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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 diptidoscopes, 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.

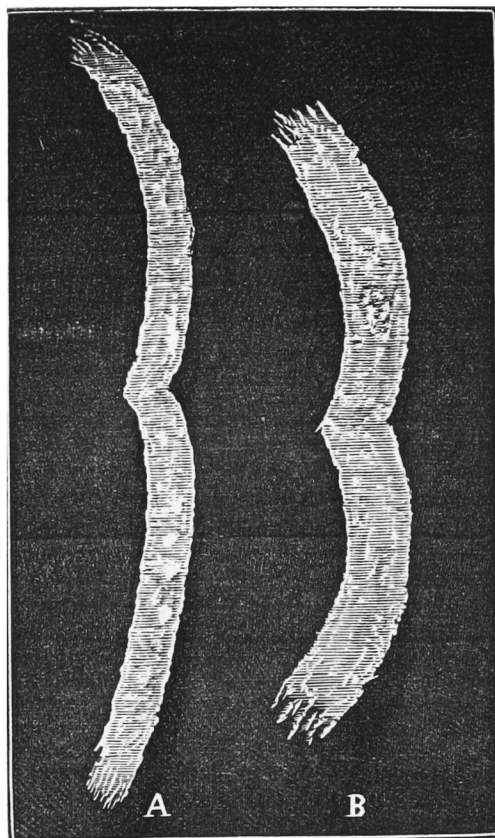


Fig. A.—The tail of the meteor, as seen three minutes after its descent.

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 waved 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.

FAIRMOUTH, 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 Faccombe.”

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 Sagittarii, 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.

ALMOUTH, 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 Toynebee 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 $0^{\circ} \cdot 12$ 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, $0^{\circ} \cdot 27$ 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 com- menced.
				feet.	1868
Aberdeen ...	D. Thomson, M.A., Professor of Natural Philosophy	$57^{\circ} 8'$	$2^{\circ} 5'$	88.5	April.
Glasgow ...	R. Grant, LL.D., F.R.S., Professor of Practical Astronomy.....	55 51	4 16	184.0	Jan.
Armagh.....	Rev. T. Romney Robinson, D.D., F.R.S., Astronomer	54 22	6 39	207.3	May.
Valencia ...	Rev. Thomas Kerr	51 54	10 25	23.0	Aug.
Stonyhurst..	Council of Stonyhurst College ...	53 50	2 25	360.7	Jan.
Kew	Kew Committee of British Asso- ciation.....	51 29	0 18	34.0	Jan.
Falmouth ...	Royal Cornwall Polytechnic So- ciety	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.				Days on which ·01 or more fell.	TEMPERATURE.				No. of nights below 32° on ground.	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.			Max.		Min.			
				Dpth	Date		Deg.	Date.	Deg.	Date.		
		inches	inches.	in.								
I.	Camden Town	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.	Hitchen	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	
"	Grimsby (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	26	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.	Portarlinton	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.

SCOTLAND.

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 locks 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 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.

IRELAND.

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.