

# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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XXX.]

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## THUNDERSTORMS AND TIDAL DISTURBANCES.

On the 5th of June, 1858, at 5.30 a.m., the clouds in the vicinity of London assumed a form entirely new to us, and we believe unknown even to the greatest authority on cloud—Luke Howard. Once seen, it is not easily forgotten, but having neither the pen nor pencil of a Howard, we do not find it easy to describe it. Mentally, we have always remembered it as “bags of sand cloud,” the simplest idea being that of a soft textile fabric full of something heavy, supported at intervals and sagging down between, the edges perfectly smooth and regular. There were several rows of this, like sacks, filled and tied, lying sideways one on another.

At 5.55 a.m. the most severe of the violent thunderstorms of that year began. A policeman was blinded in the Bethnal Green Road, the telegraph apparatus at Bow, Bow Bank, and Victoria Park was partially destroyed; several trees were struck in Greenwich and Victoria Parks, and seven sheep killed; a house was struck at Hackney, and the church at Walthamstow. The storm lasted in London from 6 to 9 a.m.

At Ramsgate it was very severe, and about 9.15 a.m. the “water in Pegwell Bay, the tide being then about two hours past flood, suddenly receded about 200 yards, and returned to its former position within the space of about 20 minutes. The shrimpers, many of them elderly men, and others in the neighbourhood, never before experienced such a surprising phenomenon.”

Ten years passed, and though we had often questioned observers, and kept a look out ourselves, we neither saw, nor heard of anyone else seeing, these sand bags. In 1867, however, we received Dr. Clouston's *Weather Prognostics*,\* and on the cover were delighted to see our acquaintance of June, 1858, and to find it and its usual attendants described in detail, for which we must refer our readers to Dr. Clouston's interesting pamphlet, merely quoting a few words, which are almost a paraphrase of our own description:—

“It is a series of dark cumulous-looking clouds like festoons of dark drapery, over a considerable portion of the sky, with the lower edge well defined, as if

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\* An explanation of the popular *Weather Prognostics* of Scotland, on scientific principles, by the Rev. C. Clouston, LL.D., L.R.C.S. Edin., &c. Edinburgh: A. & C. Black, 1867.

each festoon or 'pock' was filled with something heavy, and generally one series of festoons lies over another, so that the light spaces between resemble an Alpine chain of white peaked mountains. It is essential that the lower edge be well defined, for a somewhat similar cloud, with the lower edge of the festoons fringed or shaded away, is sometimes seen, and followed by rain only."

We will take one line only as to its effects—" *This cloud is well known, and much dreaded by Orkney sailors.*"

In the second edition of "Buchan's Handy Book of Meteorology," (just published) we read:—

"Since Dr. Clouston has drawn attention to this cloud, it has been several times observed farther south. In the autumn of 1866, the Hon. Ralph Abercrombie observed it twice in the west of Scotland, when it was on each occasion followed by a storm. It was also observed by R. Ballingall, at Eallabus, Islay, on the day before the great hurricane which swept over Scotland on the 24th January, 1868."

This year, on June 21st, at 8.45 p.m., looking westward from London, a perfectly black uniform cloud extended through about 70° of azimuth, and perhaps 60° high; at 9 p.m. this cloud showed signs of thickening in parallel horizontal lines; at 9.5 p.m. these horizontal lines became gently sinuous, and a close approach to the 1858 cloud was noticed; about 9.10 it broke up; at 9.20 there was a violent rush of wind from W.S.W., like the electric breeze of a thunderstorm; no thunder was heard, but a sharp shower of rain fell.

The characteristics of June 1868, were heat, drought, and the absence of thunderstorms. Did these features continue unchanged through the period before and after this cloud manifestation? An examination of the notes of our regular contributors will show that they did not; that at most stations nearly all the rain in the month fell on the 20th or 21st; that at about 8.15 p.m. there was T and R in Hampshire, Wales, Worcester, and other places, in fact a temporary interruption of the otherwise uniformly fine weather.

Still stronger evidence of disturbance is afforded by the following letters and extracts:—

*To the Editor of the Meteorological Magazine.*

SIR,—I received a letter this morning from my father's gardener to say that on Monday morning last, the 22nd, he registered 2.69 inches of rain as having fallen at Browne's Hill, Carlow, on Sunday, 21st. There was a shower about daybreak, and then the heavy rain commenced at 1 p.m. Such a rainfall being quite exceptional in our part of the world, I thought you would like to know about it.

Believe me, your obedient servant,

R. C. BROWNE, JUN.

*Jermyn Street, St. James's, June 23rd, 1868.*

*To the Editor of the Meteorological Magazine.*

SIR,—I enclose you three extracts from the *Sussex Gazette*, giving a short account of a storm on Sunday, 21st June. Possibly other correspondents have sent you a more scientific account. The rain here was .32. The cloud came up from S.W., the wind here blowing from N.E.—Yours truly,

H. MASTERS WHITE.

*Littlehampton, July 2nd, 1868.*

**"BOGNOR.—THE STORM ON SUNDAY EVENING.**—There has not been a more prevailing topic of conversation of late than that of the heat of the weather. On Sunday afternoon most of the places of worship were thinly attended, probably from this cause. About seven in the evening the clouds rose rapidly towards the west, and gradually became more compact and intense. This, with the declining sun, gave the western sky a beautiful but unusual colour, forming a background which rendered trees, houses, or other objects to stand out in such clear relief as to cheat the eye as to their probable distance. The south, which had hitherto been unobserved, begun now to show clouds of a spiral shape, which hung over the sea like waterspouts. These imperceptibly but quickly became massed into one immense form, of varied blue and white tints, such as icebergs are sometimes represented to be, and stretching from south to north-west gradually became darker, but so attractive were they from their singularity, that a great number of persons seemed determined to remain on the beach and promenade to watch their progress, heedless of the threatening and coming storm. However, about eight o'clock the wind arose like a hurricane and whirlwind combined, forming such eddies of blinding dust and sand as nearly to hide one person from another, and throwing up in the air small particles of grit, which descended like hailstones, assailing every one, and rapidly changing the appearance of the habiliments of the company, especially the light attire of the fair sex. Then came the flight, the scamper, and the crowd disperser—namely, a heavy shower of rain, welcomed and longed for, excepting by those who got well drenched after being well dusted."

**LITTLEHAMPTON.—EXTRAORDINARY APPEARANCE OF THE HEAVENS.**—The utmost astonishment, with much alarm, was felt by all here a little before eight on Sunday evening by the extraordinary threatening aspect of the weather. Clouds of intense blackness rapidly rose from the south and south-west, and at the eastern extremity of the former the appearance was that of a whirlwind and waterspout combined; but fortunately as it neared us, the violence of its character abated, and the only effect that we have heard of by the gust of wind with which it was accompanied was the laying of a lady prostrate in the Western-road, without however seriously hurting her. Unlike the eastern and other parts of our county, rain fell only on the night of Sunday."

**"WORTHING.—EXTRAORDINARY PHENOMENA.**—On Sunday evening, shortly after eight o'clock, some very extraordinary phenomena were observed here. The appearance of the sky in the south was most wild and singular. Clouds of a heavy greyish colour flew past in an easterly direction, assuming formations unlike anything we have ever seen before. They seemed like masses of twisted columns whirling through the air. At one time they partook more of a pyramidal form, and it was when this effect was particularly observable that large raindrops fell, and the wind, suddenly veering, blew strongly from the south-west. Some seats upon the esplanade were overturned, and persons hurrying to shelter were nearly carried off their legs. The tide, which was flowing fast and had nearly reached the beach, *suddenly receded 60 or 70 yards*; and the noise occasioned by the sea rushing out between the piles of the pier induced the one solitary person who was upon the structure at that time to beat a precipitate retreat. The tide flowed again very rapidly, though not nearly so quickly as it had receded, and there was a long wave of foam thrown up as it again approached the shore. The watermen, apprehensive of a storm, hurriedly got their boats ashore and hauled them high on the beach; but the wind soon dropped, the sea grew calm, and only beneficent showers of rain fell through the night."

Can any of our readers say whether the coincidence of these tidal phenomena with this peculiar form of cloud is, or is not, more than a coincidence, and if so, can they explain the connection?

## THE MOON'S INFLUENCE ON THE WEATHER.

WHETHER or not any special lunar influence has been recently in operation we know not, but within the last month we have had more enquiries as to the effects of the moon than in the whole course of our editorial existence. While thanking our correspondents for their notes, we regret our inability to give categorical replies. The subject is so extensive, and so much has been written upon it, that neither one, two, nor half-a-dozen articles would exhaust it. We make, therefore, no apology for submitting an unconnected collection of fragments, indicating what has been done and what remains for enquiry.

In examining a question of this kind, preconceived opinions are very liable to influence the results obtained, except where absolute measurements (such as height of barometer, depth of rain, &c.,) are employed; therefore, though we have lunar maxims and theories more than 2000 years old, we leave them unnoticed, for the present at any rate, and with them all but instrumental records, for an observer predisposed to a belief in the influence of lunar phases will consider himself warranted in classing as a change of weather a variation which one holding opposite views would consider far too trivial to constitute a "change."

Schübler made observations in Bavaria for 28 years, during which time he found that (assuming .002 in. of rain as the minimum) of 10,000 rainy days, the number falling to each phase would be :—

<i>Schübler, Bavaria.</i>			<i>Flaugergués, France.</i>
Phases.	Days.	Rain.	Barometer.
		inches.	inches.
New Moon .....	306	26.55	29.743
First Octant .....	306	...	29.761
First Quarter .....	325	24.60	29.740
Second Octant .....	341	26.73	29.716
Full Moon .....	337	24.69	29.736
Third Octant .....	313	..	29.751
Last Quarter ..	284	19.54	29.772
Fourth Octant ...	290	...	29.744

Schübler measured the quantity of rain at Augsburg, 1813 to 1828, and found the amounts as stated above. He also examined the influence of *perigee* and *apogee* in 371 lunations, and found that in the seven days nearest *perigee* it rained 1169 times, and in the seven days nearest *apogee* it rained 1096 times; thus rain was 7 per cent. more frequent when the moon was nearest to the earth, than when at its greatest distance.

Lastly, Schübler found that southerly and south-westerly winds are more frequent shortly before full moon, and less about last quarter.

Flaugergués, of Viviers (Ardèche, France) read the barometer at noon every day for 20 years, and the readings reduced to 32°, converted

into English measures and grouped, give the third column in the previous table. He also found that the mean reading with the moon in perigee was 29·713, and in apogee 29·753, and that the number of rainy days was at a maximum at first quarter, and minimum at last quarter. M. Bouvard found that the observations at the Imperial Observatory of Paris gave—

Quarters .....	29·786
New and Full .....	29·759

Royal Society observations, reduced by Howard, 1787-96, give—

	Barometer.
New Moon .....	29·795
First Quarter .....	29·891
Full Moon.....	29·781
Last Quarter.....	29·882

Cotte, in his *Memoires sur la Météorologie*, discusses the question of lunar influence at considerable length. We pass, however, his detailed analysis of Toaldo's researches, since he omits those based on instrumental records, and come to a table formed from Cotte's own observations for eight years prior to 1782—

Phases.	Mean Temp.	Mean Barometer	Prevailing Winds.
New.....	51·8	29·579	E. & N. W.
First Quarter ..	53·7	·578	E. & N. W.
Full .....	53·2	·575	S. & E.
Last Quarter .....	51·5	·570	E. & S.
Gt. Declination, N. ....	51·6	·572	E. & N.
Gt. Declination, S. ....	51·7	·590	S. & E.
Equator going N. ....	52·0	·579	N. W & W.
Equator going S. ....	52·7	·597	E. & N.
Apogee .....	53·7	·570	N. E. & E.
Perigee .....	51·6	29·544	E. & N. W.

Subsequently, he incidentally remarks that "The last quarter is characterized by the greatest thermometric changes, whether from heat to cold, or *vice versa*, and next to it the 4th day before full moon ; the first quarter is generally accompanied by cold [? by a change to cold] the fourth day before new moon, has a warmer influence. New moon, apogee, and southern declination seem to be the reverse."

M. Delamark observed that when the moon is going from south declination northwards, the wind is N., the weather fine, and the barometer high, and that when the moon is going from north declination southwards, the wind is southerly, (sometimes strong), with rain and low barometer. These rules are most closely followed when the moon is at some distance from the equinoctial and in perigee.

Thomas Forster, in his *Atmospheric Phenomena*, says, "It is certain that the place of the moon has much influence on the weather. That changes of weather oftener take place about the full and new of the moon and about the quadratures than at other times, is really a fact founded on long observation, and is quite conformable to what we actually know, respecting the moon's influence on the tides."

M. Mathieu (de la Drôme) in 1862, brought out a pamphlet on the possibility of predicting the weather by lunar positions, and taking as his basis the Geneva observations 1796 to 1856, he proved (to his own satisfaction, if not to that of M. Le Verrier) that the amount of rain in each quarter lunation depends very much upon the hour at which the preceding new moon occurs.

Mr. J. Park Harrison has devoted great labour to the determination of the influence of the moon's age on the temperature, and finds that the greatest heat is in the early part of the lunation, the greatest cold shortly after full moon.

Mr. Baxendell, from an examination of nine years' observations at St. Petersburg, arrived at exactly opposite results.

Mr. Glaisher, in 1867, published an analysis of the results of Osler's Anemometer at Greenwich, 1840-47, his conclusions being that at new moon the air was less calm, and N.E. winds were less frequent, and S.W. winds more prevalent, than at and near full moon, and that during those years the moon's position had a decided influence.

Luke Howard obtained from a discussion of his own observations during nine years, 1815-23, the following results :—

Phases.	Barometer	Mean temp	Rain.
New Moon .....	29·819	48·9	55·6
First Quarter .....	·802	49·6	61·8
Full Moon .....	·793	49·1	65·5
Last quarter .....	·846	49·3	46·6
Apogee ..	·853	48·2	59·2
Perigee ..	·757	48·9	60·9
Equator going N. ....	·872	49·7	64·7
"      "      S. ....	·845	49·4	60·5
Gt. Declination N. ....	·861	49·6	64·2
"      "      S. ....	29·826	49·4	66·7

Professor Daniell obtained results very similar to the above.

Dr. Marcet found the number of rainy days almost uninfluenced by lunar changes.

Rev. L. Jenyns, from 19 years' observations, found bar. <sup>h</sup>higher at new than at full, and in last quarter than in first. Max. at new, min. at full.

### THE SPRING OF 1868 IN ENGLAND AND AMERICA.

It is worthy of note, that the spring which has been so remarkably genial on this side the Atlantic, has been as singularly cold and uncomfortable in America. The New York *Round Table* of May 23rd has a leader, whereof the following are the opening sentences :—

#### "BUSINESS AND THE WEATHER.

"If the course of trade during a series of years could be collated with synchronal meteorological tables, it would probably be found that the weather has a much greater influence upon business than is generally supposed. A cold and backward spring, like that from which we are just painfully emerging, would doubtless prove to have affected in a very definite degree the prosperity of every individual

in the country; and although a bright and inspiring season afterwards may restore confidence and elasticity, it is only, in doing so, making up a loss, not affording profit."

When we on this side the Atlantic have a season either above or below the average temperature, we are generally forthwith informed in the most authoritative manner that the course of the Gulf Stream has shifted, and this year the hypothesis has been in as much favour as ever. It seems to us clear that those who start and those who propagate this idea must be either reckless in their statements or ignorant of the simplest laws of meteorology.

If our spring is a warm one, we are told that the Gulf Stream has set more this way than usual. Indeed, the Gulf Stream is neither more nor less than an ocean-banked river of warm water; the air over this river is generally warm and damp; if, therefore, the path of this vapour-bearing current were so diverted that its presence raised the thermometer to the pitch we have recently seen it at, surely a vast condensation of vapour must result from its impact on the headlands of our sea-girt isle. In short, it seems to us that if the Gulf Stream *did* set more this way, the immediate result would be an increase in the amount of cloud and rainfall along our western coasts, so that the influence of such a change, if it did occur, would be just the reverse of what it is supposed to produce; whence we conclude, the motion of the Gulf Stream is not shown to produce our fine springs.

#### THE HURRICANE OF APRIL 27TH, AT BRUCE CASTLE.

It will be in the recollection of our readers that we deferred a description of the remarkably local squall in Bruce Castle grounds. Mr. Hill having favoured us with some very fine photographs of the wreck (by Hunnings, of Tottenham,) we have drawn up the following description from our own notes, Mr. Hill's letters, and the photographs.

Bruce Castle stands on the north side of Lordship Lane, near its eastern end in Tottenham. The grounds extend perhaps 300 yards from W. to E., rising slightly at the eastern extremity into a knoll, beyond which the ground falls 30 feet to the main road. The old "castle," with the new school buildings, are at the W. side of the grounds, and present a broad front to the W., perhaps 120 ft. long by 40 ft. high. With the exception of the above-mentioned knoll, the grounds are level, and, though higher than much of the adjacent land, are certainly not to be described as at all exposed; their height above sea level is only 70 feet, and they are well wooded, but we could see nothing special to afford a clue to their being singled out for such destructive force. We say "singled out," since tolerably close enquiries over seven square miles round Bruce Castle, only revealed the destruction of two trees—one a little to the W., and the other just outside the grounds to the S.E.; the former was certainly laid by the squall, the latter (an apple in full blossom) was positively affirmed to have been struck by lightning. If so we have the fact of only one manifestation of excessive wind force within a radius of  $1\frac{1}{2}$  miles, except in

the castle grounds, and we have already said that their position affords no clue to their special injury.

The Castle and the thickly-wooded lawn and pleasure grounds escaped, almost, if not absolutely, scathless; proceeding eastward from the house we come to the field and wooded knoll wherein the damage was excessive. A few trees stand irregularly, in a line from S. to N., those towards the N. end had limbs broken, those in the middle were untouched, one at the S. end was uprooted; further to E. stood a fine bifurcated hornbeam, about 60 feet high, 8 ft. 3 in. in diameter at 4 ft. above the ground and just below the bifurcation. This large tree was in perfect health, the wood being singularly tough, but it was utterly destroyed, the two trunks being broken off and laid down in one straight line but in opposite directions, thus:—let (A) be the root, (B) the top of one trunk, (c) the top of the other, the result was

B——A——C.

Passing still further to the east we come to the wooded knoll, part of a belt of trees fringing the estate on that side; here the scene was most extraordinary—some fine old yews had branches a foot or eighteen inches thick, broken and twisted in a marvellous way, and “a large hawthorn was treated as if some woodman had lopped all the branches and put them in a heap,” and not a confused heap either, for all the heads were laid together, like a sheaf of corn or a nosegay, and yet close by in all directions stood trees which had hardly lost a leaf.

### THE ATMOSPHERIC DRYNESS OF MAY 19TH.

*To the Editor of the Meteorological Magazine.*

SIR,—In recording the above a writer to the *Times* says:—“Last year the dryness came with the N.E., this year with a S.E. wind, and a temperature 7 degrees higher, but on both occasions there was a very brisk breeze throughout the days. Where did it come from? Was it the tail of the sirocco from the Sahara? If so, what was it last year?”

Assuredly the S.E. wind of May 19th was not the tail of the sirocco, which is the occasional south wind of Italy. It was the usual polar wind of May, with a dash of southerly in it, due to the full effect of the sun's declination this year, in his northward advance.

The established facts of meteorology do not seem to be known to those who express wonder at the dryness of the polar current of air—coming to us necessarily dry, and wafting away the more moisture the stronger it blows, thereby producing a clear atmosphere for the passage of the heating rays of the sun. Hence, as Scoresby tells us, the tar of the seams of a ship will be melted on the *sunny* side of a ship in the Arctic Circle, whilst water freezes on the opposite side, during the polar summer. The same writer gives curious proofs of the wonderful dryness of the polar current.

The capacity of winds for moisture is ascertained. The driest winds are those blowing between N. and E. at all times, but also from S.E. in May, because it then passes over countries where it has parted with



all its moisture. The moistest winds blow from the opposite quadrant to N.E.—that is, S.W. Moisture is diminished in the other quadrants, N.W. and S.E., but, as the spring advances, and in summer, the character of the S.E. wind is altered. It then becomes the wind intimately connected with electrical manifestations—hail, rain, and lightning. But, as Luke Howard observed, the vapour brought to us by the S.E. wind on such occasions, has been generated in countries lying to the S. and S.E. of our island—the extensive valleys of the Meuse, Moselle, the Rhine, and even the Elbe, Oder, and Weser—whence the water arises in the midst of sunshine, which is soon afterwards to form *our* clouds, and pour down in *our* thundershowers. England probably does the same office for Ireland, and the eastern for the western counties of South Britain.

The laundresses know perfectly well the *drying* property of the different winds—that is, the extent to which they favour *evaporation*, which depends upon the amount of *aqueous vapour* they already contain on reaching a locality.

It has been said that most winds are liars—because they do not really come from the regions from which they appear to blow. This is the result of the earth's rotation, and other causes well ascertained; but, by the aid of the hygrometer, we should always be able to trace a wind, not only through its travels or deflections, but also to its source. This fact is important, especially in connection with the effect of winds on the heat of countries, which they constantly tend either to maintain or to diminish. A series of tables, drawn up specially with this view, would be a great acquisition to meteorology—capable of being turned to good account in estimating results in the matter of the crops and the public health.

A. S.

### WHAT IS FROST?

*To the Editor of the Meteorological Magazine.*

SIR,—Since your June number contains conflicting opinions on this subject, the question would seem to resolve itself into this: Are we to have a natural or mechanical test as to what really frost is? My own idea was, from the great liability the latter had to err, we ought to adopt the former when there were vestiges of it; but this view seems to be questioned by Mr. Festing, as well as by others, who may perhaps be right. But another question arises amongst those who, like myself, have kept meteorological notes for some years, are we wrong in recording such days as frosty as have been described, when non-conducting substances, such as wet cloths, wet straw, &c., near the earth were stiffened, although the instrument three feet above that substance stood at 33° or higher? if so, we must reduce the number of days recorded as frosty perhaps five or more each year. Now will this be a just record? Non-scientific men would certainly say not. In a number of years I find on an average about 90 nights have been registered as frosty ones, and assuredly when the air cools down so as to congeal water on any part of the earth's surface, or near it accessible

to us, it ought to be called a frost, and I do not see any material difference whether the water be in a body or held in suspension by some other substance more accessible to the cold air. The question at issue would be whether the phenomenon frost is to be tested by the artificial or natural standard; I certainly have a strong bias to be guided by the latter.—Yours truly,

J. ROBSON.

[We think the balance of opinion is more uniform and more in unison with Mr. Robson's views than he imagines, and that this arises from his not having worked a sensitive minimum thermometer on grass. If he had, he would not, we think, have contrasted artificial and natural standards, for he would have found both in perfect accord. We doubt if he would *ever* find frost on wet mats without finding also his grass minimum below 32°. Mr. Festing's experiments, as we said last month, are very valuable, as showing the correctness of the usual practice of placing air thermometers at 4 feet above the soil, but we do not see that they touch the present discussion, inasmuch as we might quite as justly endeavour to avoid the influence of wind and rain, as of radiation. The only difficulty which we see in the adoption of the grass minimum thermometer as our measure of frost arises from the grass not being always kept in the same state. At present, for instance, owing to the drought, many lawns are almost as bare as gravel paths, and a grass thermometer on them would be a farce. The grass must be kept short and watered at intervals, so as to preserve it in good condition.

So far as this discussion bears on the monthly table in this magazine, we intend in that for August to alter the heading slightly, so as to make it impossible to misinterpret it, and to give in the last column the "number of nights below 32° on grass." We have given lengthy notice, in order that any persons who disapprove the change may have full opportunity of stating their reasons before the alteration is made.—Ed.]

#### APRIL COLD PERIOD.

*To the Editor of the Meteorological Magazine.*

SIR,—Will you permit me to add to my communication of last month the following note in reference to the April cold period, taken from the "*Bullettino Meteorologico di Roma*," of 31st May, 1868, published by Father Secchi.

"A retrospective examination of the temperature of the air in Rome during 25 years at midday, shows that there exists a period of extraordinary cold, which manifests itself invariably towards the 10th of April, and that within a limit of 3 days, and sometimes even from one day to another, there occurs from 10° to 15° (Fah.) and more of difference. This year the thermometer on the 10th, at midday, was 59°·5; on the 11th it was 44°, the difference, therefore, was 15°·5."—I am, Sir, your obedient servant,

D. A. FREEMAN.

*Upper Tooting, S. W., 20th June, 1868.*

# METEOROLOGY IN ABYSSINIA.

WE are sure our readers will learn with pleasure that our "Special Correspondent" has returned in safety, having with his excessively small apparatus obtained results in remarkable accord with those obtained by Mr. Markham, the geographer to the expedition, with far larger instruments. It is, we believe, almost the first time that a geographer was sent with an invading army. The accordance between his results and those of our correspondent prove several points. 1. The accuracy of both. 2. The portability and yet accuracy of the smaller instruments. 3. That correct temperature, humidity, rain, wind, and weather notes, and altitudes correct to a few feet, may be obtained from apparatus not weighing more than 1 lb. or 1½ lbs., and only a few cubic inches in bulk. At Koomayle, near Zoulla, at 310 ft. above sea level, the temperature in perfect shade, 4 ft. above ground, was, noon 106°, 2 p.m. 105°, 3 p.m. 103°, 4 p.m. 102°, 5.30 p.m. 99°. We are promised a few remarks on some peculiarities in the fall of rain for our next.

## SOLAR RADIATION TEMPERATURES.

*To the Editor of the Meteorological Magazine.*

SIR,—Can you help me out of a difficulty which operates rather discouragingly upon my observation of meteorological phenomena?

There is a very large difference between my readings of a solar thermometer in Holloway and those recorded at Greenwich, and reported weekly in the returns of the Registrar-General. I cannot in any way reconcile them. My observations are made from one of Casella's best black bulb mercurial thermometers, enclosed in a vacuum tube, laid upon a grass plat, in the same manner as adopted by Mr. Glaisher at Greenwich. Not to trespass too much upon your space, I will select a few of the most striking instances of the difference I speak of; thus, omitting fractions—

June		Greenwich.		Holloway.
20	.....	165°	.....	122°
19	.....	149	.....	124
18	.....	152	... ..	127
17	.....	153	.....	130
14	... ..	159	.....	128
13	.....	148	.....	130
6	.....	146	.....	124
3	.....	148°	.....	131°

Can so large a difference as forty-three degrees be owing to a clearer state of the atmosphere at Greenwich Observatory, consequent on its more elevated and exposed position? The ground on which my thermometer lies is 95 ft. above the sea level, by Ordnance Survey; at Greenwich it is 155 ft.—I remain, Sir, your obedient servant,

W. B. KESTEVEN, F.R.C.S.

*Holloway, June 30th, 1868.*

[Reference to the tables contributed to the quarterly reports of the

Registrar-General by Mr. Glaisher seem to show that Greenwich Observatory recently reports higher solar radiation temperatures than any other station. For instance, the mean max. in sun for July, August and September, 1867, is given for 29 stations, at 10 of which it was below  $100^{\circ}$ , at 19 below  $110^{\circ}$ , at 27 (*i. e.*, all but two) under  $120^{\circ}$ , at one  $123^{\circ}9$ , and at Greenwich  $147^{\circ}$ . The excess of the Greenwich readings over all others dates from the spring of last year, and reference to the weekly returns of the Registrar-General shows that about the 10th of February, 1867, a change was made in the position of the vacuum black bulb ther. In the week ending February 9th, it is stated to be "in an open box, a foot in height, so as to be about 9 inches from the bottom of the box, and 12 inches from its sides." In the return for February 16th and subsequently, it was described as "placed on the grass *in the full rays of the sun*." On a previous occasion (Vol. II. p. 142) we took some little pains to defend the Greenwich *winter* solar radiation observations, which had been attacked for being too low; now the summer readings are charged with being too high. We have long contemplated some experiments on the subject; they are now in progress, at 62, Camden Square, and some important results may be given next month. In the meanwhile, we shall be happy to show them to any observer.—Ed.]

### NEW INSTRUMENTS.

*To the Editor of the Meteorological Magazine.*

SIR,—Permit me to correct an error in the interpretation you have put upon my letter relating to "New Instruments," that appeared in the last number of the *Meteorological Magazine*. In your remarks thereon you are evidently under the impression that I suggested that the *entire* terrestrial thermometer should be *in vacuo*, whereas I only propose that the *stem* should be, for you say, "but we fear though the great heating power of the sun's rays penetrates with ease the vacuum bulb, the glass of which it is formed, however thin it be blown, would check the sensitiveness of a terrestrial radiation thermometer." Such could not possibly take place if my plan be adopted, for the *bulb* would be entirely free, and the *stem* alone protected.

Yours truly,

A. M. FESTING, F.M.S.

69, Lower Mount Street, Dublin,  
July 6th, 1868.

[We noticed that Mr. Festing said "having the stem *in vacuo*," but three years ago we applied to two opticians so to mount a minimum radiation thermometer, and each declared it impossible to have a weld at the bulb end, owing to the unequal expansion of the different layers of glass—hence we suggested the alternative of putting the *whole in vacuo*.—Ed.]

JUNE, 1868.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which -01 or more fell.	TEMPERATURE.				No. of nights below 32°.
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.				Max.		Min.		
				Dpth	Date.			Deg.	Date.	Deg.	Date.	
inches	inches.	in.				Deg.	Date.	Deg.	Date.			
I.	Camden Town .....	.78	— 2.27	.25	4, 23	4	87.8	21	44.6	8	0	
II.	Staplehurst (Linton Park) ...	.51	— 2.23	.39	22	3	90.0	20	41.0	7	0	
III.	Selborne (The Wakes).....	.46	— 2.77	.34	21	3	84.0	16	38.5	8, 9	0	
III.	Hitchen .....	.42	— 2.22	.21	21	4	81.0	27	42.0	7	0	
IV.	Banbury .....	.46	— 2.82	.22	21	4	82.0	27	38.5	10	0	
IV.	Bury St. Edmunds (Culford).	1.12	— 1.46	.43	4	5	86.0	20	36.0	7	0	
V.	Bridport .....	.40	— 2.84	.30	21	3	79.5	18*	38.0	3, 8	0	
"	Barnstable .....	.52	— 3.60	.33	21	5	...	...	...	...	...	
"	Bodmin .....	.87	— 3.17	.35	21	6	75.0	19	47.0	3	0	
VI.	Cirencester ..	.31	— 3.07	.23	5	3	67.0	21§	56.0	5, 7	0	
"	Shifnall .....	.14	— 2.97	.14	21	1	82.0	19†	39.0	5	0	
"	Tenbury (Orleton) .....	.46	— 3.06	.29	21	5	85.4	27	37.0	5	0	
VII.	Leicester (Wigston) .....	.33	— 2.43	.30	21	2	92.0	20	35.0	2, 4	0	
"	Boston .....	.41	— 1.78	.38	21	2	88.8	27	42.0	8	0	
"	Gainsborough .....	.55	— 1.54	.37	21	4	90.0	20	41.0	7	0	
"	Derby.....	.27	— 2.62	.16	22	5	86.0	20	42.0	5	0	
VIII.	Manchester .....	.37	— 2.97	.12	23	8	92.0	...	39.0	5	0	
IX.	York .....	1.26	— .74	.62	22	6	82.0	21	43.0	5	0	
X.	Skipton (Arncliffe) ...	1.40	— 2.70	.83	20	8	82.0	30	43.0	3	0	
X.	North Shields .....	.43	— 2.31	.20	21	5	73.0	12‡	41.3	5	0	
X.	Borrowdale (Seathwaite).....	3.47	— 7.04	1.06	4	16	...	...	...	...	...	
XI.	Cardiff (Town Hall).....	...	...	...	...	...	...	...	...	...	...	
"	Haverfordwest .....	1.16	— 2.49	.86	21	4	79.1	19	38.5	2	0	
"	Rhayader (Cefnfaes).....	.24	— 3.74	.18	22	7	...	...	35.0	...	...	
"	Llandudno.....	.15	— 2.14	.07	10	4	81.0	27	42.0	5	0	
XII.	Dumfries .....	.56	— 2.34	.18	21	7	82.0	18	39.0	10	0	
"	Hawick (Silverbut Hall)...	1.25	...	.61	21	6	...	...	...	...	0	
XIV.	Ayr (Auchendrane House) ...	.95	— 2.40	.20	16	13	77.0	20	47.0	8	0	
XV.	Castle Toward .....	1.55	— 1.94	.38	16	14	84.0	30	36.0	6	0	
XVI.	Leven (Nookton) .....	.50	— 1.74	.17	21	8	73.0	19	39.0	18	0	
"	Stirling (Deanston) .....	1.29	— 1.63	.31	16	14	79.0	19	34.0	18	0	
"	Logierait .....	1.00	...	.43	21	10	...	...	...	...	...	
XVII.	Ballater .....	.61	...	.44	26	7	81.5	19	...	18	1	
"	Aberdeen .....	.63	...	.31	26	12	75.2	13	41.1	3	0	
XVIII.	Inverness (Culloden) .....	.78	...	.15	27	10	77.3	20	45.2	5	0	
"	Fort William .....	6.04	...	.91	5	20	...	...	...	...	...	
"	Portree .....	...	...	...	...	...	...	...	...	...	...	
"	Loch Broom .....	3.88	...	.83	5	23	...	...	...	...	...	
XIX.	Helmsdale .....	2.26	...	.73	26	12	...	...	...	...	...	
"	Sandwick .....	2.80	+ 1.26	.60	10	18	71.0	19	44.0	7	0	
XX.	Cork .....	.95	...	.62	21	7	...	...	...	...	...	
"	Waterford .....	...	...	...	...	...	...	...	...	...	...	
"	Killaloe .....	1.97	— 1.66	.91	21	11	82.0	19	87.0	12	0	
XXI.	Portarlington .....	2.32	— .93	1.53	22	12	74.0	20	40.5	3	0	
"	Monkstown .....	.99	— 1.63	.65	21	4	81.0	19	38.8	10	0	
XXII.	Galway .....	1.74	...	.39	21	16	82.0	30	43.0	5, 8	...	
"	Bunninadden (Doo Castle) ...	1.81	...	.90	21	10	74.0	19	39.0	5, 18	0	
XXIII.	Bawnboy (Owendoon) .....	2.48	...	1.49	21	15	81.0	18*	39.0	2	0	
"	Waringstown .....	.89	...	.45	21	10	84.0	19	39.0	2	0	
"	Strabane (Leckpatrick) .....	1.32	...	.64	22	12	78.0	21	39.0	8	0	

\* And 19th. § And 28th. || And 10th. † And 27th. ‡ And 14th.

+ 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; vegetation of most kinds suffering much from drought; corn and other crops early; very little T, and that distant; 13th to 21st and 27th very hot, the 20th being the hottest.

SELBORNE.—The greatest variation in the bar. from 5th to 19th did not exceed 0.11 in., the highest during that time being 29.81, and the lowest 29.70. Frequent distant L on 19th in the E. at 10 p.m.; R and distant T on 21st.

HITCHIN.—The driest June since 1849.

BANBURY.—Mean temp. of month 60.6, being 3° above the average; wheat in blossom at the end of the first week; distant T on 20th.

CULFORD.—Another exceedingly dry and hot month; crops of all sorts suffering severely; mean temp. 60.3. T on 20th.

BRIDPORT.—Remarkably fine month. "Had none of the storm of the 5th so severely felt in London, Brighton and other places." On night of 19th very vivid L, flash following flash in quick succession, though but little T was heard. The lowest rainfall registered here for at least 12 years.

BODMIN.—A month of singularly fine weather, but no intense heat. Average temp. 61.2; on 19th difference of 14° between the wet and dry bulbs, the greatest I have ever registered.

SHIFNALL.—Cuckoos unusually numerous; swallows fewer than usual; hawthorn hedges a mass of woolly blight on 12th; wheat in ear and beginning to blossom on 17th; barley short and poor; hay on the uplands scarce worth cutting, and the pastures generally look burnt up, as in the dog days; turnips almost a failure, only those sown last month likely to be a crop.

ORLETON.—A very dry month; the rainfall less than I have recorded in June for 38 years; during that period the least falls in June were 0.61 in 1844, and 0.81 in 1850. So bright, hot, and dry a June has not occurred since 1826; the first ten days were dry, but not warmer than the average; the remainder were very hot and dry, so that the temp. altogether has been 4° higher than the average, and has only been exceeded by June 1858. At 8.15 p.m. on 21st 0.16 in. of R fell in about 6 minutes; no L was seen, and only very faint T was heard on that day. Wheat was generally coming into ear about the 3rd, and was in blossom on 10th.

WIGSTON.—The rainfall of May was 0.53, that in June was 0.33, thus it will be seen that in two months less than .90 of an inch fell. This extraordinary absence of moisture, combined with a mean maximum temp. of 74° 6 in May, and 76° 7 in June, has produced the severest drought of which I or any one in Leicestershire has any record since 1826.

BOSTON.—Unusually hot and dry; pastures brown and scanty for want of R; wheat looking very well, and the ears assuming a golden colour at the end of the month. Harvest expected to begin in a fortnight or three weeks.

GAINSBOROUGH.—The sky was generally free from cloud during the month. TS on 20th, and R on early morning of 21st.

DERBY.—The drought has every appearance of continuing; Bar., though falling, still high. Wind N.E., and temp. 2° above the mean for June of the last seven years.

MANCHESTER.—The past June the driest since 1826; the fall in that year for June was less than this, being only 0.20 instead of 0.37 in.

YORK.—T at 5 p.m. on 20th.

ARNcliffe.—Unusually dry and fine; heavy TS, .83 in. of R in one hour, on the 20th, several cattle killed.

NORTH SHIELDS.—Grass cut on 13th; white rose in flower on 15th; cabbage rose on 18th; wheat in ear on 22nd, in flower on 30th. T on 20th and 30th.

W A L E S.

HAVERFORDWEST.—The first half of month fine, dry and cool; temp. seldom above 60°; latter half much warmer; vivid sheet L during the whole of the night of the 20th, with distant T; a few large drops of R fell, followed on the 21st by a tremendous storm of R and wind, after which the air became clear, with great heat and sunshine to the end of the month; winds principally N. and N.W.; hay crops very good; drought becoming serious.

CEFNFAES.—Dry and hot days, cold nights, at times frosty; hay crops generally very light; pasture lands much burnt, and the hills becoming destitute of herbage; great scarcity of water; prevailing winds N.W.

LLANDUDNO.—A remarkably dry month; prevailing winds W. and N.W., E. on five days. Bar. fell from 30·250 on 18th a.m. to 29·590 on 21st p.m.; on the latter day the clouds were very heavy, but only a few drops of R fell; vegetation suffering greatly from the drought; grass crops very light, with short straw; hay very light; potatoes early but small; fruit poor, though it promises well for a plentiful crop; mean temp. 58·8.

S C O T L A N D.

DUMFRIES.—The month has been very droughty; the R 1·69 in. below the average of the last five years; crops looking fine at the beginning of the month, but towards the end barley and oats had become stunted in growth, and were in ear prematurely; grass also much injured; T on 20th and 21st; temp. above the average. Wheat in ear on the 10th, and has since made great progress.

HAWICK.—A dry warm though windy month; turnips suffering much from drought; the TS on 21st lasted nearly all day; T loud, and L, both sheet and forked, was very vivid, but did no damage here.

AYR.—This June the rainfall being little more than quarter of the mean of June for the last 12 years, has been a very dry month, the driest of the whole June series, with a warm parching atmosphere, and an evaporation greatly exceeding the rainfall in amount; so severe a drought following the rather dry month of May, has not been favourable to vegetation on many soils; the rivers have fallen very low, and water is very scarce.

CASTLE TOWARD.—A fine month, with alternate sunshine and showers; garden and farm crops look well, and are full three weeks in advance of last year.

NOOKTON.—T from 2 to 10 p.m. on 21st.

DEANSTON.—First half of the month very windy and chilly, some showers; distant T on 21st; very hot and dry at the end of the month.

LOGIERAIT.—A month of considerable drought, though hitherto the crops have not suffered much, hay being secured in excellent condition. A very decided degree of frost on the night of the 17th; T on 21st.

BALLATER.—A month of remarkably dry weather, with a continuance of strong winds in the early part; crops suffering much from want of R, the soil on Deeside being very light; the exposed min. ther. was found to indicate 26°; but although there was (according to various reports) frost on the night of the 17th, it seems scarcely conceivable that the temp. could have fallen to 26° without injuring vegetation, which however was not touched.

ABERDEEN.—Mean temp. 57·1, or 2°·2 above the average of 10 years; humidity 6 per cent. less than average; R about one-quarter of average. The month was remarkable for heat and drought; during the last 12 years no June has equalled it in heat, except June, 1865, when the mean temp. was the same, but the days were cooler and the nights warmer; less R has fallen than in any June for 12 years, and in any month since May, 1859; the Dee is said to be as small as in 1826, and the crops to have suffered as much as in that year, as, though the drought has not lasted so long, there have been heavier and more parching winds; the fall of ·30 in. on the 26th gave the crops a chance, but on the 2nd of July it is as dry looking as ever, with a difference of 10° between wet and dry bulb ther.

CULLODEN.—Frequent strong winds in the first half of the month, with slight showers; hot and sunny afterwards; L on 22nd.

FORT WILLIAM.—High S.W. wind through the night of the 3rd; greater part of month wet and ungenial; very fine at the end; R was registered on 20 days;

total 6·04, against 3·95 in., 2·69 in., and 1·97 in. in the corresponding month of the three preceding years.

LOCHBROOM.—This month has been singularly cold, retarding the growth of everything; it has not been so dry here as reported from other places; R fell on 23 days; fine at the end of the month.

SANDWICK.—Colder and wetter than the mean, and very much more windy, in fact the most windy June since I have had an anemometer; there was a gale of 45 miles an hour from 1 to 6 p.m. on 6th, and two of 50 miles per hour, one from 5 to 7 a.m. on 15th, the other from noon to 3 p.m. on 17th.

#### I R E L A N D.

MONKSTOWN.—R fell only on 4 days; the temp. has been considerably above the average, and day after day the sun has shone in a cloudless sky with almost tropical power; the drought is now much felt, and the crops of after grass and turnips are, it is feared quite lost, many of the fields being quite brown; oats, however, though poor as to the straw, seem to promise a good yield of grain; wheat is a fair crop, and the principal fear now is that heavy R later on may have a ruinous effect; fruit is very abundant, but from so much of it ripening at the same time (instead of as usual at different periods) much has been lost; very clear on 24th, distant mountains visible. TS on 16th in evening, and T on 20th at 4 a.m.

DOO CASTLE.—Much wind till 21st, when heavy R fell; fine to the end of the month; a hard dry month, a few days R excepted; oats and meadows short, and poor in consequence.

OWENDOO.—This month has been remarkably dry, and the meadows appear rather light, but the crops do not at present seem to be injured; very wet with high wind on the 21st; and H on the mountain side on the 2nd.

#### LATEST INTELLIGENCE.

SIR,—On the 11th, after one of the driest, though not hottest, of the dry and hot days we have been broiling under, the sky, which looked a little suspicious at sunset, became overcast about 10 p.m., and at 11·30 down came the long wished and prayed-for rain, accompanied by thunder and lightning, which never approached within a mile of us. But the rain was tropical, and at 8·30 this morning I measured 1·39 in., again at 2 p.m. 0·45 in., and before midnight 0·52 more, making 2·36 in 24 hours.

The effect upon vegetation is perfectly marvellous. I have not had time to look at the wheat, but as a brisk wind from the northward blew about sunrise, I fear the crop will be much lodged in many places.

An extraordinary feature of the change is the steadiness of the barometer, which only fell ·05 during the night, but, now that the sky is once more serene, and the thunder has ceased to grumble over the hills, is beginning to descend in earnest.—W. F. HARRISON.

*Bartropps, Weybridge Heath, July 12th, 1868.*

#### COBHAM RAINFALL AND THUNDERSTORM, JULY 11TH TO 13TH.

11·30 p.m., July 11th to 9 a.m. 12th.....	1·03 in.
9 a.m. 12th to 1 p.m. 12th .....	·47
1 p.m. 12th to 10 p.m. 12th ..	·585
10 p.m. 12th to 9 a.m. 13th .....	·185

Total..... 2·270 in.

Just the average fall for July (43 years), which is 2·277 in.—G. DINES.