant, where I ascertained that the time was one minute to 7, which, allowing four minutes for walking the 400 yards, would make the time of the appearance five minutes to 7. So far as I have seen, there is but one describer of the meteor whose record of the time exactly agrees with mine, and as it is incredible that two such unusual meteors should occur in the same minute, it is almost absolutely certain that he and I saw the same. My co-observer was the writer of a letter in the *Times*, signed J. A. Cayley, dated from the neighbourhood of Bristol, where he witnessed the phenomenon at a distance of 260 miles from where I saw it in Northumberland. As viewed by him it appeared to descend from the zenith to about 20° above the *western* horizon, while I, as already stated, saw it in the *south*. His description of the meteor differs from mine only in regard to the train, which is described as continuing visible to him for 15 minutes, a difference which may be attributed to its being nearer and more overhead to him than to me.

I will not hazard even an approximate calculation of distance from the data I have given, but I confess my inability to reconcile the different angles under which this object was seen at opposite ends of a base-line having Bristol at one end and Rothbury at the other, with the supposition that its height did not exceed that which is ordinarily assigned to the atmosphere. At all events, if the atmosphere exists at the height of this meteor, it will be more attenuated than in the exhausted receiver of the most perfect air-pump, and it is difficult to conceive how air so rarified can so oppose the flight of a solid body as to produce the intense ignition

exhibited in a meteor. Yet it seems impossible to attribute the incandescence of these bodies to any other cause than the resistance opposed by the atmosphere to their prodigious velocity.—W. G. ARMSTRONG.

ALNMOUTH, BILTON.—It may be interesting to some of your correspondents who saw the brilliant meteor on Saturday evening, to know that about 7 o'clock the same evening I was driving from Bilton Station, and saw a magnificent meteor, similar to the one described by your correspondent from Falmouth.—D.

ANSTRUTHER.—On returning to town I have just glanced over my file of papers, and observing several letters in your journal referring to a brilliant meteor seen on the night of the 6th inst., beg to add my testimony. I saw the meteor about 7 o'clock, nearly south-west from West Anstruther, Fifeshire, where I was going to inspect some interesting antiquities, very lately discovered at St. Adrian's Caves, near Crail. The meteor was large, of a blue colour, travelling from the north-east to south-west, and left a long line of light behind it; its elevation little more than 20°.—JOHN S. PHENE.

SEA SPRAY IN RAIN WATER.

To the Editor of the Meteorological Magazine.

SIR,—In consequence of the peculiar effect which the storms during the past fortnight have had upon the foliage, I was induced to examine the water collected by my gauge on the 19th inst., which fell during squalls from the W. and N.W. The amount of rain on that day was .07 in. On applying the characteristic tests for common salt I found an amount equivalent to 11.2 grains per gallon. Owing to the small quantity of water at command, I could not pursue an examination for iodides or bromides. If your readers will examine any map, they will see the distance which the sea spray (to which alone the presence of the salt can be attributed) must have been carried in suspension, with the wind in the quarter mentioned. The effect above referred to was apparent mostly on the elms and limes, of which the leaves on the western side presented the appearance of having been scorched with a fire; some so much so that in a day they were stripped of their foliage. Had I tested the rain which came up from the S.W. it would probably have given a greater amount.

It would be interesting if some of your many observers would, during the coming winter, at any period of great atmospheric disturbance, submit the rain collected to chemical analysis, with a view to ascertain how far inland sea spray is carried and to what amount, noting at the same time the direction of the prevailing wind.

Your obedient servant,

JAMES G. WOOD, M.A.

Chepstow, 22nd September, 1869.

[We wish Mr. Wood much success in this matter, but are not very sanguine thereof, having spent time and money over it in 1865—see *British Rainfall*, 1866, p. 11.—Ed.]

REVIEWS.

Charts Showing the Surface Temperature of the South Atlantic Ocean in each Month of the Year. Issued under the authority of the Committee of the Meteorological Office. Folio vii.—28 pages and 12 Charts. London: J. D. Potter, Poultry, and E. Stanford,

Report of the Meteorological Committee of the Royal Society for the year ending December 31st, 1868. 8vo., 72 pages. Eyre and Spottiswoode.

Report to the Committee of the Meteorological Office on the Meteorology of the North Atlantic. By CAPTAIN HENRY TOYNBEE, F.R.A.S., Marine Superintendent, Meteorological Office. 8vo., 16 pages, 8 plates. J. D. Potter, and E. Stanford.

Report to the Committee of the Meteorological Office on the Use of Isobaric Curves, and a Line of Greatest Barometric Change, in Attempting to Foretell Winds, Illustrated by 14 Diagrams of Gales in January, 1867, and August, 1868, &c., with some Practical Suggestions for Seamen, and a few Remarks on Buys Ballot's Law. By CAPTAIN HENRY TOYNBEE, F.R.A.S. 8vo., 19 pages, 14 Charts.

THE publications issued by the Committee of the Royal Society (who now control the office of which Admiral FitzRoy was so long the director) are of two classes, official and non-official; in the above list there are two of each, the only difference being, if we understand it aright, that the committee are solely responsible for the former, but only secondarily so for the latter, or non-official papers. The outlay for printing and engraving is, we presume, charged to the grant, as the extremely low prices at which they are sold cannot possibly repay the cost of production.

The Charts of Surface Temperature are based on a series of extracts made under the superintendence of Admiral FitzRoy, for which the observations were grouped in what are termed "five degree squares," *i.e.*, for spaces of 5° of latitude and longitude; they were not corrected for instrumental errors, nor for the hour of the day. It is obvious that, assuming the observations to be in all other respects correct, areas containing about 100,000 square miles are too large for the purpose of anything like accurate observation.

As to instrumental errors, we think it was probably a wise decision to neglect them, for we presume most of the thermometers were those lent by the office, and that if so their errors were far less than the uncertainties of observation. Here, *en passant*, we cannot but express our conviction that one of the most important steps the Committee can now take with respect to ocean meteorology is to issue a manual of instructions for the use of their naval observers; it is not a work to be lightly undertaken, or hastily "knocked off." If clearly expressed, copiously illustrated, and well arranged instructions were prepared, and freely circulated among the officers of the Royal Navy and the Merchant Service, we are sure the number, and what is of more importance, the quality of their observations would be enormously

raised. This, however, is a digression. We have yet a third element of possible inaccuracy—non-correction for the hour of observation; but how could that be corrected for, when to the best of our knowledge no observations on the subject have yet been made? What an illustration (if such really is the case) is this of the vast work in store for future observers, and what a sign of deficient instructions, that none of the thousands of vessels traversing this ocean have taken a series of hourly observations on the temperature of the surface water.

Some indications of the importance of this omission are afforded by the diagrams appended to the work third on our list.

Although there is no statement to that effect in the work before us, it is not improbable that Admiral FitzRoy did not press forward the publication of the data thus collected because, in the year 1861 the Royal Meteorological Society of the Netherlands published their "*Onderzoekingen met den Zee-thermometer*," giving the results of a very large collection of observations by Dutch vessels, which observations had been grouped in a most singular way—viz., in squares of 5° of longitude and 1° of latitude; it is not very obvious why the observations should not be discussed as completely in one direction as the other. The Meteorological Committee have inserted the Dutch values as well as the English ones on the charts before us, and in their preface have also quoted largely from the work before noted. The remarks on the variation of the position of the sea isotherms are incapable of abridgment; we cannot, however, refrain from quoting a few sentences as to sudden changes of temperature:—

"We now come to the district bounded by the meridians of 10° E. and 40° E., and lying between the coast of Africa and Lat. 50° S. In this region most sudden and remarkable alternations of temperature are met with at all seasons of the year.

"Changes of temperature have been observed by some homeward-bound vessels between the parallel of 35° and the coast, when crossing the Agulhas Bank, and Captain Toynbee remarks (see p. 6) that the temperature of the water is a good guide to show whether you are on the bank or not.

"However, by far the greater number of the extracts refer to a region lying one or two degrees on either side of the 40th parallel of Latitude. In the northern part of this belt the observations all fall to the eastward of the meridian of 10° E., but in the southern part it will be seen that in a few instances considerable alternations of temperature have been noticed as far west as the 8th or 9th meridian of east longitude.

Throughout the whole of this area the alternations of cold and warm water are most striking, and the changes of temperature are nearly as sudden and as great as those well known to be experienced on the northern edge of the Gulf Stream, where it is bounded by the Arctic current. The greatest actually observed has been a fall of 19°·5 in one hour, recorded by Captain Major, in the month of February. His position was in 41° 38' S. and 21° 30' E., and the surface temperature was observed to be 69°·5 at 9 a.m., 50° at 10 a.m., and again 59°·5 at noon.

"Captain Fitzsimons, in October, in lat. 41° and long. 21° E., noticed a decrease of temperature of 14° (from 67° to 53°) in one hour, while the ship passed through some heavy tide rips.

"Captain Wherland, in November, in lat. 39° 56', and long. 17° 20' E., noticed an increase of 14° (from 53°·5 to 67°·5) in two hours.

"In almost all the registers the fact of the sea being very high and confused is recorded, as well as the frequent occurrence of tide-rips or rippings, and of great changes of colour in the water."

The work being the joint product of the two administrations of the government meteorological office, can hardly be expected to be in all respects complete, but taking all the circumstances into consideration, we think the Committee deserve credit for everything but its extremely and needlessly unweildy shape ; why it was not made half the size, with the maps fastened to guards, like ordinary atlases, we cannot understand.

The report of the Committee for 1868 does not contain anything particularly calling for remark ; it shows that they are steadily endeavouring to make the best use of their instruments and funds, and to raise the tone of their observers. A graceful act towards the Scottish Meteorological Society may be mentioned. In addition to twelve sets of instruments originally presented to the society, others to the value of £100 had subsequently been lent for use at foreign stations. These also have been presented absolutely to the society.

There are two statements in the report which may perhaps indicate a wise arrangement, but hardly suggest an economical one. Our readers are aware that the Committee may be said to have two classes of observatories, the seven principal ones where temperature, pressure, humidity, and the direction and velocity of the wind are continuously recorded by most admirable apparatus ; and also a series of stations whence the observations are sent which are published daily in the *Times* and other papers. On page 13 we read with reference to the telegraph stations :—

“All the stations have been visited by Mr. Scott in the course of the year, except Nairn, from which the observer was absent at the time.”

And on page 20 we read of the principal observatories :—

“All these observatories were inspected by Mr. Stewart in the course of the year.”

We yield to none in our estimate of the importance of such inspection, and we think it an excellent arrangement that Mr. Stewart, the Superintendent of the Observatories, should personally examine their arrangements, but we do not see the advantage of the two superintendents going to the same place, *e g.*, two separate visits to Valentia, one to the recording observatory, and the other to the telegraph station ; and the same applies to Aberdeen and other places.

The second part of the report contains an account of the various arrangements adopted with a view to detecting errors at the principal observatories, either in the instruments, or reductions of the photographic traces, being in fact a continuation of the subject from the last report. Concerning which we can only say, as we have previously said with respect to the instruments, we consider them eminently satisfactory. We are not, however, yet satisfied as to the situation of the various instruments ; in reviewing the first report of the committee we used the following words :—“There is one point upon which we hope that the next report will be explicit, namely, the position in which these splendid instruments have been placed.” The present report thus deals with the question :—

SITUATION OF INSTRUMENTS.

Thermographs.—The situation of their various thermographs was a point carefully considered by the Meteorological Committee, and there is no reason to think that the effect of local peculiarity is considerable in the case of any of their instruments.

“In the Report for 1867 this subject was alluded to, and the result of simultaneous comparisons made at Kew between the readings of two sets of dry and wet bulbs was given for the month of February; one of these sets being placed in a frame detached from the main building of the observatory, and the thermometers having very small bulbs, the other set being the wet and dry bulb standard thermometers of the thermograph frame.

“The result seemed to indicate that the local peculiarity of either frame was comparatively small, indeed, taking the average of the month, there was no residual difference between the dry bulbs, while, on the whole, the thermograph wet bulb stood 0°·12 higher than the other.

“A similar comparison made for the month of July gave no residual difference either for the dry or wet bulbs.

“Dr. Robinson, of Armagh, has likewise made a similar comparison between his thermograph dry bulb and another thermometer placed at a higher elevation, and has obtained as the result of 150 observations made during the months of April and May, a mean difference indicating that the thermograph thermometer read, on the whole, 0°·27 less than the other. While this difference is not large, Dr. Robinson is of opinion that the upper thermometer is more liable to be affected by the sun, and that the thermograph thermometer is, in consequence, the more correct. No other observations have been made on the subject.

Anemographs.—These instruments are placed on the highest points of the various observatories, and as far as possible out of the reach of local influences. The exposure may therefore be considered good in the case of all the observatories.”

The only element affecting the records of the barographs is their height above the sea, this, with other items of position, is given in the following table :—

Observatory.	Superintended by	Latitude, N.	Longitude, W.	Height of Barograph Cistern above Sea Level.	Records commenced.
Aberdeen ...	D. Thomson, M.A., Professor of Natural Philosophy	57° 8'	2° 5'	feet.	1868
Glasgow ...	R. Grant, LL.D., F.R.S., Professor of Practical Astronomy.....	55 51	4 16	88·5	April.
Armagh.....	Rev. T. Romney Robinson, D.D., F.R.S., Astronomer	54 22	6 39	184·0	Jan.
Valencia ...	Rev. Thomas Kerr	51 54	10 25	207·3	May.
Stonyhurst..	Council of Stonyhurst College ...	51 54	10 25	23·0	Aug.
Kew	Council of Stonyhurst College ...	53 50	2 25	360·7	Jan.
Falmouth ...	Kew Committee of British Association.....	51 29	0 18	34·0	Jan.
	Royal Cornwall Polytechnic Society	50 9	5 4	210·8	March.

It would certainly have been an advantage (if practicable) if all had been at the same altitude, but failing this we do not see why several of them might not have been made equal, *e.g.*, Falmouth and Armagh differ only by 3 feet 6 inches, and Falmouth, Armagh, and Glasgow are

within 27 feet, and, as we believe a new building was erected for the observatory at Falmouth, these three might surely have been made uniform. Again, Valentia is 23 feet and Kew 34 feet, these could easily have been equalized. If *all* had been at one height the correction for altitude might, in many cases, have been neglected; if there had been only two or three different altitudes a mental correction might often have sufficed; but as it is, nothing but accurate correction tables will avail. We do not for a moment assert that this uniformity was possible; if Kew and Stonyhurst were to be two of the observatories it obviously was not; but the correction for elevation is an integral part of barometric reduction, to which we see no reference in the present report, while we do see a number of uncorrected barometric observations.

The influence of position on thermometers if not a new subject is certainly a neglected one, and the committee cannot be held responsible for not employing non-existing data as to the indications of stands of different patterns; we trust soon to supply this want, and shall not be surprised if the stand adopted by the Kew authorities proves one of the best. The committee seem, however, from the paragraphs we have quoted, to consider that the data given in their previous report settled the question; they did nothing of the kind. The tables then given showed that the thermometers in two stands of similar construction but differing somewhat in size, and both placed on the north side of the observatory, some feet above the ground, but actually fastened to the building, agreed. If one of them had been placed in the observatory grounds quite away from the building, the comparison would have been of infinitely more importance. The question being *not* the form of the stand, but the influence of the observatory buildings, which Mr. Freeman has already referred to in these pages.*

No one can write of anything done by Dr. Robinson, of Armagh, otherwise than with respect, but whatever he may have done the account thereof (quoted above) given in the report is so vaguely worded as to afford no evidence at all.

From all that we have had heard, the position of the anemometers is similar to that at all other observatories, and in some respects superior thereto.

Whether the existing anemometers in this and other countries with very few exceptions are not so placed as to register in excess of the truth is a general question of too much importance to be incidentally raised.

On the whole, we still think that, having regard to the facilities offered by the universality of photography, any publication of results from these observatories should be prefaced by ground plans and engravings (we purposely employ the plural, since one view alone will not adequately indicate the local environments) of the several observatories.

* *Meteorological Magazine*, Vol. III., p. 188.

In the organization of these observatories, in the construction of the instruments, and in the arrangements for checking the reductions, the committee have adopted such delicate refinements (quoting barometric differences to *five places of decimals* ($\frac{1}{100000}$ of an inch) and thermometric ones to hundredths of a degree) that it is impossible to be proportionally strict in examining the influence of locality upon their records.

Incomparably less is expected of the stations sending up the telegrams upon which the daily weather report is based, and while we fully endorse the account of the bad condition of these stations when they first came under the control of the committee, and gladly accept the statement in the present report that "the state of things existing was found to exhibit a most marked improvement on that noticed in the First Annual Report," we confess that various facts brought under our notice convince us that more remains to be done than has yet been effected, and that in many respects these stations are unworthy of the nation, of whom they are, to a certain extent, representative.

The third work to be noticed is a discussion, by Captain Toynbee, of the logs of certain steamers plying between Liverpool and New York, the observations being given in a series of well arranged diagrams. In one respect we fail to catch the author's meaning, for we cannot believe that his idea can be that which his words convey to us. He takes logs alternately for the outward and homeward passage, and remarks briefly upon each separately. We extract a few words from each :—

- DIAGRAM I.—*Outward*. "The pressure decreased whilst the wind remained southerly."
 „ II.—*Homeward*. "It [the wind] was *northerly* when it [the pressure] was lowest."
 „ III.—*Outward*. "The lowest pressure taking place just before the shift of wind from a south-westerly to a westerly direction."
 „ IV.—*Homeward*. "A southerly gale lasting three days, with a quickly rising barometer."
 „ V.—*Outward*. "The wind has changed eight times from a westerly to a southerly direction and back again, with a corresponding decrease in pressure."
 „ VI.—*Homeward*. "Having an increasing pressure with a southerly wind, whilst it decreases with a westerly wind, just commencing to rise again as the wind drew to the southward; this state of things has never yet occurred during an outward passage (excepting the partial instance mentioned in the note below)."

We need quote no further to illustrate our difficulty. Captain Toynbee appears to consider that two meteorological elements, wind and pressure, which are ordinarily so synchronous in their variations that we hardly know which is cause and which is effect, are exhibited in antithesis, according as the observer is going E. or W. We have always considered that an observation on a vessel at sea was the equivalent of a temporary observatory at the latitude and longitude in

* "On the 24th April there is an irregularity, for it will be noticed that after a shift of wind to west, and accompanying rise in barometer, the wind backed to the southward, returning to west without a corresponding fall in the barometer."

which she was at that instant, and that whether her head was N., S., E., or W., was (except for magnetic observations) of no moment.

Excepting this, we think no objection can be taken to the deductions in the pamphlet, which may to a certain extent be embodied in the creed, that the normal condition of the atmosphere over the North Atlantic is a series of gigantic whorls of air whose axes are nearly horizontal, revolving with considerable velocity, and at the same time travelling bodily to N.E. at a rate of some eight miles per hour.

We do not see that the last pamphlet contains anything specially worthy of note; there is a *naïveté* in some of the opening paragraphs particularly refreshing to those who are acquainted with what has been done in this and other countries long before Captain Toynbee commenced his "study of the daily weather reports." The publication contains some remarks which will be useful to beginners, and a series of charts the value of which would have been more conspicuous had the observations on board ships within the area at the time, and also the records of the observatories of the committee been employed, as they ought to have been, in regulating the course of the isobars, which as here given indicate a somewhat fertile imagination.

GREAT FLOODS AT MALTA.

A correspondent, writing to a contemporary from Valetta on the 15th of October, says:—"On Sunday last this island was visited by an unusually heavy fall of rain, which did not cease an instant for upwards of six hours. The pluviometer in Valetta marked 5·04 in., and one in the Three Cities is 6·07, and in some parts of the island the fall was still greater. Much damage was effected, whole fields and gardens, roads and walls, having been carried away into the sea. Luckily, as the flood occurred in the daytime, no loss was occasioned to human life, and but few animals were destroyed. The scene presented in the town of Cospicua was terrific. Men, women, and children were saved from drowning by being lifted up with ropes from streets into the second floors of houses. Others, in their struggle for existence, broke through the roofs of the first floor rooms into the rooms above, while others were picked up by boats which had been carried to the inundated town from the sea. These boats, some of them rowed by four men, plying on what was a few hours before dry land, had a most singular appearance, and the heavy stones and rubbish remaining in the streets after the waters had subdued gave the idea of a city in ruins."—*Echo*, October 20th, 1869.

THE TEMPERATURE OF THE HYGROMETER DRY BULB.

To the Editor of the Meteorological Magazine.

SIR,—A conversation with you, some time since, on the subject of hygrometers, has induced me to note the influence of saturation, or of the presence of a large proportion of moisture in the air, upon the dry bulb of the hygrometer. For this purpose I suspended one of Casella's solar radiation thermometers enclosed in a vacuum tube, by the side

of my other shade thermometers, and noted the difference in the readings every morning at 9 o'clock. I herewith subjoin the readings, from which it will be seen that a thermometer protected by a glass jacket stands higher than another not similarly protected, and which therefore is reduced in temperature by the evaporation of the moisture that has been condensed upon the bulb.

Dates, 9 a.m. Oct.	Weather.	Hygrometer.		Solar Ther- mometer in tube in shade.	Amount of difference	Barometer.
		Wet Bulb.	Dry Bulb.			
7	fine	52°	54°	54°·5	0·5	30·24
8	cloudy	56·	58·	58·5	0·5	30·11
9	foggy	56·	56·	57·	1·0	30·24
10	do.	57·	57·	58·	1·0	30·24
11	do.	53·	53·	53·5	0·5	30·22
12	do.	50·5	50·5	51·5	1·0	30·20
13	rainy	57·5	58·	58·5	0·5	30·08
14	fine	46·	48·5	49·	0·5	30·17
15	cloudy	51·	52·5	53·	0·5	29·86
16	rainy	53·5	57·	57·5	0·5	29·49
17	fine	35·5	40·	40·5	0·5	29·70
18	rainy	44·	45·	45·	0·0	29·56
19	fine	40·5	44·	44·5	0·5	29·45
20	do.	32·5	36·	37·	1·0	30·12
21	do.	48·	50·	50·	0·0	30·19
22	overcast	40·5	43·	44·	1·0	30·45
23	do.	45·	47·5	48·	0·5	30·36
24	do.	49·5	53·	53·5	0·5	30·18
25	rainy	42·5	44·	44·5	0·5	30·25
26	fine	39·5	43·	44·	1·0	29·90
27	do.	33·	35·	36·	1·0	29·80
28	do.	30·5	34·	34·5	0·5	29·78
29	do.	38·	41·	41·5	0·5	30·12
30	rainy	43·	43·	43·5	0·5	29·91
31	foggy	41·	41·	42·5	1·5	30·22

Out of twenty-five readings, twenty-three showed excess on the enclosed bulb over the degree indicated by the uncovered thermometer in the shade; of these, in fifteen the difference was half a degree; in seven, it was one degree; in one, it equalled one and a half degree; and in two instances both thermometers read alike. The reasons for these differences I confess myself unable to discover.

I remain, Sir, your obedient servant,

W. B. KESTEVEN, F.R.C.S.

Holloway, Nov. 4th, 1869.

BRITISH RAINFALL.

To the Editor of

Sir,—Can you find space for the enclosed extract from the Report of the Rain-fall Committee, presented to the British Association at Exeter? And will you allow me to supplement it by the request that any persons who may be recording the fall of rain, or intending to record it, who are not already in communication

with me, but are willing to assist by forwarding copies of their observations, will at once oblige me with their names and addresses, so that duplicate gauges may not be started unnecessarily near to them ?

As soon as possible after the receipt of the replies to this letter, I shall have to ask you further to oblige me by inserting a list of places whence observations are urgently required.

I am, Sir, your obedient Servant,

G. J. SYMONS.

62, Camden Square, N.W., Dec. 2, 1869.

EXTRACT FROM REPORT OF THE RAINFALL COMMITTEE FOR 1868-69.

"It has been the practice of the Committee, in their various reports, to adopt for convenience of comparison, a decennial grouping of returns, such as 1840-49, 1850-59, &c. We are now on the eve of completing one of these decennial periods, and it behoves us, therefore, to consider how we may best secure for the ensuing period the attainment of the objects for which we were originally appointed. One of these is expressed in the first grant in the following words :- 'For the purpose of constructing and transmitting rain-gauges to districts where observations are not at present made.'

"Even to those least acquainted with the subject, will it be apparent how much more desirable as well as easy it is to compare simultaneous observations than those wherein both the observed values and their times are different. Your Committee have, therefore, felt it to be their duty to examine how far the existing stations adequately represent the true rainfall of the British Isles. The result shows that their number and distribution, though incomparably superior to that which existed when your Committee were appointed some years since, is still capable of great improvement; tracts of land, the rainfall of which as water supply is of high importance, are without adequate observations, while other places are, if possible, too well provided.

"To take Devonshire as an example: excepting two gauges at the Convict Prison, one on the northern edge at Chagford, and one on the south at Lee Moor Clay Works, Dartmoor (that wettest of Devonshire districts) has no representative, Exmoor has none at all, and there is no gauge between Torquay and Plymouth. On the other hand, Sidmouth has four or five observers, and Exeter an equal number.

"Similar cases of unequal representation occur in various parts, and should be removed. The Tyneside Naturalists' Club are about to establish a series of gauges along the Cheviots, the Cardiff Naturalists' Society are doing the same in South Wales, and other instances could be quoted.

"We have already shown that there is a special reason for endeavouring to equalize the representation during the ensuing autumn, so that the new observers whom we hope to obtain may have a few months' practice before the commencement of the decennial period of 1870-79.

"We hope that the landed proprietors of Great Britain and Ireland are becoming sufficiently aware of the importance of rainfall statistics in engineering and draining operations to see their own advantage in helping us by having observations regularly made by careful persons under their own supervision."

[The above has been favoured with insertion in the *Times* and many other influential journals, and many new observers have communicated their returns in consequence thereof. The list of localities cannot be completed until a little more time for replies has elapsed, but in the interim we may point out that central and North Scotland, and Ireland, are still badly represented. Any persons who can secure observations in those districts would confer a great benefit by so doing.—Ed.]

NOVEMBER, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on ground
		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	inches.	in.							
I.	Camden Town	2·38	- ·03	1·03	27	14	58·2	15	27·6	12	6
II.	Staplehurst (Linton Park) ...	2·14	- 1·05	·54	28	18	58·0	14	24·0	21	10
	Selborne (The Wakes).....	2·54	- 1·00	·96	27	10	57·2	15	22·5	12*	13
III.	Hitchin.....	2·32	+ ·18	·91	27	16	58·0	14	27·0	30	5
	Banbury.....	2·34	+ ·14	·68	27	18	57·5	2	22·0	12	15
IV.	Bury St. Edmunds (Culford) ..	2·48	+ ·09	·76	27	15	57·0	2	24·0	20+	9
V.	Bridport.....	2·09	- 1·07	·67	27	10	59·0	16	24·0	12	12
"	Barnstaple.....	3·97	- ·17	·66	27	21	67·0?	3	28·0	25	...
"	Bodmin.....	4·29	- ·69	1·17	27	25	59·0	15	31·0	25	1
VI.	Cirencester	2·85	+ ·06	1·03	27	9	...	...	...	...	...
"	Shifnall (Haughton Hall) ...	2·21	+ ·64	·55	27	20	57·0	14	25·0	11‡	11
"	Tenbury (Orleton)	2·37	- ·10	·72	27	18	58·5	1, 15	25·0	12	11
VII.	Leicester (Wigston)	1·85	- ·31	·45	28	13	58·0	14	27·5	10§	10
"	Boston.....	1·65	- ·49	·30	29	17	57·5	14	29·0	21	5
"	Grimby (Killingholme)	1·93	..	·38	22	17	54·0	2, 16	30·0	10||	...
"	Derby.....	2·04	+ ·41	·41	29	21	58·0	14	26·0	25	7
VIII.	Manchester.....	4·28	+ 1·52	·63	13	22	54·0	2&5	23·2	12	11
IX.	York.....	1·65	- ·33	·38	5	19	63·0	7	29·0	21¶	6
"	Skipton (Arncliffe)	8·71	+ 2·26	2·15	13	20	55·0	1	24·0	29	6
X.	North Shields	2·95	+ ·25	1·06	23	16	58·0	14*	29·0	10	6
"	Borrowdale (Seathwaite).....	23·19	+ 6·52	6·70	14	27	...	...	...	...	...
XI.	Cardiff (Town Hall).....	...	...	...	...	...	...	...	...	...	...
"	Haverfordwest	4·40	- 1·27	1·24	26	14	56·0	1, 14	27·5	24	7
"	Rhayader (Cefnfaes).....	5·17	+ ·59	·95	2, 27	16	55·0	...	24·0	...	...
"	Llandudno.....	3·92	+ ·76	·67	3	24	57·0	15	34·0	11	...
XII.	Dumfries.....	4·27	+ 1·05	1·15	13	16	57·0	1	24·5	30	10
"	Hawick (Silverbut Hall)....	2·39	...	·65	13	19	...	...	...	...	...
XIV.	Ayr (Auchendrane House) ...	7·22	+ 3·15	1·74	13	25	58·0	18	20·0	30	20
XV.	Castle Toward	6·08	+ 1·44	1·16	13	25	58·0	18	24·0	30	15
XVI.	Leven (Nookton)	1·14	- 1·90	·15	5	19	56·0	18	24·0	30	12
"	Stirling (Deanston)	4·15	+ ·64	·81	12	22	57·0	19	16·8	30	15
"	Logierait.....	2·54	...	·40	2	19	...	...	...	...	...
XVII.	Ballater.....	1·61	...	·30	2	14	59·5	18	7·5	30	13
"	Aberdeen.....	1·72	...	·30	4	22	59·1	2	20·7	30	20
XVIII.	Inverness (Culloden)	2·91	...	·48	3	...	57·3	18	25·4	30	5
"	Fort William .....	...	...	...	...	...	...	...	...	...	...
"	Portree.....	13·28	+ 2·80	1·71	17	28	...	...	...	...	...
"	Loch Broom	10·59	...	1·45	2	30	...	...	...	...	...
XIX.	Helmsdale.....	5·09	...	·62	7	25	...	...	...	...	...
"	Sandwick.....	6·70	+ 2·70	·58	12	29	56·8	18	28·6	7, 29	5
XX.	Cork.....	2·44	...	·49	26	16	...	...	...	...	...
"	Waterford.....	2·23	- 1·72	·67	27	19	56·0	2&3	30·0	25	1
"	Killaloe.....	5·50	+ ·61	·84	14	24	59·0	18	24·0	11	8
XXI.	Portarlington	2·66	- 1·26	·53	30	27	56·0	18	26·0	11	6
"	Monkstown	2·19	- ·70	·55	29	13	61·3	15	24·5	25	7
XXII.	Galway.....	5·01	...	·65	14	25	55·0	4	27·0	11	...
"	Bunninadden (Doo Castle) ...	6·18	...	·95	12	29	55·0	15	25·0	24	10
XXIII.	Bawnboy (Owendoon)	5·69	...	·97	12	26	57·0	18	27·0	10	11
"	Waringstown	3·41	...	·74	12	21	58·0	18	26·0	24	10
"	Strabane (Leckpatrick)	5·58	..	1·25	13	30	58·0	18	26·0	10	15

* And 18. † And 13. ‡ And 25. § And 11. || And 29. ¶ And 30.
+ 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 on the 22nd, but not remarkably so; the whole month more mild than usual, and excepting during the last five days, very dry for November. Bar. generally unsteady, and frequent changes of wind; the ground covered with snow on morning of the 11th. Fogs frequent. Wind, W. and compounds of W. on 25 days.

SELBORNE.—The month shows some remarkable changes of temp.: on the 12th the min. ther. was at $22^{\circ}5$; on the 14th it did not fall below $47^{\circ}4$; it continued to indicate 47° for three days, and on the 18th it again fell to $22^{\circ}5$. On the 27th at noon the ther. was at 47° , and in two hours rose to 53° , wind S.W.; on the 30th the temp. indicated in the morning was 35° , at noon it had risen to 40° , and during the short snow storm it fell in a quarter of an hour to $32^{\circ}5$, though there was not snow enough to measure. On the 2nd a remarkably red sunset, followed by extremely high wind, S.W. and N.W., which continued during the 3rd and 4th; nearly 1 in. of rain on 27th.

HITCHEN.—Nearly 1 in. of rain on 27th; S on 29th.

BANBURY.—S and H on 10th; unusual fog on 17th, both night and morning; S on the last three days.

CULFORD.—High winds on 5th and 7th; heavy R on 27th.

BRIDPORT.—Prevailing winds the first half of the month, north-westerly. Bar. fell an inch between 9 a.m. on 21st and 9 a.m. on 22nd; fine aurora about 9 p.m. on 17th; very sharp frost on the 25th, the ponds frozen over; ther. was 26° at 9 a.m., but the afternoon turning in damp and foggy, the lowest temp. of the following night was 42° .

BODMIN.—1.17 in. of R fell on the 27th, causing on the two following days the heaviest flood since October, 1867.

CIRENCESTER.—Generally a bright month, with fine sunsets, up and down wind, a few hoar frosts, and S on the 29th and 30th.

SHIFNALL.—Exceedingly mild to the 20th, with slight R almost daily, and frequent gales; sleet on 4th, 6th, 10th, 28th, 29th, and 30th; a dense fog on the 17th, and much fog during the last week; hard frost on nights of 10th and 24th. Great flocks of fieldfares at the beginning of the month. 10th. The ladybirds still remain in smaller numbers (seven and two spot ones), but now quite red again, having been light orange in the summer. 14th. Three or four swallows still remain.

ORLETON.—The first 9 days generally fair and warm; sudden S storm on the 10th, covering the ground; the remainder of the month generally cold, but subject to great and sudden changes; S on the 29th, again covering the ground; temp. nearly 2° above the average. Brilliant meteor seen about 7 p.m. on the 6th, which left a long train of light, and two meteors on the 20th, the one about 8 p.m. the other 8.30, the latter followed at a considerable interval by a distant rumbling report.

KILLINGHOLME.—Wind W. and its compounds on 25 days; frequent corona. On 2nd, sea gulls inland, stormy at night, squalls on 28th, snow on 29th, but previously pleasant, and finer weather for the late wheat seed-time never was known.

DERBY.—The character of the month was cold, wet, and foggy—indeed, as unenjoyable as November usually is, with however some magnificent astronomical nights.

MANCHESTER.—Stormy on 2nd, 4th, and 5th; H on 28th, and S on 10th & 29th.

ARNcliffe.—2.15 in. of R fell on the 13th, one of the wildest days ever remembered here.

SEATHWAITE.—Six inches and a half above the average, and no wonder, as 11.46 in. fell in 48 hours—*i. e.*, 13th and 14th.

W A L E S.

HAVERFORDWEST.—Damp stormy month, not very cold; from the 24th to the end very heavy R and H, air cold and raw; stiff gale from the S.E. on 29th; the wind veered to the N.W. on the 30th, on which day there was S on the hills.

CEFNFAES.—First week much R, afterwards fine, good for agricultural work ; wind chiefly N. W.

LLANDUDNO.—November, usually so fine at Llandudno, has been damp and disagreeable this year, beside being cold. S on the distant hills on the 7th. Horse chesnut and mountain ash divested of leaves on 9th, purple beech on 13th, hawthorn on 19th, common poplar on 25th, and weeping elm on 30th. On 21st, a beautiful lunar rainbow of perfect form and with prismatic colours seen at 8.40 p.m.

S C O T L A N D.

DUMFRIES.—The weather has been very variable, with wind and storm. S on 6th, 9th, 10th, 26th, 27th, and 29th ; T on 10th. The month closed with severe frost and hills all white ; both rainfall and temp. above the average of five preceding years ; in the middle of the month young pear trees in blossom. [On the 2nd of December the frost is said to appear as if it would continue, the pools and lochs being frozen over sufficiently to bear skaters and curlers.]

HAWICK.—The month has been wet enough to keep the rivers running pretty full, and the the salmon have ascended the Teviot and other streams in great numbers to spawn. The gale on the 8th tore up some trees ; the frost was keen on several nights, but it was not until the three latter days of the month that curlers ventured out on their ponds to enjoy the "roaring game" of curling.

AUCHENDRANE.—The equatorial winds this November were to the polar as 10 to 5, and ten calms were interspersed among violent gales, principally equatorial, which in their northward course precipitated an excessive rainfall, yielding thereby a proportional excess of heat. Beside the general wetness of the month, there fell during the 48 hours preceding 9 a.m. of 14th more than 2½ in. of R, causing a great flood in the river equal to that of 18th August, 1840 ; the effect of such a condensation of the vapour of an atmosphere in these latitudes may give a dry and cold character to the rest of the winter.

CASTLE TOWARD.—The first five days wet and windy ; a sharp S storm on the 10th ; S lying on the ground for three days ; changeable and cold to the 27th ; on the night of the 28th 1 in. of S fell, sharp clear frost since ; S lying close to the salt water. Holly berries abundant, several pyramids profusely covered are at present beautiful.

NOOKTON.—Rather a fine month, with R considerably below the average.

DEANSTON.—Some severe blasts of wind during the month ; much S on the hills, but not above half-an-inch on low ground, and that at the end of month with severe frosts.

LOGIERAIT.—Severe gales and much unsettled weather. Keen frost set in on the 26th, and continues ; slight showers of S on the 27th and 28th ; lunar rainbow on 14th.

ABERDEEN.—Bar., temp., and rainfall all below the mean of previous 13 years ; winds chiefly N. W. and S. W., none from the E. A dry but cold ungenial month ; severe frosts during the last three days ; L on the 6th and 26th ; aurora frequent but faint.

PORTREE.—The wildest November on record, continued gales, with R, H, S, and sleet ; towards the end of the month hard frosts, with 6 in. of snow, which is telling on the sheep flocks ; everything having been so soaked and having frozen so rapidly that all the grass and heather is in one sheet of ice.

SANDWICK.—This has been one of the wettest Novembers on record here, there being only two exceeding it much and another by only 0.11 during the previous 28 years ; it has also been by far the most stormy November during the 9 years that an anemometer has been kept, that instrument marking 18,303 miles, or 6,157 more than the mean ; there has likewise been more S than usual, the ground having been covered with it six days ; the wet state of the soil has prevented the taking up of a great part of the potatoes, which must probably remain in the ground till the spring. Gales of 50 miles per hour on 2nd, 7th, 8th, 9th, 14th, 18th, 19th, 20th, and 29th ; on 19th, from 5 to 7 a.m., it was 60 miles per hour.

I R E L A N D.

DOO CASTLE.—It rained 29 days this month ; potatoes not all got up yet ; low lying lands flooding fast ; S on the mountains at the end of the month ; some nights of severe frost.

WARINGSTOWN.—Rainfall above the average, but as the ground was very dry it did not materially delay the wheat sowing, &c.

LECKPATRICK.—R measured on every day of the month; this never occurred before; the greatest fall of the month 1·25 on the 13th, is less than half the greatest fall in July, 1867, (2·90), yet the flood is nearly as great as on that occasion, the ground being so saturated that none could be absorbed.

THE SUPPOSED FALL OF METEORIC STONES IN THE “BLACK” COUNTRY.

To the Editor of the Meteorological Magazine.

SIR,—With reference to the supposed shower of meteorites at Wolverhampton on Tuesday, May 25, it is perhaps worthy of notice that a precisely similar fall was recorded by Mr. Thomas Plant, F.M.S., as having taken place at Birmingham on Friday, May 29—only four days later. The following is an extract from Mr. Plant's letter, published in the *Birmingham Daily Post* for Saturday, May 30, 1869 :—

“The thunderstorm this morning was remarkable for the immense quantity of rain which fell; also for the long duration of the tempest; likewise the strange shower of meteoric stones referred to at the close of this report. . . . There was an extraordinary phenomenon during the deluge of rain. From nine to ten meteoric stones fell in immense quantities in various parts of the town. The size of these stones varied from about one-eighth of an inch to three-eighths of an inch in length, and about half those dimensions in thickness. They resembled in shape broken pieces of Rowley ragstone. A similar phenomenon visited Birmingham ten years ago. On the 12th of June, 1858, during a severe thunderstorm, there fell a great quantity of meteoric stones, in every respect like those discharged this morning.”

In a catalogue of all the known British meteoric descents,* I find only twelve instances on record of the fall of meteorites in England, four in Scotland, and a like number in Ireland. But here we have not an isolated instance of this phenomenon, but two “showers” in “immense quantities.”

The letter published in your last number gives, not one atom of evidence in this matter, save perhaps the fact that the author had placed traps, consisting of a sheet and a large tin pan, in his garden, but had failed in catching any of the meteorites. What we require is, however, positive evidence. If the meteoric stones descended in such numbers as Mr. Plant describes, surely there must be some forthcoming for a crucial examination. Let them be properly analyzed, and the results will prove either that the Birmingham and Wolverhampton meteorologists were very much mistaken, or that the “black” country had the unparalleled good fortune to be visited by two showers of meteorites within four days.

I may add, that it has fallen to my lot, on several occasions, to conduct examinations on reputed meteoric stones, and the result in general has been by no means favourable to their authenticity. One proved to be a piece of scoriæ from an iron foundry; another was a fragment of iron pyrites; and a third was evidently derived from some neighbouring glass works.—I am, Sir, yours &c.,

TOWNSHEND M. HALL, F.G.S., &c.

November, 1869.

* *Popular Science Review*, vol. v., p. 414.

SYMONS'S

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JANUARY, 1870.

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THE CHRISTMAS FROST OF 1869.

ALTHOUGH by no means unusually severe in the vicinity of London, the frost of December 25th to 28th was sufficiently so in some parts to merit a passing notice.

In addition to the points to which attention is drawn in the following letters, we may specially note the very low temperatures at many places at and near the sea coast. Black Rock, Dublin, Haverfordwest, March Hill Cottage, Dumfries, Bridport, Wern, and Auchendrane, at all of which the temperature fell to or below 10° Fahrenheit are all either on or proximate to the sea coast.

Then there are the usual bewildering inconsistencies, such as Clifton, where Mr. North, a most careful observer, reports a minimum of 25°·0, while all round him at Barnstaple, Westward Ho! (Northam), Haverfordwest, Sellack, and Bodmin, it ranged from 9° to 18°.

Then, again, we have in Dorsetshire, Bridport 10°·0 and Weymouth 22°·8. And again, most puzzling of all, Llandudno 26°·3, while at Wern, near Port Madoc, it was 10°, Holker 13°, Haverfordwest 9°·0, and Dublin 8°.

Mr. Nutter, of Beech House, Cambridge, has favoured us with a statement of the minima on the morning of 29th, from five stations, all within a radius of one mile, viz., Cambridge Observatory, 19°; Mr. Payne's, 18°; Mr. Cuming's, 14°; Mr. Nutter's, 12°; and Mr. Chater's, 9°. Considering the proximity of the stations, and the flatness of the district, we would suggest that the thermometers should all be compared; possibly also variety of position, *i.e.*, mounting, may account for these differences; at any rate they merit examination.

To the Editor of the Meteorological Magazine.

SIR,—I enclose you the following low temperatures registered here last month:—

December 27th, at 9 p.m. (local time)	9°·0
December 28th, at 9 a.m. (local time)	6°·6

Lowest during night:—

At 4 feet from the ground	4°·9
On surface of snow	3°·0 below zero.

These readings are lower than any previously observed here during an uninterrupted period of eight years —I am, yours, &c.,

H. DODGSON, F.M.S., &c.

Cockermouth, Jan. 10th, 1870.

To the Editor of the Meteorological Magazine.

SIR,—I enclose readings of maximum and minimum thermometers for part of this month, as showing rather, I consider, a curiously small range of temperature in 24 hours, and also a *rather* low reading on 28th (19°·5). Perhaps you may think it worth insertion in the *Meteorological Magazine*, for next month. The thermometers are both made by Pastorelli, verified quite lately, the one at Kew, and the other at Greenwich Observatory.—Yours truly,
FRANCIS NUNES.
Heathfield Lodge, Chislehurst, Kent, Dec. 31, 1869.

Day.	Min. deg.	Max. deg.	Range in 24 hours. deg.
23	35·0	41·0	6·0
24	36·0	38·5	2·5
25	30·0	32·0	2·0
26	26·0	27·0	1·0
27	21·0	31·0	10·0
28	19·5	32·0	12·5
29	21·0	38·5	17·5
30	33·5	39·5	6·0

THE EXPERIMENTAL THERMOMETERS IN THE FROST.

To the Editor of the Meteorological Magazine.

SIR,—Many of your readers will probably be interested in the following short table. The readings are corrected for index error.—Yours truly,
C. H. GRIFFITH.

Strathfield Turgiss Rectory, Winchfield, Jan. 1st. 1870.

Minimum temperature recorded at 9 a.m., of December 28th, 1869.

	deg.		deg.
James's Stand.....	16·3	Pastorelli's Stand... ..	15·9
Lawson's, do.....	15·0	Morris's, do.	19·8
Stow's, do.	16·4	Griffith's, do.	14·7
Martin's, do.	17·8	*Shrubbery, do.....	17·6
Stevenson's, do.	17·2	Window, do.	21·0
Glaisher's, do.	16·9	Kew, do.	17·3

*[This stand has not yet been described; it is a Pastorelli stand, completely buried in thick shrubs, none of which are, however, allowed to *touch* the thermometer.]—ED.

MINIMUM TEMPERATURES IN SHADE, DECEMBER, 1869.

Temp. Fah.	Date	County.	Station.	Observer.
— 4·0	28	Westmoreland ..	Kirkby Lonsdale.....	W. Harrison, Esq.
+ 1·0	27	Aberdeen	Ballater	J. W. Paterson, Esq.
4·9	28	Cumberland	Cockermouth	Dr. Dodgson
6·0	28	Westmoreland ..	Casterton, Kirkby Lonsdale	S. Morris, Esq.
7·8	28	Worcester.....	Bromsgrove	G. Dipple, Esq.
8·0	27	Lanark.....	Cessnock Park.....	R. Hart, Esq.
"	28	Dublin.....	Black Rock ..	T. Bewley, Esq.
9·0	28	Pembroke.....	Haverfordwest.....	E. P. Phillips, Esq.
"	27	Perth	Deanston ..	J. Finlay, Esq.
9·5	28	Dumfries	March Hill Cottage.....	T. Hogg, Esq.
10·0	28	Dorset	Bridport	A. Stephens, Esq.
"	28	Yorks	Arnccliffe	Rev. W. Boyd.
"	28	Northumberland	Whitfield ..	Rev. J. M. Mason.
"	27	Carnarvon	Wern, Port Madoc	Major Mathew.
"	28	Ayr	Auchendrane	E. Cathcart, Esq.
10·7	29	Worcester	Orleton.....	T. H. Davis, Esq.
11·9	28	Nottingham ..	Highfield House	E. J. Lowe, Esq., F.R.S.
12·0	28	Tyrone.....	Leckpatrick.....	Rev. C. Maxwell,
18·0	27	Kent.....	Bromley	Rev. A. Rawson,

Temp. Fah.	Date	County.	Station.	Observer.
13·0	28	Lancashire	Holker	Mr. W. Wilson.
13·6	28	"	Manchester	G. V. Vernon, Esq.
14·0	27	Leicester	Wigston	T. Burgess, Esq.
"	28	Wilts	Wilbury	<i>The Times.</i>
14·5	28	Devon	Barnstaple	T. Mackrell, Esq.
"	28	"	Northam, Bideford.....	Rev. I. H. Gosset.
15·0	28	"	Meshaw	Rev. W. H. Karslake.
"	28	Suffolk	Culford	Mr. Grieve.
"	28	Essex	Audley End	Mr. J. Bryan.
"	28	Shropshire	Shiffnal	Rev. J. Brooke.
"	27	Staffordshire ...	Barlastone	W. Scott, Esq.
"	28	Derby	Derby	J. Davis, Esq.
"	27	Cheshire	Macclesfield	W. Jeffery, Esq.
"	29	Yorks	York	F. Thorp, Esq.
"	27	Dublin	Monkstown	A. H. Pim, Esq.
"	27	Down	Waringstown	Captain Waring.
16·0	29	Middlesex	Winchmore Hill	T. Paulin, Esq.
"	28	Leicester	Leicester	H. Bilson, Esq.
"	27	Argyll	Castle Toward ...	Mr. McIntosh.
"	27	Queen's County	Portarlinton	Dr. Hanlon.
"	28	Sligo.....	Doo Castle	Mr. D. O'Dowd.
16·9	28	Hants	Strathfield Turgiss	Rev. C. H. Griffith.
17·0	29	Kent.....	Linton Park	J. Robson, Esq.
"	3	Lincoln	Killingholme	Rev. J. Byron.
"	26	Yorks	Middlesboro'	W. Fallows, Esq.
17·4	28	Denbigh	Trevalyn Hall.....	Captain Griffith.
17·5	28	Hants	Selborne	T. Bell, Esq.
"	28	Hereford	Sellack	Rev. W. C. Ley.
17·7	28	Lincoln	Boston	Dr. Adam.
17·8	2	Aberdeen	Aberdeen	Rev. A. Beverly.
18·0	26	Cambridge	Cambridge Observatory ..	Prof. Adams, F.R.S.
"	26	Herts	Hitchin	W. Lucas, Esq.
"	28	Cornwall ...	Bodmin	Capt. J. Liddell, R.N.
"	27	Gloucester	Stroud	Miss Stanton.
"	28	Warwick	Birmingham	T. L. Plant, Esq.
18·5	28	Berks	Lynnwood	Adm. Sir F. W. Grey.
"	5, 28	Yorks	Willow Hall	Louis J. Crossley, Esq.
18·7	28	Northumberland	N. Shields	R. Spence, Esq.
19·0	27	Cavan	Owendoon	G. H. L'Estrange, Esq.
19·5	28	Kent.....	Chislehurst	F. Nunes, Esq.
19·8	28	Hants	Wainsford	H. Fawcett, Esq.
20·5	27	"	Newport, I. of Wight ...	E. G. Aldridge, Esq.
20·8	29	Middlesex	Camden Square	G. J. Symons, Esq.
21·3	28	Kent.....	Greenwich Observatory ...	J. Glaisher, Esq., F.R.S.
22·8	28	Dorset	Weymouth	E. Glyde, Esq.
23·7	27	Orkney.....	Sandwick	Rev. Dr. Clouston.
24·0	27	Galway.....	Queen's College	Prof. Curtis.
25·0	28	Cornwall	Penzance	W. H. Richards, Esq.
25·0	27	Gloucester	Clifton	A. North, Esq.
26·3	2	Denbigh	Llandudno	Dr. Nicol.
MIN. ON GRASS.				
- 3·0	28	Cumberland ...	Cockermouth	Dr. Dodgson.
+ 6·5	28	Pembroke	Haverfordwest.....	E. P. Phillips, Esq.
9·0	28	Lincoln	Boston	Dr. A. M. Adam.
9·4	28	Notts	Highfield House	E. J. Lowe, Esq., F.R.S.
16·5	28	Aberdeen.....	Aberdeen	Rev. A. Beverly.
17·0	27	Flint	Llanerch	Whitehall Dod, Esq.
17·2	28	Middlesex	Camden Square	G. J. Symons, Esq.
18·7	28	Dorset	Weymouth	E. Glyde, Esq.
28·0	28	Gloucester ...	Clifton	A. North, Esq.

BEST TIME FOR READING THERMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—I should like to know from those who have studied the subject what hours are thought best for the reading of registering thermometers. Many, myself included, have been in the habit of reading both maximum and minimum thermometers at 9 a.m. The chief objection to this practice seems to be, that one warm day often furnishes maxima for two, and in winter one cold morning not unfrequently furnishes minima for two days.

If diurnal changes can justly be compared to waves, we should naturally measure the height between successive troughs, and the depth between successive crests. In other words, the maximum should be read at the hour of minimum temperature, and the minimum at that of greatest heat. This would obviate the above-mentioned objection in nearly every case. The objection to it of course would be that most observers are in bed at 3 a.m., and it must therefore be dismissed as impracticable. But might it not be an improvement on the present practice to read the minimum at 10 a.m. and the maximum at 10 p.m. ? At any rate the subject might well be discussed.—Yours, &c.,

FENWICK W. STOW.

Hawsker, Whitby.

 TRUE TIME.

To the Editor of the Meteorological Magazine.

SIR,—I read the article on this subject in your last number with much interest, and I hope some good may come of it.

There can be no doubt that the best means of obtaining correct time is by transit of the stars ; but it seems to me that for the great majority of people, sidereal observations are out of the question. Apart from their cost, the instruments now in use require far too much nicety and care ever to become popular.

I think one of the simplest and most accurate instruments that we have is the meridian dial, and for those of your readers who have not seen one, I will give a short description of it. It consists of an upright plate, which has a very narrow vertical slit reaching to the bottom. This plate is fixed facing south, upon a smooth horizontal slab of iron or stone. At the time of solar noon the line of brightness is marked upon the slab, the exact time having been ascertained and carried by a good watch or chronometer from some trustworthy source. When once the plate is properly fixed, the line will always shew solar noon, and give correct time within a very few seconds.*

In using an instrument of this kind, allowance must of course be made for longitude, and for the equation of time. Supposing, for instance, that we have the plate fixed at Bristol, and wish to find Greenwich mean time by it on March 1st, 1870. Solar noon at Bristol occurs 10m. 12s. later than at Greenwich, and on the day mentioned we find from the almanack that the equation of time is + 12m. 32s.

* See Denison's Treatise on Clocks, &c., page 19.

When, therefore, the dial shews solar noon, Greenwich mean time will be 22m. 44s. past 12.

There is a simple method of regulating a clock by transit, as follows. If a thin plate with a small hole in it be set up facing south, and due S. of it there be fixed a perfectly vertical straight edge, the occultation of any given star against the straight edge will be seen through the hole exactly every 24 sidereal hours. Now the mean day is 3m. 55·7s. (mean) longer than the sidereal day: if then a clock keeping mean time be set by any star; after an interval, say of 10 days, it should be 39m. 17s. behind the star. If very great care is taken to fix the plate and straight edge exactly in the meridian, the apparatus might even be used for ascertaining correct time, by means of tables.

One word about clocks. I consider that more than half our troubles are due to the extraordinary want of enterprise and ambition on the part of our English clockmakers. It is a remarkable fact, that excepting the regulator, which is very costly, there is no kind of clock commonly made in England which can be depended upon to keep time within two or three minutes per week. Some clocks, however, have lately been brought to England from the Continent, which keep time uncommonly well, and are moderately cheap. They are commonly called German regulators. Some care is necessary in the choice of them. The train should be driven by a weight, not a spring, and the pendulum should have a wooden rod, with the bob consisting of a long cylinder of zinc or lead; the escapement of course should be dead. A clock of this kind, if carefully made, will keep time within about 10 seconds per week.

There are very few people who have not the means of occasionally obtaining the correct time, and if they have a clock which keeps time within a quarter of a minute per week, they will never be far wrong. I strongly recommend these clocks to your notice; their price varies from 4 to 7 or 8 guineas, according to finish, and the character of the case, &c.—I remain, Sir, yours truly,

A MEMBER OF THE BRITISH HOROLOGICAL INSTITUTE.
January, 1870.

To the Editor of the Meteorological Magazine.

SIR,—Your remarks in the December number of the magazine induce me to tell you my experiences in the determination of mean time, as I have for some time been striving to find out a cheap and accurate method.

An observation of the altitude of a heavenly body by means of a sextant and artificial horizon seems to be by far the best method. A good second-hand sextant may often be bought very cheap, and the labour of working out the observation is not very severe.

A diploidoscope has lately been lent to me, and I find that an observation of a transit of the sun may be taken, subject to an error not greater than two seconds: a star, however, cannot be observed with any such accuracy. I have not had the opportunity of testing the accuracy with which the instrument is made—*i. e.*, whether when it

is adjusted for the transit of a body of small elevation, it would also be equally accurate for another body of much greater elevation. One great disadvantage is, that it can only be used for meridian observations, and these are often rendered impossible by passing clouds.

The cheapest and most easily constructed apparatus, which is at the same time accurate to a few seconds, that I have ever seen is the following:—A school slate is firmly fixed, approximately perpendicular to the plane of the meridian and inclined at a small angle (say 20°) to the horizon. A stoutish piece of zinc, about 14 in. long and 6 in. wide, is bent at about 5 inches from one end at an angle of about 40° . A very small hole has been previously bored in the shorter part of the zinc, about an inch from the bend; the zinc around this small hole for a radius of about a quarter of an inch should be gradually thinned as much as possible; the longer part of the zinc must now be firmly fixed in a vertical position to or near the slate: thus the shorter part of the zinc will be about parallel to the slate, and a small bright spot (the image of the sun) will be seen on the slate for some time before, at, and after, the meridian passage of the sun. Now take a fine needle and fasten to it as symmetrically as possible and near the point a good sized shot; pass a fine silk thread through the eye of the needle and through the small hole in the zinc plate; you have thus a plumb-line which will determine the point in the slate vertically below the hole in the zinc. Taking this point for the centre, with a pair of compasses describe about ten or twelve concentric circles on the slate. On some one day mark the points at which the bright spot crosses each circle before noon and again after noon; bisect the arc between each of these pairs of points, and join with the centre of the circles the mean point of bisection; this line will be the meridian line, and the transit of the sun across it may be observed within a very few (3 or 4) seconds. The position of the meridian line ought to be determined when the sun's declination is changing slowly.

This apparatus is far inferior to the dipleidroscope, since it is only available for solar observations, but it is very cheap (not costing more than a few shillings).

Another very simple method is to fasten a straight-edge accurately vertical against a wall which is nearly in the meridian, and to observe the transit of sun or stars seen through an eye-hole some 20 feet from the straight-edge; the position of the eye-hole might be fixed by observing the transit of a known star on some day when the observer's watch had been accurately set.—Yours truly,

J. M. DU PORT.

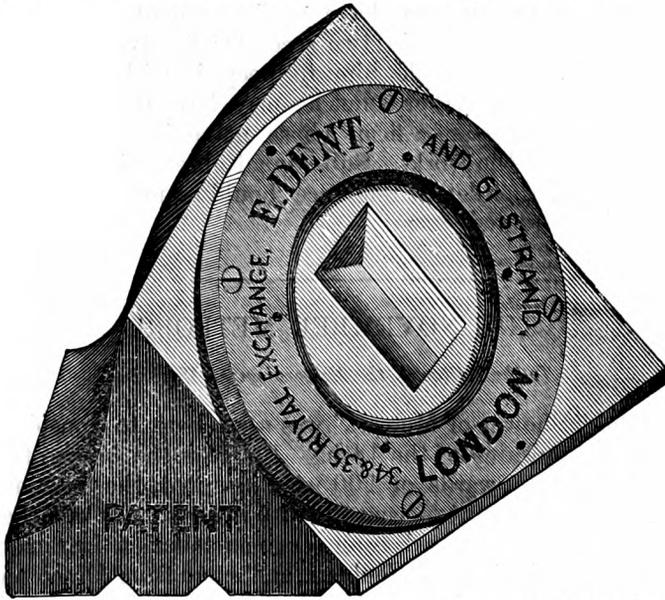
Mattishall, Jan. 8th, 1870.

DIPLEIDOSCOPES.

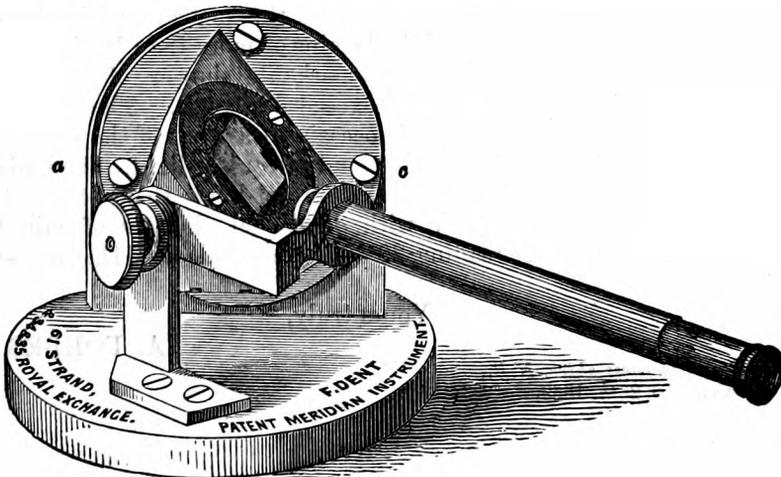
As probably many of our readers are not familiar with these instruments, we append a few details, for which we are indebted to a pamphlet by the patentees.*

* A description of the Dipleidroscope, by E. J. DENT, F.R.A.S.; 8th Edition, London: E. Dent & Co., 1867.

The name of the instrument truly indicates its principle, namely, observations of a double image, one being simple reflection from a plain glass surface, the other double reflection from two reflectors inside it. The instrument being once firmly fixed in the right position by a chronometer, by careful magnetic observations, or by Polaris, it will (in its simple form, costing £2 2s.) give time by the sun within two seconds, and is available for a considerable range of latitude.



The following engraving shows a very much improved form, whereby the line of vision is kept permanent, and the motion of the object observed is increased by the multiplying power of the telescope; in this form there seems little reason to doubt that it is little inferior to a small transit :—



Messrs. Dent add the following foot-note :—

“To any gentleman who may be disinclined to take the trouble of fixing the Dipleidoscope for himself, and who is desirous of securing the utmost possible accuracy, Mr. Dent will send a competent person, furnished with a chronometer, to fix the instrument, on payment of the actual travelling expenses, and a remuneration to the party of ten shillings per day.”

We have, therefore, reached one stage of our inquiry, and find that for two guineas any one can have an instrument which will enable him to *keep* true time within two seconds; for five guineas he can have one which will enable him to keep it within a quarter of a second; for a small further sum he may have the instrument fixed for him by an *employé* of a firm whose name is sufficient guarantee for the accuracy of the work. Subsequent observations are extremely simple, but for further details reference should be made to the pamphlet whence we have quoted.

THE NOVEMBER METEORS.

To the Editor of the Meteorological Magazine.

SIR,—The “Shower of Meteors” was seen here to considerable advantage on the morning of the 14th. Between the hours of 3 and 7 (Greenwich time) upwards of 200 were counted, the maximum part of the shower appearing to occur about 5 o'clock. While the greater number of meteors emanated from the constellation Leo, many came from Perseus, Cassiopeia and Cepheus, and some from Draco and other constellations. The meteors generally shot forth from two to three together, at intervals of from 30 seconds to 45 seconds, their course being downwards, or towards the horizon, with the exception of one which came from Perseus. This meteor shot across the zenith from W.S.W. to E.N.E.—the nucleus, which was about the size of Jupiter, and intensely bright, bursting in two before it disappeared. The time of its occurrence was 4h. 48m. None of the meteors, with the exception of the one just described, had trains of more than 10° in length, and, different from those in the remarkable shower of 1866, the duration of their visibility did not exceed 5 seconds. The colour of the nucleus of the meteors on this occasion was that of the stars, but a few of them had hues of red, blue, and greenish light. The night of the 13th was mild, with a temperature not lower than 44°·3. The wind blew briskly from S.W., with occasional showers of rain till midnight, the barometer reading 29·364 (corrected) at 11h., and still falling.

Yours truly,

A. FORBES.

*Culloden, Inverness-shire, N.B.,
November 26th, 1869.*

THUNDERSTORM OF DECEMBER 15TH.

Early on Wednesday morning last another exemplification of the proverbial fickleness of the weather, was given by the unexpected and remarkable occurrence of a severe thunderstorm in York and neighbourhood. The weather on the previous day had been dull but mild for the season; and a clear, frosty moonlight evening was followed by a heavy storm of thunder, lightning, and rain. The first rumblings of thunder were heard about half-past one o'clock on Wednesday morning, occasional flashes of lightning being also seen. As the early hours of the morning wore on, the storm, which proceeded from the south, gradually increased in intensity, and was accompanied by a heavy downpour of rain. Between three and five o'clock the storm appeared to be at its height, remarkably vivid flashes of forked lightning following each other in rapid succession, and peal upon peal of terrific thunder disturbing the repose of the more wakeful inhabitants. After five o'clock the storm, which appeared to have made the circuit of the horizon, gradually subsided, but occasional flashes of lightning and reverberations of distant thunder were recognisable till half-past six. There was no material alteration in the temperature during the occurrence of the storm.

A correspondent at Easingwold, says:—On Wednesday morning last, a little before six o'clock, a violent storm of thunder and rain passed over this town. There were several vivid flashes of lightning, followed by loud peals of thunder, causing considerable alarm to most of the inhabitants. The wind was very boisterous at the time, which made the storm more terrific.

A Malton correspondent writes: between four and six o'clock on Wednesday morning, two violent thunderstorms occurred in this neighbourhood. Being very dark, the flashes of lightning were terribly grand. Several showers of hail fell, followed by extremely heavy rains. The rivers have been top full for a week back, and an overflow is now feared.

A later letter from Malton, says: from numerous quarters we hear of timber shattered by lightning, and also cases of stock killed in the fields. At Alncliffe-dale Head an ash tree was split in pieces, and a thatched shed beneath it was fired, and a mare and foal roasted. Mr. Gibb, the owner, had just fed the mare, and had not left more than three or four minutes. Owing to the fury of the storm, and the incessant blaze of lightning, all effort to save the animals was useless. On Lyulph Common more than twenty sheep were killed, and the furze was set on fire, but put out by the rain. Windows were broken by the hailstones—or rather angular lumps of ice—and in various places streets were like rivers, and houses flooded. The North Riding rivers have risen rapidly, and there is every appearance of an overflow.

From Filey we learn that the storm broke over that neighbourhood about seven o'clock in the morning. The rain fell in torrents, accompanied by peals of thunder and terrific lightning. A large wind-

mill upon the hill, a short distance from Hunmanby Station, occupied by Mr. Plewes, was struck by lightning; the electric fluid entering a crevice at the top of the mill and running down a chain, which fortunately acted as a conductor, entered the ground without doing any injury to the mill, but the links of the chain were welded together into one mass.

At Ripon, about a quarter-past five, a terrific storm of thunder, lightning, sleet, hail, and wind passed over the city. The lightning struck the house of Mr. W. Abbott, of the Old Market-place, but the inmates escaped without injury. The damage done to the premises was slight. The storm raged about half-an-hour.

At Winestead, near Hull, three horses were killed and the man in charge of them was injured by the lightning. The young man (Norgraves), foreman on the farm Mr. T. G. Dunn, of Winestead, had three horses yoked to a cart for the purpose of leading turnips, and he having obtained a load of turnips was proceeding towards Mr. Dunn's farm with it, when about half-a-mile from it a vivid flash of lightning struck the horses, knocking them down, and striking Norgraves with great force, completely shattering one of his boots, tearing it off his foot, and hurling it a considerable distance. A watch-guard which Norgraves was wearing at the time was broken in pieces, and the face of his watch was also shattered. Norgraves, although stunned, was able to shout to some workmen a few hundred yards off, and they at once hastened to see what had occurred, when they found that the three horses were dead, and that the man had been injured. Norgraves was at once conveyed to Mr. Dunn's, and medical assistance obtained; his injuries were found to be wholly external, and hopes were entertained of his speedy recovery. The horses were worth about £80, which is nearly covered by insurance.—Another accident from lightning occurred at Winestead, about the same time as the above, but in this case no one was injured. The lightning struck the gas piping fixed to Mr. Marshall's flax mill, causing it to burst and the gas to ignite, but the gas was turned off at the main pipe, and no serious damage was done. Had it occurred when the hands were off work the damage would probably have been very serious.

In the East Riding the storm seems to have followed the wolds, several reports of damage coming from the western slopes. In Holderness—the flat country between the wolds and the sea—the storm was severe.

The metropolis and suburbs were also visited shortly before daylight on Wednesday morning with a hailstorm of extraordinary severity. A violent gale blew during the early part of the night; this was followed by a very heavy fall of rain, and between six and seven o'clock a burst of hail took place which lasted for some minutes. The roads in the south-western suburbs were torn up as they sometimes are after a severe thunderstorm in summer. Such a tempest at this season of the year is very rare.

The Bristol papers report a heavy thunderstorm in that city.

REVIEWS.

Tyneside Naturalists' Report, 1868. [Second Notice.]

(Continued from page 92.)

OUR previous notice, and the letters arising therefrom, have occupied so much space that we are reluctantly obliged to abandon our intention of examining in the detail which the excellence of the publication merits, the residue of its contents. Since our September number appeared, we have received from the observer at Greta Bridge the necessary data for completing the table (on p. 123) in that number. He states that the fall really was in January 3·21, April 3·29, May 1·01; therefore, the yearly total is wrong, both in the *Tyneside Report* (28·81), and in *British Rainfall* (28·69), the real amount being 28·79. We sincerely hope that all those of our readers who are also observers will accept as a warning the trouble and discredit errors of this class bring upon those who of necessity must rely to some extent upon the carefulness of their correspondents.

We notice similar anomalies in the barometrical returns; most of them agree very well, and from them and other sources we know that the difference between the mean reading of the barometer at stations in the North of England in November and December, 1868, was 0·61 in. but we find from the tables that at Alston it was 0·74 in., and at Wallington, 0·06 in. Very probably some entries have been made an inch too high in December, but if meteorology is to make any progress errors of this sort must be hunted down, however unpleasant the process to all parties—most of all to those whose duty it is to point them out. The wind records have been tabulated in a very useful manner by Dr. Hooppell, who draws attention to some want of uniformity in the observers, and suggests improvements for 1869.

Sur le Régime Pluvial du Bassin Occidental de la Méditerranée.

Par V. RAULIN. 8vo, 8 pages. [Extrait des Actes de l'Académie des Sciences de Bordeaux, 1867.]

THIS paper is so brief, so much to the point, and to English readers difficult to obtain, that instead of reviewing it we shall freely translate it, inserting any remarks of our own between square brackets [].

In my "Observations Pluviométriques faites dans le Sud-Ouest de la France, de 1714 à 1860," I said, speaking of the constancy of the three-monthly and monthly curves, that "if for rainfall observations a period of ten years is quite insufficient when we endeavour to determine the mean fall over a country, ten years, provided they are consecutive, or taken hap-hazard from a long series will suffice to give a fair idea of the relative fall in different seasons of the year, and fix approximately the course of the monthly curve belonging to the locality, such as in the Aquitaine in the zone of autumn rains, or in the central

districts, and the Pyrenees in the zone of spring rains. In fact, in "two localities where two series of continuous observations of nearly half-a-century have been made—namely, at Courçon (Charente Inférieure), where the autumn rains predominate, and Toulouse, where the vernal ones are heavier, two periods (one of the ten wettest years and one of the ten driest years) give the means and seasonal curves almost identical with those of the 50 year values."

It appears to me of high interest to ascertain the distribution over the French shores of the Mediterranean, and indeed over the whole area from Spain on the west to Italy on the east, France on the north, to Tunis and Algeria on the south.

Even up to 1840, the series of observations necessary for this study existed only for the centre of France, for Italy, and Gibraltar. In 1850 we had besides, three Algerian stations. In 1867 we further obtained a series from Corsica, three from Spain, and one from Portugal.

The series of which I shall make use contains at least the twelve years 1856—67.

Even the most superficial examination of the monthly amounts shows that the district I have named, possesses a rainfall region distinguished by drought during the three summer months, which is slight in Northern Italy, but severe in France and Southern Italy, and extremely so in Corsica, the Balearic Isles, Sicily, Algeria, Spain, and Southern Portugal.

In Spain, on the coast at Alicant, as in the high plateau of Madrid, and in Roussillon, at Perpignan, the winter is exceptionally dry, spring and autumn are the most rainy seasons, and they are nearly equally so.* On all the rest of the coast autumn and winter are always the two most rainy seasons, but there are great differences in the relations which exist between them. In France, at Montpellier, Marseilles, and Toulon; on the south-west coast of Italy, at Gênes, Pisa, and Rome, autumn is much more rainy than winter. In Corsica, at Ajaccio, and in the Balearic Isles, at Palma, autumn slightly exceeds winter. A series at Cagliari, in Sardinia, would be very interesting.

In Northern Italy, at Naples, Molfetta, Locorotondo; in Sicily, at Nicolosi and Palermo winter and autumn are nearly alike. In Algeria, Southern Spain, and at Lisbon, winter rains far exceed those of summer.

(To be continued.)

* Since writing the above, I have received from Monsieur José Monserrat at Valencia (Spain) a series of eleven years, which form a remarkable anomaly. Contrary to what occurs in the three localities just named, and one may almost say at Palma, the autumn rains at Valencia, in the interior of the trapezium, far exceed those of winter and spring. It will be very important to know what occurs at Barcelona, but M. Antonio Rave has not yet sent the observations for which I have asked him.

DECEMBER, 1869.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which ≥ 0.1 or more fell.	Max.		Min.		
				Dpth	Date		Deg.	Date.	Deg.	Date.	
		inches	inches.	in.			Deg.	Date.	Deg.	Date.	
I.	Camden Town	2.94	+ 1.44	.65	16	14	57.7	19	20.8	29	11
II.	Staplehurst (Linton Park)	3.79	+ 1.96	.84	21	21	52.0	18	17.0	29	16
„	Selborne (The Wakes).....	4.72	+ 1.97	.98	16	15	52.3	18	17.5	28	17
III.	Hitchin	3.27	+ 1.96	.56	16	21	57.0	18	18.0	26	10
„	Banbury	4.29	+ 2.62	.89	16	21	54.0	18	16.0	28	17
IV.	Bury St. Edmunds (Culford).....	4.84	+ 3.35	.64	16	21	54.0	18	15.0	28	8
V.	Bridport	4.37	+ 1.00	.72	16	17	54.0	17.7	10.0	28	13
„	Barnstaple.....	5.19	+ 2.07	.83	17	18	57.0	18	14.5	28	...
„	Bodmin	5.68	+ .44	.85	16	23	52.0	8	18.0	27	10
VI.	Cirencester	5.30	+ 3.01	1.40	16	16	...	...	...	...	...
„	Shifnall (Haughton Hall) ...	3.31	+ 1.63	.60	14	19	55.0	18	15.0	28	17
„	Tenbury (Orleton)	4.45	+ 1.99	.62	18	21	58.0	18	10.7	29	13
VII.	Leicester (Wigston)	3.58	+ 2.06	.57	17	14	55.0	18	14.0	27	11
„	Boston	4.44	+ 2.95	.64	17	26	55.8	18	17.7	28	9
„	Grimsby (Killingholme)	4.72	...	.58	17*	27	55.0	18	17.0	3	...
„	Derby.....	3.91	+ 2.36	.88	17	21	55.0	18	15.0	28	13
VIII.	Manchester	3.62	+ 1.29	.86	17	20	55.0	18	13.5	28	12
IX.	York	3.66	+ 1.86	.58	5	22	56.0	16	15.0	29	13
„	Skipton (Arncliffe)	8.12	+ 3.57	2.08	18	13	51.0	19	10.0	28	17
X.	North Shields	2.81	+ .61	.51	26	23	56.0	18	18.7	28	11
„	Borrowdale (Seathwaite).....	17.77	+ .82	3.87	11	16	...	...	...	...	...
XI.	Cardiff (Town Hall).....	5.55	...	1.40	16	14	...	...	...	...	...
„	Haverfordwest	5.94	+ 1.11	1.32	16	14	54.0	18	9.0	28	14
„	Rhayader (Cefnfaes).....	7.39	+ 4.10	1.72	17	12	53.0	...	13.0	28	5
„	Llandudno.....	3.07	+ .87	.67	17	16	56.6	18	26.3	2	7
XII.	Dumfries	4.49	+ 1.03	.65	13	12	54.0	18	9.5	28	17
„	Hawick (Silverbut Hall)....	3.62	...	.69	10	16	...	...	...	...	...
XIV.	Ayr (Auchendrane House) ...	6.80	+ 2.78	2.36	10	19	61.0	13	10.0	28	23
XV.	Castle Toward	6.16	+ .81	1.01	10	15	52.0	13	16.0	27	17
XVI.	Leven (Nookton)	1.58	+ 1.20	.43	10	13	...	...	...	...	...
„	Stirling (Deanston)	5.26	+ 1.06	1.08	10	19	51.1	18	9.0	27	25
„	Logierait	3.42	...	.67	30	14	...	...	...	...	...
XVII.	Ballater	2.78	...	.53	30	16	49.0	18	1.0	27	26
„	Aberdeen	2.81	...	.71	30	20	48.2	13	17.8	2	27
XVIII.	Inverness (Culloden)	2.67	...	..	..	..	47.9	18	21.0	27	17
„	Fort William .....	...	...	...	...	...	...	...	...	...	...
„	Portree	10.64	+ 4.99	1.28	13+	20	...	...	...	...	...
„	Loch Broom	5.63	...	.68	14	16	...	...	...	...	...
XIX.	Helmsdale	2.71	...	.42	14	23	...	...	...	...	...
„	Sandwick	3.76	+ .21	.92	30	21	45.0	14.7	23.7	27	9
XX.	Cork	7.12	...	1.88	29	18	...	...	...	...	...
„	Waterford	5.41	+ .99	.69	16	21	50.0	12	19.0	27	14
„	Killaloe	6.19	+ 2.68	.93	17	29	55.0	18	18.0	28	12
XXI.	Portarlington	3.39	+ .19	.49	18	28	56.0	18	16.0	27	15
„	Monkstown	3.14	+ .52	.55	30	16	47.0	1	15.0	27	...
XXII.	Galway	8.07	...	1.35	29	25	51.0	1	24.0	27	9
„	Bunninadden (Doo Castle) ...	6.19	...	1.27	30	21	53.0	18	16.0	28	11
XXIII.	Bawnboy (Owendoon).....	6.06	...	1.00	17	19	54.0	17.7	19.0	27	18
„	Waringstown	3.37	...	.48	10	19	56.0	18	15.0	27	18
„	Strabane (Leckpatrick)	6.55	...	.92	29	23	54.0	18	12.0	28	28

* And 21. + And 29. ‡ And 18. § And 28.
 + Shows 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.

STAPLEHURST.—First week cold and frosty; middle of month mild and wet, with floods on 17th and 22nd; last week frosty, with a considerable quantity of S on the ground; high winds on nights of 13th, 15th, and 17th; fogs prevalent in the middle of the month.

SELBORNE.—A little S at noon on 3rd, heavy fall on following day; fog on 7th, 8th, 9th, and 10th; wind changed from N. and E. to S. 11th; white frost on 12th; violent H storm with T, R, and wind from W. at 6 a.m., 1 p.m., and 4 p.m. on 15th; hurricane all night of 16th and morning of 17th.

HITCHEN.—S on 24th, 25th, 26th, and 27th.

BANBURY.—H, T, L, and R on night of 14th and morning of 15th. S on 1st, 21st, 24th, 25th, 26th, and 27th.

CULFORD.—A month of great rainfall being more than three times the average; S on the 1st and 3rd; Christmas morning was ushered in by a S storm, and S continued at intervals during the next three days.

BRIDPORT.—On the 16th, 0·72 in. fell in ten hours; L on 9th, 15th, and 19th; gales on 13th, 14th, 15th, 16th, 19th, and 30th; bar. at 29·10 at 6 p.m. on 16th. Sea very rough on 30th; a brig came on shore at 7 p.m., and soon went to pieces.

BODMIN.—Average temp. of the month 40°·0, being 3°·4 below the average.

CIRENCESTER.—An extraordinary fall of R on the 12 days—10th to 21st, and on the 16th R equal in bulk to that from a July TS, more than 20 an hour, total fall being 1·40; T six miles E. of Cirencester was heard on that occasion, and the R was succeeded by a gale of wind commencing at 5.30 p.m., very violent at 7.30 p.m. On Christmas Eve real winter began, lasting only five days; temp. 20° on two nights.

SHIFNAL.—A most variable month, the changes from heat to cold were very sudden; hard frosts on the first five days; the ground was saturated with the continuous rainy days from the 8th to 22nd, inclusive, and there was such a flood as has not been known in this century, it is said, exceeding that of 1852; the water nine inches deep in the old Abbey Church. Hard frosts again from 25th to 29th, inclusive; fog or mist from 3rd to 10th.

ORLETON.—Cold and frosty to the 3rd, then a dense canopy of clouds till the 10th; heavy falls of R and S afterwards till the 23rd; great floods in the Severn on 21st; cloudy after, with severe frost at times till the end; L on evening of 15th; T on the 19th. Temp. about 3°·0 below the average; very variable, and subject to frequent and sudden changes.

WIGSTON.—Mean temp. 6°·5 below that of last December; rainfall above the average, although an inch and a half less than in December, 1868.

BOSTON.—The month began with frost, but thaw came on the 3rd, and the weather was wet and misty up to the 12th, when the falling mercury slightly rallied; the bar. was very steady for a few days, and on the 16th it fell as low as 28·768; this great depression was followed by a severe gale. On Christmas Day a frost of considerable intensity set in, and S fell heavily; thaw set in on the 29th, and the last two days of the old year were wet and gloomy. Ther. on grass went down to 9° on 28th.

KILLINGHOLME.—Three inches of S on 2nd, nearly all gone next day; seagulls inland on 11th; brilliant meteor in N. at 6.15 p.m. on 12th. Bar. 29·00, and low tide at high water in Humber on 13th; lunar corona on 14th; TS between 7 and 8 a.m. on 15th, followed by H. Sea roaring at night from 21st to 26th, inclusive, very loud on 25th. Very wet wintry month throughout.

DERBY.—A cold wet month; ther. fell to 15°·0 on 28th-29th; 2·40 in. of R fell from the 13th to 18th, causing a very serious flood in the low-lying districts of the town; S 5 in. deep on the 27th, yielding 0·26 in. of water. It is much to be regretted that the custom is extending of speaking of low temperatures as so many *degrees of frost*, which is not only unscientific, but is the cause of many

errors. There are sufficient annoying discrepancies already in meteorological records without importing this.

ARNCLIFFE.—3·20 in. of R fell on the 17th and 18th, causing, on the latter day, the highest flood for 40 years; temp. rose from 11° on the 29th to 35° on the 30th.

NORTH SHIELDS.—S on 1st, 3rd, 24th, 25th, and 26th; TS on 23rd and 26th.

SEATHWAITE.—Though nearly 4·00 in. fell on the 11th, the total fall in the month was only ·82 above the average.

W A L E S.

HAVERFORDWEST.—A most variable month; first fortnight cold and frosty, with a slight fall of S, this was followed by a very wet and stormy period till the 22nd, after that frosty with S; intense frost from 25th to 28th; ther. on S on morning of 28th, at 8 a.m., reading 6°·5; on the following morning all trace of the recent severity disappeared as suddenly as it came; tremendous gales on 16th and 30th, with heavy rainfall.

CEFNFVAES.—This month has been generally damp, heavy rains, H storms, T, L, and boisterous winds. On the morning of the 28th a ther. having an eastern aspect, but slightly shaded, at a quarter past nine stood at 13°.

LLANDUDNO.—S on the near or distant hills every day in the month.

S C O T L A N D.

DUMFRIES.—The first nine days frosty and fine, from 10th to 19th wet and stormy, with occasional S showers; 20th to 28th frosty, with a heavy fall of S on the 26th, on morning of 28th the protected ther. being at 9°·5. The month closed wet and stormy. The frost has not been so intense since January, 1861.

HAWICK.—Skating and curling went on merrily for the first four days of the month, and although there were some pretty sharp frosts afterwards, it was not until the 21st that these invigorating sports were resumed for a few days. Stormy winds on 13th, 18th, 25th, 26th, 29th and 30th. The weather during the month has been very changeable. Brilliant meteor at half-past six p.m. on Sunday, the 12th, going in a westerly direction. I was in church at the time, or should have liked to have traced its course.—[We presume this is the same meteor as seen at Killingholme and Huddersfield at 6.15 p.m., though there is a difference of a quarter of an hour in the time mentioned.—ED.]

AUCHENDRANE.—The rainfall this December has been excessive, considering that the mean temp. was very low, and the bar. rather above the mean. The well-marked presence, however, of the polar and equatorial currents, with their attendant great fluctuations of heat and cold, may explain both the large rainfall, those wide oscillations of bar. and ther., and those calms and tempests for which this December has been remarkable. The heaviest gales here were on the 13th and 30th. The S on the 26th and 27th only measured 4 in. The river has been in constant flood.

CASTLE TOWARD.—The first 8 days clear and frosty; then wet and stormy until the 20th; fog and heavy white frost to the 22nd; then clear with intense frost to the 28th, when it changed suddenly to wet; strong gale on the 30th, with reports of losses on the Clyde; fog so close on the 20th that steamers on the Clyde could not go between Greenock and Glasgow. I have just taken up a common garden ther., that has been buried 8 inches in the centre of the garden; it stands at 41°, at this time last year it stood at 46°.

DEANSTON.—This month set in with sharp frost and sunshine; then some days dull and foggy; on the 10th stormy and wet, with heavy R on the 11th; gale on the 13th, wet and slight S showers, but none lay on low ground. Hard frost on 21st to 25th, with bright sun. Heavy blast of S on the 26th, lying two inches deep. Very hard frost on 27th and 28th; ther. at 9° during 12 hours from 9 p.m. on 27th to 9 a.m. on 28th; a little S on the night of the 28th; slight thaw on 29th; fresh S almost off all the low ground on the 30th; very stormy all day, with cold sleety R; wind S.S.W., with a swift upper current, accompanied by a loud rolling noise, which I think indicated a storm on the coast; blowing hard in the evening; 31st more settled, cloudy with some sunshine and light showers.

LOGIERAIT.—The frost which set in towards the end of November continued

without much intermission till the 28th December. From the 10th to the 18th there were several heavy falls of R, but there was always a degree of frost, while from that date till the 28th its intensity was very great. A strong gale on the 13th. Altogether it has been the most severe December we have had for many years.

BALLATER.—A very cold disagreeable month, with occasional intense frosts; the mean temp. 5° under that of December during the past 6 years; the rainfall under the average of the last 9 years.

ABERDEEN.—A month of cold unsettled weather; intense cold during the first three days of the month, and again between 24th and 29th; severe S storm during the latter period; 19 nights on which auroræ were seen. Min. bar. 28·230 on 13th, on which day there was a heavy gale from the S. Bar., temp., R, and estimated pressure of wind, all under the average.

LOCHBROOM.—The month continued frosty from the 1st to the 9th; then unbroken R, S, H, sleet and wind to the 21st; then a week of very severe frost; and then we had four days of beautiful thaw, which ushered in as fine a new year's day and two following as we ever had.

SANDWICK.—December has been drier than the mean of the previous 28 years. The first part was particularly dry, and nearly half the R of the month fell in the last three days. On the 13th, at 9 p.m., the bar. fell to 28·096 in., which is the lowest since 8th of April, 1860, when it was 28·090, yet there were no violent storms here. There was some S with severe frost from 25th to 29th. Auroræ on four nights.

I R E L A N D.

GALWAY.—Severe storm at night on 13th, and also on 14th, with T and L.

DOO CASTLE.—Much R this month. T on the 13th, and a fierce gale, which lasted for one hour, from 3 to 4 p.m.; a gale also on the morning of the 30th. Some severe frosts; ther. down to 16° on the 28th. It was a month of extremes, heavy rains and severe frosts; the S covered the ground from the 25th to the 29th.

OWENDOON.—Great aurora on 13th, and high storm on morning of 30th.

WARINGSTOWN.—Heavy gales on the 10th, 13th, 19th, and 30th; that of the 30th was unusually violent. Sharp frosts during the fourth week. Rainfall above the average.

LECKPATRICK.—The wettest and coldest December registered here; about one-third of the whole rainfall of the year fell in the last two months; number of nights' frost on grass in the last three months, 56, the grass ther. falling to or below 32° on every night in December. Mean temp. of month, $34\cdot15$. Severe gale on night of 30th.

METEOR OF DECEMBER 12TH.

To the Editor of the Meteorological Magazine.

SIR,—I send you the following, as written out for me by the spectators:—

“On the evening of December 12th, about 6.15, as we were descending the hill towards Huddersfield, and about two miles therefrom, we were suddenly surprised and delighted by one of the most brilliant meteors we had ever seen. Its course was north to north-west. It was yellow at first, rapidly changing into pale green. There were three bursts of light, and we fancied they were accompanied by a hissing sound. It lasted, we thought, about three seconds, the tail being visible a second or two later, and my sister insists it was crimson, though I did not notice that interesting fact.

H. B. C.

Fartown, Huddersfield.