

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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THE THUNDERSTORM OF JULY 11TH AND 12TH.

THE narrative of this storm is probably best written in the words of the observers and reporters, whom we thank most heartily for their notes. We would impress upon *all* that there is no such thing meteorologically as a "slight" accident by L—the least as well as the greatest, marks the actual site of electric discharge—and we believe very much may be done by carefully and in great detail noting the site, soil, aspect, altitude and vegetation at places struck, and carefully tracking every step in the lightning's course. The above storm seems to support the theory that the intensity of the storm depends on the metalliferous character of the subsoil. Will our south-eastern readers complete the list of accidents we have commenced in the following pages? If so, we might perhaps find confirmation or refutation, by the relation of the sites struck, to those of the old iron works, for which tracts of that district were once so famous.

SUSSEX.

To the Editor of the Meteorological Magazine.

SIR,—The storm here yesterday was remarkable in many respects. 1st, for the very slight variation of the bar. and ther., and direction of wind, before, during, and after it. 2nd, for its persistence (with lulls at intervals) for about 26 hours. Commencing at 9.30 p.m. on the 11th, when the bar. had fallen from 30.10 in. to 30.03 in., it passed over in successive waves of electric rain-cloud in an E.S.E. current until after 11.30 p.m. on the 12th, when the bar. had fallen gradually to 29.95 in., at which point it remains. Throughout the whole time the earth current was nearly due N., with a low scud often masking the majestic course of the huge thunder-clouds in the upper current. Between 7 and 8 a.m. on the 12th, a wave of storm-cloud passed directly over this town, the L discharges, which were very rapid and near, being twice followed instantly by loud crashing T. This violent phase lasted about 15 minutes. A chimney of a cottage was struck, and the grate in the room below displaced, and a tree had its bark partly stripped.

The quantity of R that fell between 9.30 p.m. of the 11th and 9
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a.m. of the 12th, measured 1·48 in., and from that to 9 a.m. of the 13th, 0·48 in., *i.e.* nearly two inches in 36 hours. There was scarcely any **H**. The **L** on the evening of the 12th was very vivid and frequent, and often in flashes of immense length, from cloud to cloud, with the accompanying heavy continuous rolling **T**. But there were also frequent discharges to the earth, showing a high degree of electrical tension.—Yours truly,
Steyning, 13th July, 1868. HUGH INGRAM.

UCKFIELD.—*C. L. Prince, Esq.*—Storm clouds came up in afternoon of 11th from S.S.E. against the wind, which was N.E. ; about 9.30 p.m. **TS** began in S. ; **R** began at 10, and from 10.30 very violent and almost uninterrupted for 12 hours. About 3 a.m. 12th, I observed a large copper-coloured cumulus slowly advancing from the eastward, and pass under a large mass of cumulo-stratus cloud, situated nearly in the zenith. Almost immediately afterwards a vivid flash of forked **L** descended upon the vane on the top of a gentleman's stable, splitting to pieces one of the rafters, and ripping off the contiguous tiles. Upon reaching the eaves of the building, it rushed along a cast iron shoot, and passing around two corners of the roof, expended itself in a water tub, one stave of which was partially forced out. Had the **L** descended into the centre of the stable, a valuable horse would probably have been killed. The **R** frequently descended in torrents, and the total for the twelve hours was 2·10 inches. On the evening of 12th we had another **TS**, and ·26 more **R**, making a total of 2·36 in. Several oaks struck in the neighbourhood.

UCKFIELD—MARESFIELD.—*Rev. E. Turner.*—Total **R**, 2·99 in.

CUCKFIELD—FLETCHING.—Large oak knocked to pieces at 4 a.m. 12th.

TUNBRIDGE—FRANT.—*Dr. Allnatt.*—On 11th, at 10.30 p.m., distant **L** in S.W. ; wind N.E. ; 10.50 **TS** began here, and 1·73 of **R** fell in three hours. On 12th another **TS**, ·64 of **R**, making 2·37 in the two storms. At 10.46 p.m. on 12th two trees struck in Shernfold Park.

LEWES—RODMELL.—Warehouse struck, not much damage.

HURSTMONCEUX.—A fine oak, near the old ruins, was split from top to bottom.

HASTINGS.—On 12th **L** struck a cottage near Fairlight Church, in early morn, knocked down the chimney stack, doubled up the fender and threw it on the bed, and temporarily, if not permanently, blinded one of the inmates.—**L** also struck and damaged a cottage near Bachelor's Bump Mill ; killed a mare at Ore Place ; struck Uplands, breaking the drawing-room mantelpiece ; struck a slaughter house near Halton toll gate, damaging the roof and killing a lamb inside.—On night of 12th, chimney of Mr. Thompson's house was struck ; the **L** passed through two rooms, doing very little damage, beyond singeing the bed curtains and melting the bell wires. Rye station was slightly damaged ; six sheep killed at Guestling Park ; a house was struck in Hastings, and the bows of a yacht on the beach. **TS** more violent than for many years. Total **R**, 2·12 in.

PETWORTH.—On 12th, about 10 a.m., cottage struck and damaged, and at Hardham a hay-rick set on fire.

STEYNING—WISTON PARK.—A silver fir and a large elm struck, and at Guest Gate two fine oaks.

BRIGHTON.—On 12th, at 2.30 a.m., L struck a stack of three chimneys on S.W. side of Ellerslie House, broke the slates from five rafters, went through the roof into a bedroom, making an aperture 15 in. by 12 in. ; next passed diagonally to a register stove, displacing in its way a gilt frame and hand screen from the mantelpiece, but avoiding a large cheval glass immediately under the aperture ; it seems to have passed round the stove, tearing away the cement facings, and finally escaped by the flue. On 12th, at 7 a.m., the tower of St. Peter's Church was struck ; the L conductor on the N.W. pinnacle doubtless took the main force, but the S.W. pinnacle was split from top to bottom in two places ; several of the crockets knocked off, lead torn up, &c.

SIR,—I send particulars of the seasonable R we have just had.

Saturday, 11th.—Electric appearance, with few heavy drops in evening, but not enough for 0.01 at 9 p.m. At 11 p.m., TS, half hour's duration, and at 2 a.m. (12th) TS 1 hour. R at 9 a.m., exactly 1.50 in. in an hour and a half.

Sunday, 12th.—No R till 9 p.m. ; had tail of TS (centre 10 miles out to sea), with heavy showers. At 1.30 a.m. 13th, TS ; heavy shower again at 6.20. R at 9 a.m., 1.05 inches, making—

Saturday, 11th, rain	1.50	} No day rain.
Sunday 12th ,,	1.05	

In 36 hours 2.55 in.

L of destructive character, with as loud T as ever remembered.

Peculiar feature was the steady persistence of strong N.E. wind during Saturday night's storms, and N.N.E. during yesterday's. Wind still blowing strong from latter quarter. Crops (wheat) laid, but think not seriously. No H.—Yours truly

THOS. H. MORGAN.

Oakhurst, Ore, Hastings, July 13th, 1868.

WEST HOATHLY.—*J. Dudgeon, Esq.*—About 9 p.m. 11th, without any previous indication, L began, and about 11 p.m. R and T followed, passing off soon after midnight, but returned in the early hours of 12th with renewed violence. Up to 9 a.m., 12th, 1.17 in. had fallen. T was heard at intervals all day, and about 9.30 p.m. a terrific TS came up, with excessive R, and at 9 a.m., 13th, 2.26 in. was registered, making in little more than 24 hours a total of 3.43. Slight accidents from L about 1½ miles hence in E., S. and N., but none here.

KENT.

BECKENHAM—FOX GROVE.—*Percy Bicknell, Esq.*—Distant T heard in S. about 11 p.m. 11th. R, T and L for some hours, but not very

near. **R** to 9 a.m. 12th, '49. On 12th, distant **T** in **S**. at intervals all day ; from 8 p.m. till 11.30 **T** and **L** were all round ; from the latter hour till 0.30 a.m. the **T S** was very violent ; **R** to 9 a.m. 13th was '42.

WOOLWICH.—On night of 12th a soldier struck by **L** and lost his sight.

SIR,—Thinking perhaps you might be making a tabular statement of the late heavy rainfall and thunderstorms, I forward you a note or two. As near as I am able to judge, 2 in. of **R** must have fallen in the 24 hours, from half-past 10 p.m. on the 11th, the total quantity measured on the two days being 2.18 in.

July 11th, p.m.	9.50 to 10.50.....	showers	} 70
" "	10.50 " 11.10.....	heavy downpour.....	
July 12th, a.m.	1.35 " 1.45.....	" "	} 12
" "	8.50 " 9.10.....	" "	
" "	9.30 " 10.5	excessive at times	} 60
" "	10.30 " 10.35.....	" "	
" "	10.55 " 11.30.....	greater part in 5 minutes	} 26
" p.m.	10.0, five minutes .	" "	
" "	10.30 " "	heavy	} 50
July 13th, a.m.	6.30 to 6.45.....	light.....	
Total			2.18

The following accidents are reported within about 18 miles of here, being an analysis I have made from a local paper. Many I believe especially of minor importance, are not reported. Houses struck, 9 ; outbuildings, 9 ; persons struck, 5 ; horses killed, 4 ; by taking fright, 3 ; bullocks struck, 3 ; church, 1 ; windmill, 1 ; tower, 1 ; hay rick burnt, 1 ; sheep and lambs killed, and trees struck, great numbers. No less than 6 oak trees struck in Biddenden parish. At the Appledore railway station considerable damage was done, and at Smeeth the fluid passed through the telegraph room with a report, singeing the porter's hair ; the wires were damaged in several places.

The total rain from end of January to August 4 in 1866, was . . . 15.92 in.
 " " " " 1867, " " " 15.95 "
 " " " " 1868, " " " 8.80 "

Yours truly,

GEORGE PILE, JUN.

Hartley, Cranbrook, 3rd August, 1868.

CRANBROOK—TURNDEN.—Three bullocks killed under a tree, no marks. At Sissinghurst Park a fine oak was splintered.

APPLEDORE.—Mill struck on night of 12th.

SURREY.

GUILDFORD.—**T S** began about 1 a.m. 12th, after which a stream of clouds charged with electricity passed from N.E. to S.W. for nearly 24 hours. Very heavy showers of **R**, with occasional intermissions. No gauge, but estimate the fall at 2 inches. "Between 8 and 9 p.m. on 12th beautiful 'sparks' from cloud to cloud. Once three, and once five simultaneous and parallel sparks, generally at right angles to the direction of the clouds. Sparks bluish green, with reflections same colour, but roseate towards the horizon, like the colour of glass tinged with manganese,"

GUILDFORD—SHEERE.—*Rev. Emilius Bayley.*—Midnight of 11th to midnight of 12th, 3·40, and 3 miles S. of Sheere, 3·28.

COBHAM AND WEYBRIDGE.—See p. 96 of *Meteorological Magazine* for July.

BERKS.

WANTAGE.—*E. C. Davey, Esq.*—T S on morning of 12th, with 1·25 of R.

HANTS.

STRATHFIELD TURGISS.—*Rev. C. H. Griffith.*—On 12th, at 3.45 a.m., T S skirted the horizon from N.E. to N.N.E., lasting till 11 a.m. At 8.30 p.m. on the same day a T S came from S., soon crossed by another from S.S.E., the wind all the time being N.N.E. R from 3.45 a.m. to 9 a.m., ·80 in.; from 9 a.m. to 11 a.m., ·58; from 8.30 p.m. to 1 a.m. 13th, ·28; total, 1·66 in.

BUCKS.

STOKE, BUCKS.—*W. Hatfield, Esq.*—About 11 p.m. fresh cool breeze came from E.; at 0h. 5m. on 12th, T, L and heavy R began, lasting till 6 a.m. The storm went W., and reached Abingdon about 1 a.m.

MIDDLESEX.

SHORTWOOD HOUSE, STAINES.—*H. S. J. Joyner, Esq.*—July 11th, T S which lasted 24 hours; total R, 1·37.

HAMPSTEAD—BRANCH HILL LODGE.—*B. W. Smith, Esq.*—T first heard on 11th at 11.30 p.m. L about midnight in E. At 5 a.m. 12th, T again heard. R to 9 a.m. 12th, ·16 in. Distant T in S. about 10 a.m., 2 p.m., and 6.30 p.m., after which it was continuous, with vivid L, but never within 10 miles, and no R.

WINCHMORE HILL.—*T. Paulin, Esq.*—Distant L was observed in E.S.E. at 10.20 p.m. (11th.) The storm approached very rapidly, and by 11 p.m. the L was very vivid, with incessant peals of distant T in S. and S.E. This continued till 12.0, when the sky became intensely black, the L, however, having ceased. At 12.15 there was a tremendous fall of R for three minutes. At 12.23 there was a terrific flash of intensely vivid, pale violet coloured L, followed by a deafening crash of T, which shook the house three times, like a violent earthquake; the noise was tremendous and peculiar, sounding as if the house was being compressed with enormous force. The flash struck an apple tree in an orchard about 150 yards to the westward, splitting it in two; it also scorched all the leaves off a poplar about 50 ft. to the N.E. of the house, making the leaves as crisp as if baked in an oven. There was another fall of R at 12.30 a.m., after which the storm ceased. Distant T continued all through the 12th, till an early hour on the 13th. From 9 p.m. on the 12th, till 1 a.m. on 13th, the display of L from N.E. to S.S.W. was magnificent.

PECULIARITY OF ABYSSINIAN RAINFALL.

To the Editor of the Meteorological Magazine.

DEAR SIR,—At the time of year at which we were in Abyssinia, moving along the Eastern Highland, viz. :—in February, March, April and May—the chief peculiarities in the climate were as follows. From dawn to noon the sky was *invariably* clear; but at some time during the afternoon, in the later part of the season, clouds appeared in the sky, and this occurred with a most remarkable punctuality. It was evident to us that at the same place this phenomenon would occur day after day at the same time within an hour or so. There was often mist at dawn; but this mist was soon dispelled by the sun and only precipitated at all on three occasions. This would be merely a local accident and may be neglected. But the daily punctuality of the gathering clouds, from which we often got a hail or rain shower, could not pass unnoticed even by the most careless. I took notes when there was an actual fall, but the cloudy formation was a daily occurrence. This was no peculiarity of the year we were there, for mention of rain frequently occurs in the statements of travellers over the same ground at the same time of year, and almost invariably towards the end of the day's march, which would naturally be between 3 and 6 p.m. Thus Combes and Tamisier in April, 1835, and Mansfield Parkyns in the "summer" of 1843, give mention of such showers. In April, 1842, Dr. Krapf was moving along the mountain chain, and mentions rainfall nearly every afternoon, while Dr. Beke, in the same month of the same year, travelling more to the westward towards Adowa, does not mention any fall of rain or appear to have met with any. The smallest shower of rain is of such importance to the traveller in wild countries, through the great discomfort it brings, that there will be almost invariably some notice in every account. Bruce's diary shows hardly any instance of rain between 6 a.m. and noon even in the rainy season.

It appeared to me, as far as I could judge, that during the whole time we were moving along the chain, the true wind was constant from the E.N.E., or N.E., although of course it often came to *us* deflected by the hills or valleys, and thunderstorms generally came up from the opposite quarter or against the wind, as cyclones; yet with these exceptions I believe the true quarter from which the wind came to have been as above stated. This being the case, of course it brought with it from the lowlands, or perhaps even from the sea, vapour, which would be precipitated on striking against the lofty mountains. Hence the punctuality and also the reason of rain not falling in the morning. For during the night, evaporation would not take place in any considerable quantity. Perhaps it would be possible to calculate from whence the major part of the vapour came, by noting the speed of the wind and the time of the arrival of the vapour which formed cloud on striking the mountain tops. Of course for this we had neither time nor opportunity.—Yours truly,

R. H. F.

TABULAR STATEMENT OF RAIN WHICH OCCURRED ON THE MARCH IN ABYSSINIA.

Place at which we arrived, p.m.	Date.	Distance in miles from last mentioned place.	Time.	REMARKS.
...	...	...	...	{ We met no rain on our line of march after the 19th February (a few drops at Senafé) till March 24th. For some days previous the clouds had been daily more threatening.
Lal	Mar. 24	0	5 p.m.	{ Only a few drops.
Mai Warra	25	14	About 5 p.m.	{ A few drops.
Dildee	26	18	5 p.m.	{ Very heavy hail and rain. A dry torrent so swollen in half an hour we had to wait to pass it.
Dildee	27	0	4 p.m.	{ Heavy rain, put down at time by guess as 0.3 inch.
Wundutch	28	9	5 p.m.	{ About 0.25 by guess.
Abdicomb	April 3	45	6 p.m. and during night.	{ }
Beat Hor	4	11	6 p.m. and a little during night.	{ }
Jidda River	5	5	6.30 p.m.	{ The river was dry at this time, with the exception of a few nearly stagnant pools at intervals.
Dabunta Plain	6	8	7 p.m.	{ On our return, April 22nd, it was about 1 to 2 feet deep and 12 to 20 wide.
Dabunta Plain	7	0	7 p.m.	{ Sharp hailstorm.
Bashelo River	10	7	7 p.m.	{ A few drops. The ford on 10th up to knee; on return on 16th it was nearly up to the waist.
Arogee	11	4	5 p.m.	{ }
Arogee	12	0	5 p.m.	{ Sharp hailstorm just before assault.
Magdala	13	4	4.30 p.m.	{ Heavy hail of large size and some rain.
Magdala	14	0	5 p.m.	{ Slight rain.
Mai Warra	29	106	10 p.m.	{ Near Lake Ashangi.
Moosagita	May 2	24	1 p.m.	{ Rain fell in showers after noon, day and night, but not heavy.
Ashangi	3	7	12 noon and after.	{ Showers at intervals after 1 p.m.
Muckdum	4	13	1 p.m. and after.	{ A "Scotch mist" at daybreak.
Bolago	5	7	6 a.m.	{ A "Scotch mist" at daybreak, and heavy rain at midnight.
Athala	6	8	6 a.m. & 12 p.m.	{ }
Mushuk	7	12	4 p.m.	{ A few very slight showers in day, though evidently heavy rain was pouring up the hill at
Musjee	8	9	3, 4, 5, & 10 p.m.	{ Mushuk and Athala. A very heavy shower at night, came through the tents.
Antalo	9	8	10 p.m.	{ Heavy rain.
Agula	15	38	8 p.m.	{ Slight shower.
Mai Wahiz	18	37	6 a.m.	{ A little rain.
Gonezoni	21	26	10 p.m.	{ Sharp shower.
Senafé	25	12	3 p.m.	{ Sharp shower. I was lucky enough to get down the pass without any rain.
Senafé	26	0	3 p.m.	{ }

On only three occasions did rain fall before noon, and then it was only a slight precipitation about daybreak, in fact a local accident. The time of rainfall was curiously exact in its recurrence. This was more than a coincidence. Though rain did not actually fall on us, and therefore is not shown in the table, in most cases heavy clouds were collected about the time of day rain was to be expected. The general time of clouds appearing was from 3 p.m. to 6 p.m. and later. The morning was *unusually* clear after sunrise till the time of clouds working up came on.

THE MOON'S INFLUENCE ON THE WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—Although it seems certain that the meteorological influence of the moon's phases is very slight, I am prepared to prove—as the result of a long series of investigations—that the *declination* influence of our satellite is very great. One extremely important secret of lunar influence on the weather is in the principle of *uniformity*—uniform movements of the moon causing fine weather, and extremes of temperature both in summer and winter; while irregularity of lunar movements (a condition far more common than uniformity) appears to cause the unsettled weather that usually prevails in this climate. Another extremely important secret of lunar influence on the weather is the distance of the sun from our meridian, or the meridian of the antipodes at the time the moon crosses the equator; for the nearer the sun is to noon or midnight at the time of this lunar phenomenon, the greater the influence of the moon in raising or depressing our temperature according to the season of the year.

The combined operation of these two (I believe hitherto unnoticed) influences, invariably causes a season of extremely high temperature, as the following law and table will show.

When in June, July or August the moon's declination places occur three times successively in the afternoon, and there is a range of not more than four hours in the times of the phenomena, and when in addition to this, on some day between the first of August and the first of December (reckoning backwards) the moon is within $0^{\circ} 0' 59''$ of the equator at 12 o'clock at midday, the mean temperature of the period from June to August inclusive at the Royal Observatory, Greenwich, has invariably been more than 3° above the 97 year average, and the maximum heat in each case more than $92^{\circ} 5$ at the same observatory. The following table contains *all* the instances that have occurred since 1833 relative to this law:—

Year.	Uniform times of moon's places in Equator and declination.	Moon's declination at midday or midnight.	Mean temp. of June to August inclusive.	Difference from the Greenwich 97 year average	Max. temp. at Greenwich.
1846	July 27th, Eq. 6.18 aft. August 3rd, S., 6.30 aft. ,, 9th, Eq., 6.50 aft.	$0^{\circ} 34''$ S. on January 17th at noon.	$64^{\circ} 3$	$+4^{\circ} 2$	$93^{\circ} 3$ on July 5th.
1857	June 8th, S., 8.15 aft. ,, 15th, Eq., 6.8 aft. ,, 21st, N., 9.45 aft.	$0^{\circ} 10''$ S. on Dec. 6, 1856 at noon.	$64^{\circ} 0$	$+3^{\circ} 9$	$92^{\circ} 7$ on June 28th.
1859	June 29th, N., 6.30 aft. July 5th, Eq., 5.12 aft. ,, 12th, S., 4.22 aft.	$0^{\circ} 6''$ N. on April 1 at midnight.	$64^{\circ} 3$	$+4^{\circ} 2$	$93^{\circ} 0$ on July 18th.
1868	July 18th, N., 3.30 aft. ,, 24th, Eq., 4.50 aft. ,, 31st, S., 5.29 aft.	$0^{\circ} 55''$ N. on July 11 at midnight.	$? 64^{\circ}$	...	$96^{\circ} 6$ on July 22nd.

The following facts, coupled with the foregoing table, appear to

demonstrate the truth of this law relative to extremely hot summers.

1. Not only have all the years (since 1833) in which the above-mentioned phenomena occurred been remarkable for summers with a mean temperature more than 3° above the average (by summer I mean the period from June to August inclusive), but in none of the 35 years has the mean summer temperature been as much as 3° above the average without those phenomena having occurred.

2. Not only has the maximum temperature in all the years in which these phenomena happened been above $92^{\circ}5$ at the Royal Observatory, Greenwich, but in no year, except 1858, has the heat reached such intensity at that observatory without the occurrence of the phenomena above referred to.

3. It is also worthy of note, as a further proof of the importance of this law, that the hottest of each of the three summer months occurred in one of the years given in the foregoing table. The following are from Mr. Glaisher's valuable 97 year tables :—

The hottest June on record was in 1846, when the mean temp. was $65^{\circ}3$.
 „ July „ „ 1859, „ „ „ $*68^{\circ}1$.
 „ August „ „ 1857, „ „ „ $65^{\circ}8$.

The instances given in the table on p. 104 are limited to those of the last 35 years for two reasons. (1) Because the lunar tables in the Nautical Almanac for the years before 1833 are not so reliable as those for the years since that time ; and (2) because the moon's declination places given in the tables before 1833 are too limited to permit an accurate determination of the times of extreme declination ; but if the roughly approximate times of these lunar phenomena (from 1769 to 1833) are likely to be useful, I will readily undertake the labour of completing the calculations.

In a future article I will, with your permission, endeavour to prove that the perigee and apogee positions of the moon with regard to our meridian, as well as perigee of the sun, have an extremely important influence on the rainfall.

In conclusion, I may observe that until the year 1860 I entirely disbelieved in the moon's influence on the weather, and invariably ridiculed the theories of lunar meteorologists ; but certain phenomena that occurred in that year induced me to examine the subject with some care, and a seven year's investigation of this branch of predictive meteorology has so far converted me, that I have become a lunarist in spite of my prejudices, and almost against my will.—Yours truly,

G. D. BRUMHAM.

Barnsbury, July 28th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—In the last number of your *Meteorological Magazine*, you have devoted some space to a discussion of the moon's influence on the weather ; moved thereto, you state, by the numerous enquiries on the sub-

* The mean temp. of July, 1868, has been $67^{\circ}5$, which is higher than any other month on record, except July, 1859,

ject which have, of late, inundated your editorial existence. Some apology is therefore necessary for adding another letter to your already too extensive *lunatic* correspondence; but the great authority, in matters of science, attaching itself to the name of Herschel, together with the very prevalent belief in lunar influence on weather, induces me to hope you will not consider me intrusive in seeking a reply to the following simple query.

In "Good Words" for 1864 there will be found an article from the pen of Sir J. Herschel, entitled "The Weather and our Weather Prophets," wherein the learned writer asserts that a clear sky and a serenity of weather, at night, are the usual accompaniments of the period of Full Moon: and further proceeds thereon to say that this is no simple connotation but—"a tendency of which we have assured ourselves by long continued and registered observations." At the conclusion of the article in question, the author invites the co-operation, in verifying his dictum, of such of his readers as may feel disposed to assist him: but whether his appeal ever met with any response does not appear, from the want of any subsequent allusion to the subject in the pages of the periodical quoted.

Now a periodicity of clear sky, as above cited, must, it is self-evident, have, as a natural consequence, a similar periodicity in absence of rainfall. Do rainfall investigations at all lead to any such inference? Do they in any way support the assumption that the sky is cloudless at nights about the time of Full Moon?—I am, Sir, yours truly,

F. BONNYCASTLE GRITTON.

Tytherton, July 21st, 1868.

[During the seven years 1841—7, meteorological observations were taken every two hours, night and day, at the Royal Observatory, Greenwich; the amount of cloud was of course one of the elements noted; and the whole of the records have recently been examined by Mr. Ellis, who finds that Sir J. Herschell's theory is unsupported; Arago says, "La lune mange les nuages;" and our own sailors say, "The full moon eats up the clouds."—Ed.]

To the Editor of the Meteorological Magazine.

SIR,—You will probably smile at the simplicity of my inquiries, but I am anxious to know from yourself, or some of your correspondents, whether there is any truth in the very common notion that the *posture* of the moon is a true index of the coming weather—that is, whether the "horns" are upwards, or downwards, or stand perpendicularly.

I have noticed, since I have lived in North Wales, that before a coming gale of wind, the light clouds are, especially soon after sunrise, brilliantly illuminated with gorgeous orange colour. Can any of your readers explain why it should be so then, and never at any other time? What connection is there between the approaching strong blast, and the peculiar brilliant orange colour of the sky?—Yours truly,

RICHARD LUCK.

Llanfairfechan, N. Wales.

THE HEAT IN JULY, 1868.

FOR our next we are preparing a map, showing the highest point reached in the shade at a very large number of stations in England and Wales, and we shall be greatly obliged by notes from *all* our readers who have trustworthy records of the daily maximum shade temperature between the 14th and 23rd of July, together with a note of the position and character of the instrument whose indications are forwarded. In the interim the few following facts may be acceptable.

The maximum shade temperature at about 40 stations will be found in the usual monthly table, page 109; that at several more, from 14th to 23rd, is given below in detail; others are as under:

Leicester, 96°·7; Beverley, 94°; Clapham, 94°; Nuthall, Nottingham, 93°; Cranbrook, Kent, 92°; Maidenhead, 92°; Cobham, 91°·4; Ore, Hastings, 89°; Hillington, Lynn, 89°; High Roding, Dunmow, 89°; Bromley, Kent, 89°; Killingholme, Ulceby, 89°; Riverhead, Sevenoaks, 88°·5; Dymock, Gloucester, 88°; Dartmoor, 81°.

Maximum Temperatures in Shade, July, 1868.

No.	STATION.	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd
1	Lansdowne, Evesham ...	90·4	93·4	91·6	78·3	82·3	82·0	91·3	96·5	97·3	72·2
2	Ross	83·0	92·0	91·2	76·0	83·0	78·0	86·0	94·0	97·0	..
3	Greenwich	85·7	88·0	92·0	84·0	87·8	82·8	90·0	92·2	96·6	79·7
4	Wimbledon	84·0	89·5	91·0	...	86·0	...	85·5	94·2	96·2	...
5	Hereford	86·1	91·6	85·8	78·4	78·1	82·1	88·4	93·1	96·1	71·9
6	Epping	89·0	89·0	90·0	86·0	85·0	82·0	90·0	91·0	96·0	69·0
7	Strathfield Turgiss	81·9	89·5	89·8	80·8	86·6	80·5	88·2	93·5	95·9	78·2
8	Beckenham, Parkside ...	87·0	91·0	91·5	84·0	87·0	84·0	89·0	94·0	95·0	78·5
9	„ Fox Grove.	84·7	88·6	88·9	82·2	84·7	81·6	86·8	91·9	93·8	79·2
10	Berkhempstead	81·5	90·0	88·0	82·5	85·0	79·0	86·5	91·5	93·7	75·0
11	Camden Square	87·6	88·0	91·0	84·2	85·5	81·5	89·5	93·3	93·2	77·6
12	Upper Tooting.....	83·0	88·5	89·0	81·5	83·0	80·5	86·0	91·0	93·0	...
13	Tunbridge Wells.....	80·0	86·5	89·3	83·3	82·3	82·0	85·0	88·5	92·4	82·0
14	Ventnor	78·0	74·0	78·0	73·0	73·0	73·0	75·0	78·0	79·0	84·0
15	Worthing	82·1	76·6	76·9	74·5	73·0	73·2	79·0	79·3	80·1	83·0
16	Aghalee, Antrim.....	...	...	...	73·0	65·0	72·0	73·0	82·0	80·0	75·0
17	Sidmouth	79·8	80·2	78·4	77·0	75·6	76·7	77·7	79·9	79·7	79·5

1. EVESHAM.—*R. Burlingham, Esq.*—Standard by Negretti, verified by Mr. Glaisher, on a double boarded “Lawson” stand, venetian in front to prevent radiation.

2. ROSS.—*H. Southall, Esq.*—Verified ther. on Glaisher stand, 5 ft. above flower bed.

3. GREENWICH—ROYAL OBSERVATORY—*J. Glaisher, Esq., F.R.S.*—Verified ther. on Glaisher stand.

4. WIMBLEDON CAMP.—*F. Pastorelli, Esq.*—Kew verified ther., properly mounted ; observations taken by a corporal, Royal Engineers.

6. EPPING.—*H. Doubleday, Esq.*—Ther. in a very shady part of the garden, $4\frac{1}{2}$ ft. above ground.

7. READING—STRATHFIELD TURGISS.—*Rev. C. H. Griffith.*—Verified ther. in large garden, on double boarded stand, 4 ft. above ground.

8. BECKENHAM—PARKSIDE—*C. O. F. Cator, Esq.*—Verified ther. on small “Glaisher” stand ; garden rather exposed.

9. BECKENHAM — FOX GROVE.—*Percy Bicknell, Esq.*—Standard, mounted on a Glaisher stand, in large garden.

10. BERKHEMPSTEAD.—*W. Squire, Esq.*—Negretti's standard, verified, on a “Glaisher” stand, some distance from house ; a 9 ft. brick wall 20 ft. N.W., otherwise clear ; no trees nor large shrubs near. Highest ever recorded.

11. CAMDEN SQUARE—*G. J. Symons, Esq.*—Verified ther. on “Glaisher” stand.

12. UPPER TOOTING.—*D. A. Freeman, Esq.*—On lawn, 4 ft. above ground, in a well ventilated double louvre boarded box.

13.—TUNBRIDGE WELLS.—*Rev. F. W. Stow.*—Verified ther. on stand designed by himself, and approved by Mr. Glaisher.

14. VENTNOR.—*Dr. Martin.*—Verified ther. under pent house stand, approved by Mr. Glaisher.

15. WORTHING —*W. J. Harris, Esq., M.R.C.S.E.*—Verified ther. in a modification of “Stevenson's” louvre box, approved by Mr. Glaisher.

16. AGHALEE, ANTRIM.—*Lancelot Turtle, Esq.*—Lat. $54^{\circ} 31' 15''$ N. lon. $6^{\circ} 16' 0''$ W.

17. SIDMOUTH, BELGRAVE.—*Dr. Mackenzie.*—Standard by Negretti, in “Lawson” stand, painted white, 4 ft. from ground, 18 ft. W. of house, 36 ft. from wall on E.

JULY, 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.	Difference from average 1860-5	Greatest Fall in 24 hours.			Max.		Min.		
				Dpth	Date.		Deg.	Date.	Deg.	Date.	
inches.	inches.	in.									
I.	Camden Town	·45	— 1·34	·22	28	3	93·3	21	48·0	5	0
II.	Staplehurst (Linton Park) ...	·63	— 1·35	·30	12	5	96·0	15½	44·0	6	0
III.	Selborne (The Wakes)	1·74	— ·46	·46	15	6	89·0	22	43·5	1	0
IV.	Hitchin	·24	— ·66	·20	11	2	88·0	22	45·0	24	0
V.	Banbury	·49	— 1·57	·33	11	5	90·0	21	42·5	24	0
VI.	Bury St. Edmunds (Culford) ..	·22	— 1·77	·19	28	4	93·0	22	39·0	29	0
VII.	Bridport	·48	— 1·63	·20	28	4	85·0	...	...	...	...
VIII.	Barnstaple	·38	— 2·48	·25	29	6	87·4	15	49·0	7¶	0
IX.	Bodmin	·82	— 2·29	·39	26	11	79·5	15	52·0	7	0
X.	Cirencester	·71	— 1·73	·54	12*	2	75·0	22	59·0	29	0
XI.	Shifnall	·45	— 1·72	·13	12†	5	90·0	22	...	...	0
XII.	Tenbury (Orleton)	·90	— 1·48	·44	12	6	92·2	22	42·0	24	0
XIII.	Leicester (Wigston)	·00	— 1·90	·00	...	0	98·0	15½	41·0	23**	0
XIV.	Boston	·33	— 1·97	·25	26	3	94·5	22	45·0	24	0
XV.	Gainsborough .....	...	...	...	...	...	...	...	...	...	...
XVI.	Derby	·33	— 2·86	·28	17	4	92·0	22	47·0	24	0
XVII.	Manchester	·45	— 2·24	·20	16	6	95·5	15	...	...	...
XVIII.	York	·40	— 1·54	·29	16	2	86·0	28	46·0	25	0
XIX.	Skipton (Arncliffe)	·81	— 2·42	·36	16	5	84·0	22	47·0	25	0
XX.	North Shields	·49	— 1·32	·27	16	6	83·3	22	47·8	5	0
XXI.	Borrowdale (Seathwaite)	2·32	— 5·82	·84	19	9	...	...	...	...	...
XXII.	Cardiff (Town Hall) .....	...	...	...	...	...	...	...	...	...	...
XXIII.	Haverfordwest	1·09	— 2·21	·29	28	8	83·1	14	45·5	31	0
XXIV.	Rhayader (Cefnfaes)	1·19	— 1·66	·53	8	6	85·0	...	41·0	...	...
XXV.	Llandudno	·29	— 2·00	·15	16	4	88·6	15	52·0	5	0
XXVI.	Dumfries	·98	— 1·27	·30	22	6	84·5	15	46·0	24	0
XXVII.	Hawick (Silverbut Hall)	·68	...	·40	22	5	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	·80	— 1·36	·35	20	9	82·0	15	41·0	24	0
XXIX.	Castle Toward	1·35	— 1·79	·63	15	8	89·0	2	36·0	24	0
XXX.	Leven (Nookton)	·25	— 2·02	·10	22	6	81·0	15	42·0	24	0
XXXI.	Stirling (Deanston)	·84	— 2·56	·43	22	9	81·3	15	39·3	24	0
XXXII.	Logierait	·58	...	·32	22	4	...	...	...	...	...
XXXIII.	Ballater	·60	...	·29	15	4	83·0	14§	37·5	11	0
XXXIV.	Aberdeen	·71	...	·16	15	6	82·1	21	44·1	24	0
XXXV.	Inverness (Culloden)	·40	...	·18	23	4	78·1	2, 15	49·2	24	0
XXXVI.	Fort William	1·60	...	·49	15	10	...	...	...	...	...
XXXVII.	Portree	3·13	— 2·94	1·12	19	6	77·2	13	41·0	23††	0
XXXVIII.	Loch Broom	·58	...	·23	21	8	...	...	...	...	...
XXXIX.	Helmsdale	·65	...	·38	15	5	...	...	...	...	...
XL.	Sandwick	1·35	— ·54	·41	20	7	71·6	15	47·7	10	0
XLI.	Cork	1·20	...	·85	28	4	...	...	...	...	...
XLII.	Waterford	1·64	— 1·67	·90	28	6	86·0	14	56·0	9	0
XLIII.	Killaloe	1·41	— 1·78	·69	28	9	86·0	11||	44·0	26	0
XLIV.	Portarlington	1·10	— 2·44	·86	29	8	83·0	14	42·0	23	0
XLV.	Monkstown	·87	— 1·56	·47	28	6	87·0	15	44·2	25	0
XLVI.	Galway	2·51	...	·71	29	14	88·0	13	43·0	28	0
XLVII.	Bunninadden (Doo Castle) ...	1·55	...	·90	28	11	81·0	2	33·0	24	0
XLVIII.	Bawnboy (Owendoon)	1·59	...	·75	28	15	92·0	14	44·0	23	0
XLIX.	Waringstown	·68	...	·29	28	9	90·0	1	39·0	23	0
L.	Strabane (Leckpatrick)	1·05	...	·27	22	12	85·0	14	35·0	24	0

* And 13th. † And 18th. ‡ And 22nd. § And 15th. || And 14th. ¶ And 10th & 20th.

** And 31st. †† And 25th.

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

METEOROLOGICAL NOTES ON THE MONTH.

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

ENGLAND.

CAMDEN TOWN.—TS after 11 p.m. on 11th to '4 a.m. on 12th, L to 7; meteor equal to Jupiter seen at 9.3 p.m., course from S. to N.E., altitude 50°. A very hot month, only one day on which the max. in shade was less than 72°, and four on which it exceeded 90°.

LINTON PARK.—An exceedingly dry hot month; TS on night of 12th, with a brisk N.E. wind blowing at the time, as well as before and after; a little T also on the 26th. The hottest days were the 15th and 22nd, ther. 96°; but the 16th, 21st, and 27th were also very hot; wind mostly N.E., but little difference felt when from a contrary direction. Harvest almost completed at the end of the month; vegetation of all sorts suffering, and water becoming scarce.

SELBORNE.—R with T at 3 a.m. on 12th from S.E.; grumbling T all day; TS from 7.30 p.m. to 1 a.m. 13th, E. by S. to W. by E.; the 22nd was the hottest day known here, 89° in shade; the TS on the 15th was remarkable; it was at one time directly over Selborne, and the R, which lasted less than 20 minutes, measured '46, yet it was so circumscribed that at a few hundred yards to the E. of my house not a drop fell; (I have traced a similar distinct line of demarcation extending many miles from N. to S. on the W. side of the line, the R being very heavy, whilst none fell on the W. (E?) side; the hailstones were nearly half an inch in diameter; wheat harvest well got in; I saw a field of barley cut near here on 13th.

HITCHIN.—Such heat, such drought, and such a high barometer have never been recorded during the nineteen years we have taken observations; the bar. has been below 30 in. only on 17 days out of the last 92; we have not had one TS this year.

BANBURY.—Mean temp. 5° above the average; violent TS on the afternoon of the 15th, four or five miles N.E. of Banbury, with heavy R and large H, but no R fell in the town. Harvest nearly finished.

CULFORD.—A month of unprecedented heat and drought; temp. in shade on four days 90° and upwards; min. on 21st, 61°. As may be supposed, this high temp. and long drought has proved injurious in the field as well as the garden, especially on light land; turnips and other green crops are an entire failure, but the wheat is excellent, and the harvest, which here this year comes to an end on the 1st of August, will prove possibly the earliest on record.

BRIDPORT.—Harvest begun in the second week.

BODMIN.—The drought has been very severe, and the streams have not been so low for nearly half a century, and yet I believe that Cornwall has suffered less than any other part of England.

CIRENCESTER.—The driest July in 25 years, except 1863, when only '50 fell. An extraordinary month for heat, yet breezy and cool nights; the intense sun and cloudless sky account for the burnt pastures. Harvest nearly completed; late potatoes (flukes) dug on the 29th; only two tubers out of thousands diseased. 1818, the season most resembling this, left permanent benefits after the 16 weeks drought of that year. T E. of Cirencester on 12th.

SHIFFNAL.—Another broiling month. The TSS that have visited other parts have not reached here, but heard in the S.W. on 22nd. The pastures like stubble fields in colour; turnips dwindled away either from grub or mildew; white butterflies innumerable, but few others, only two or three sulphur coloured ones and one humming bird sphinx; no wasps yet seen, though there were many queens in the spring. Harvest in on the 31st in early lands; wheat excellent, barley short and light, oats the same. A good year for honey, many bell glasses filled.

ORLETON.—A remarkably brilliant, hot and dry month; so severe a drought

harvest commenced about 17th, and the bulk of the crop secured by the 31st, has not occurred since 1826; pastures burnt up, even in the valleys; wheat Distant T on 12th, 15th, 16th and 22nd, and heavy storms fell round us on each of those days.

WIGSTON.—During 33 years that I have kept a register of the rainfall the present July is the only instance of any month during that period when I have not had some record to make of more or less R; there were a few drops on the 15th and 29th, but not sufficient to run into the receiving vessel; mean of max. 81°·75, and that of min. 52°·75.

BOSTON.—A month of unusually high temp.; cloudless skies and almost no R. Pastures burnt and bare, and great hardships both for man and beast, owing to the want of water in the Fen districts. Harvest commenced about the 12th July, fully a month earlier than usual; wheat crops heavy and of good quality; root crops very poor from the dryness of the soil. No TS, but vivid sheet L in the evenings.

DERBY.—The paucity of rainfall and high temp. has had no parallel in my experience since 1844. There are no instrumental indications of R, so we ought to be thankful we are so well supplied with excellent water from the strangely maligned Derwent. The absence of dew at night is also noteworthy, arising from the dryness of the air, hot nights, and bleached condition of the grass (colour being an important element in its formation.)

ARNCLIFFE.—The first time I have registered less than 1 in. in July.

NORTH SHIELDS.—Wheat cut on 31st.

W A L E S.

HAVERFORDWEST.—One of the warmest Julys during the past 20 years; drought greater than any during that period, with the exception of 1859; R fell on 8 days, and though the quantities were small, it refreshed the parched earth. Prevailing winds N. and E.; heavy gale, with more than half an inch of R, on the 27th and 28th; temp. on 29th rose only to 59°, the sudden change was much felt; the month ended fine and warm; harvest forward, wheat crops especially good.

CEFNFAES.—Hot and dry; water very scarce in this district, and the hills and pastures very short of herbage; grain harvest early; crops indifferent; wheat generally good.

S C O T L A N D.

DUMFRIES.—Hot and droughty; crops of oats and barley very stunted; pastures burnt up; water very scarce; barley harvest commenced on 21st, oats on 28th, and harvest nearly general at close of month; T on 2nd and 28th.

HAWICK.—Driest and hottest July ever remembered; Laurels, bays and shrubs in general thrive luxuriantly, but pastures nearly burnt up; fodder very scarce. Sky frequently clouded over, but dispersed again after giving a few drops of R. If R does not come soon, turnips and potatoes will be ruined.

AUCHENDRANE.—Temp. very high, and R only a quarter of the mean for the last 12 years; the atmosphere has been also very dry, and the evaporation nearly seven times the amount of the rainfall, as grass is a great evaporator the pastures and hayfields have suffered most, though vegetation generally is parched. The river Doon, where it is generally 104 ft. wide, is reduced to a small stream 6 ft. wide and 2 ft. deep! Of course all the water power mills are stopped or working short time, and farmers, &c., are fetching water from long distances. We have not had one TS; the winds have been moderate and often from polar points; harvest about three weeks earlier than usual.

CASTLE TOWARD.—First half of month very dry and warm, then a week of showery weather, then warm towards the end. Farm crops early and good, but it has been too hot for garden vegetables, though the flower-garden plants have done well and bloomed profusely.

NOOKTON.—Hours of sunshine recorded 210; frequent E. winds.

LOGIERAIT.—Very severe drought with great heat; crops suffering much.

BALLATER.—Before the end of the month the pastures burnt up and cattle suffering; the grain crops very short generally, being prematurely ripened. The Dee lower than ever before observed. The harvest commenced in this neighbourhood about the 30th

ABERDEEN.—Remarkable for heat and drought; pastures burnt up; white crops short, but better in ear than hoped for. Harvest begun in several places, and coming on very rapidly everywhere.

FORT WILLIAM.—Although the driest month since the beginning of 1865, when observations were commenced here, there has been none of that remarkable heat which has prevailed in the south; on the whole, the month has been very fine and enjoyable.

PORTREE.—The finest July on record, dry and warm throughout; the crops of all sorts have made great progress, but the potatoe disease has appeared in some parts of the island.

LOCH BROOM.—The driest month ever remembered.

SANDWICK.—Warmer and drier than the mean; the crops would have been better for a little more R, but there was a good supply in June, and refreshing showers during the latter half of July have prevented their suffering, and there is a prospect of an early harvest.

I R E L A N D.

DOO CASTLE.—Intense heat and great drought; spring wells dried up in this neighbourhood; oats and meadows short, the latter, notwithstanding, fetching high prices; the change from heat to cold was very marked on the 27th and 28th, when we had rather more than an inch of R.

OWENDOON.—All crops here are coming in at least three weeks earlier than usual. This country still looks green and promises well; we have seen no potatoe blight; T in W. on 12th.

WARINGSTOWN.—Sultry and parching beyond all precedent; pastures burnt up, and water very scarce; crops, however, good, except flax and turnips.

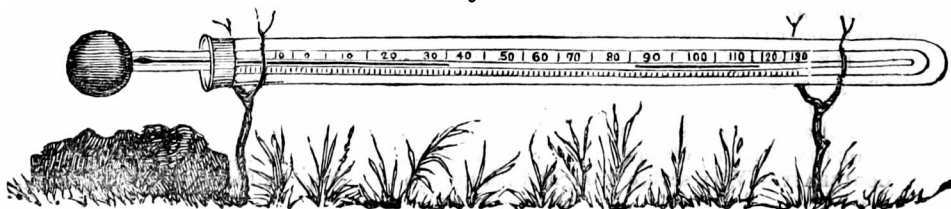
LECKPATRICK.—Hot and dry, all crops have suffered from drought; oats very short; harvest operations commenced at the end of last week. Turnips much injured by worms, and in several instances much damage done by crows, in search of the wire-worm attached to their roots.

SOLAR RADIATION TEMPERATURES.

TERRIBLE confusion evidently exists as to the amount of solar radiation and the proper means of ascertaining it. A clear conception of the causes of many of the conflicting statements may be facilitated by a brief review of the various instruments suggested at different dates, and which are *all* in present employment, the results being indifferently termed "temperature in sun."

1. **Black Bulb Thermometer.**—A self-registering maximum thermometer, the bulb being formed of black glass. In use from 1835.

Fig. 1.



2. Vacuum Black Bulb.—A similar thermometer enclosed in a glass sphere, as suggested by Sir John Herschell, used from about 1860.

Fig. 2.



3. Vacuum Dull Black Bulb.—Similar to No. 2, except that instead of the bulb being bright black glass, it is coated with lamp black, and so made more absorbent.

On a perfectly calm day, No. 1 and No 2 will read nearly alike, but when there is any wind No. 1 will be considerably below No. 2; therefore, inasmuch as the readings of No. 1 vary according to the wind's velocity, and those of No. 2 do not, the latter are much to be preferred.

Light and heat being equally reflected from polished surfaces, black glass was early substituted for the white, which, when filled with mercury, is immediately converted into a spherical mirror, whence, of course, a large proportion of the heat rays are reflected. But the smooth black glass surface was also in a less degree a reflector, and hence a year or two since it was considered preferable that the bulbs should be coated with lamp black so as to give the most absorbent surface practicable. Thermometers so coated usually considerably exceed bright black ones.

Our readers will now understand why very different results may be obtained even from instruments which, when tested in water in the usual way, accord to $0^{\circ}\cdot 1$; and yet when exposed to sunshine may differ 20° , 30° or even 40° . Before proceeding we may express our earnest hope that the result of the discussion started by Mr. Kesteven may be thorough consideration of the best form of instrument, and of the best position for it, and *uniform* acceptance of the decision, be it what it may; the present confusion renders all comparisons impossible, and throws uncertainty over good and bad observers alike. It will be perhaps advisable that some fresh term, such as "vacuum solar intensity," or something of that kind, should be used by all who employ the adopted arrangement, whatever that may be; for, if not, how are the comparable registrars to be distinguished from the incomparable, and some such there are sure to be? Uniformity of position is quite as important, as similarity of construction, and as a little self-denial, on the part of observers, will secure the former, and testing *in the sun*, will secure the latter, we do hope self will be sunk and buried, and then our records will be comparable, not only with each other, but also with those to be made in years to come. In the valuable letter from the Rev. F. W. Stow, that careful observer remarks, "my experiments and observa-

tions have been carried on with instruments placed upon short grass, as at Greenwich ; I have, indeed, occasionally, tried a thermometer at 4 ft. from the ground, and also at 1 ft., and found that at 4 ft. it will read, in summer, some 15° lower, and at 1 ft. some 10° lower than on the grass, which is the position I decidedly prefer, to any above the ground, *as wind makes no perceptible difference.*" We have italicized the last few words, as we thought the influence of wind was eliminated by the vacuum jacket, just as the effect of height above the ground was stated to be. Mr. Stow has shown that height does make an important difference, and implies, that at 1 ft. wind does so too ; we think our readers would be glad to know its amount. We mentioned, last month, some experiments in progress at Camden Square, of which we append some results.

1. Received, July 9th, from Mr. Casella, five thermometers, bulbs spherical, 0.3 inch in diameter, dull, blackened 1 inch up the stem.
2. Had, previously, a dull black, by Negretti and Zambra, oval bulb, 0.75 inch by 0.50 inch diameter.
3. Marked them, respectively, N. and A. B. C. D. E.
4. Compared their readings in perfect shade, and found no difference of more than $0^{\circ}.8$.
5. Compared them all, lying near together, on a rather burned up grass plot ; found differences amounting to 10° , and variable, sometimes A was lowest, sometimes B, and so on.
6. Placed them on a common black-japanned tin tea-tray, resting on grass ; found no difference exceeding 1° , except N., which was $1^{\circ}.5$ above the mean.
7. Placed N and C on a patch of good grass ; D on garden mould, B 1 ft. above grass, A 4 ft., and E 20 ft. above it.
8. Found N and C, equal, D 8° below them, B 11° below them, A 14° , and E 13° below them.
9. Lent D to Mr. Kesteven, to place by the side of his thermometer, at Holloway. For results, see page 118.

We therefore conclude—

10. That an oval bulb thermometer, inasmuch as it exposes (relative to its capacity) a larger surface to the sun's rays, reads higher than a spherical one.
11. That the material on which the thermometer is laid has great influence on the indications.
12. That instruments placed at any height, from 1 ft. to 20 ft. will rarely differ more than 3° or 4° .
13. That garden mould heats the thermometer about 5° , and grass from 10° to 20° , according to its length, fineness and dryness.
14. With respect to the Greenwich temperatures of 160° and upwards, we find similar readings at isolated country stations, and that the influences of varieties of grass, smoke, and local circumstances, account for them.

To the Editor of the Meteorological Magazine.

SIR,—Having last year been annoyed, like Mr. Kesteven, at the discrepancies between two of the “solar maximums in vacuo,” I set to work to find out the reason, and as I believe I have entirely cleared the whole matter up, I think it is only fair to let others know the results of my investigations.

I got four of these instruments, and set them, side by side, on the grass, last October. The result was, that that which had the largest bulb read highest, and the readings were always higher as the bulb was larger, the extreme difference among them being 6°.

The following was the mean result of a number of observations, the thermometer being placed in order of size of bulb :—

No. 1.	No. 2.	No. 3.	No. 4.
108°·1,	104°·7,	104°·0,	102°·7.

(I may mention that No. 2 had a glass shield full of flaws and irregularities, but that does not seem to make any perceptible difference.)

Suspecting the cause, I procured, from Mr. Casella, two thermometers, which I shall call Nos. 5 and 6, in which the lamp-black of the bulb was carried a short distance up the stem, and found that, though their bulbs were smaller than No. 1, they read as high, or even higher. The following were the figures :—

No. 1.	No. 5.	No. 6.	No. 3.	No. 4.
112°·0	112°·8	112°·1	108°·3	106°·6.

It was now proved to my mind, beyond all doubt, that the cause of difference was *the loss of heat by conduction from the heated bulb to the cooler tube*. The bulb covered with lamp-black would be, of course, heated far more than the almost transparent tube, and it was only a question of the relative size of bulb and tube, how much heat was thus conducted away from the former. Now the tubes are generally all about the same diameter, and therefore the temperature indicated ought to vary according to size of bulb, *which it did*. But, if so, a thermometer blackened on the stem a little above the bulb, ought not to show so much loss of heat; *and this, too, was found to be the case*.

I begged Mr. Casella (who was most kind and obliging), to make some thermometers of this description, in which the lamp black was carried much further, viz :—about an inch above the bulb. He made three, the thermometers being verified at Kew before they were enclosed in the vacuum glass. As soon as the season permitted, and I had sufficient leisure, I set to work; these I numbered 7, 8, and 9.

I was favoured by some bright weather in March, and twenty observations gave the following mean and maximum.

	No. 7.	No. 8.	No. 9.	No. 1.	No. 6.	No. 4.
Mean... ..	108°·8	108°·2	108°·0	103°·3	102°·8	98°·8
Maximum...	119°·0	118°·0	118°·0	112°·0	111°·0	106°·0

Afterwards, the following temperatures were recorded (March 19th).

125°0	125°0	124°5	118°0	—	111°0
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It was a very gratifying circumstance, that the three thermometers in which the lamp-black was carried nearly an inch above the bulb, gave

almost identical results; but if they exceeded No. 4 by 14° in March, one would not be surprised at any amount of difference, say 20° , in June.

I have had observations made throughout this summer, with No. 7, at Ripon, and have used No. 8 here at Tunbridge Wells, and I hope for some valuable results, showing the comparative solar radiation in the north and the south, the difference of latitude being 3° .

I ought to say that all my experiments and observations have been carried on with instruments placed upon short grass, as at Greenwich. I have, indeed, occasionally tried a thermometer at 4 ft. from the ground, and also at 1 ft. and found that at 4 ft. it will read, in summer, some 15° lower, and at 1 ft. about 10° lower than on the grass, which is the position I decidedly prefer to any above the ground, as wind makes no perceptible difference.

I have not made any experiments with the old shiny-black bulbs, which, of course, lose heat by reflection, as well as by conduction, and must give a lower reading than one covered with lamp-black. It is possible, however, that one of those with a large bulb, might read higher than one with a lamp-black bulb of smaller size, and not blackened, or not blackened far enough on the stem.

I do not know anything about the Greenwich thermometer, except that it is placed on the grass. I believe it has a bulb covered with lamp-black, and, for ought I know, of such a size as to render the loss, by conduction, inappreciable; or the lamp-black may, as in mine, be extended to the tube. Its readings appear not to differ much from those of mine, at this place, *e.g.*, taking the days mentioned by Mr. Kesteven.

	Greenwich.						Tunbridge Wells.					
June 3	148°	...	...	...	...	...	154°	...	...	...
6	146	...	...	...	...	...	150	...	...	...
13	148	...	...	...	...	...	152	...	...	...
14	159	...	...	...	...	...	149	...	...	...
17	153	...	...	...	...	...	158	...	...	...
18	152	...	...	...	...	...	145	...	...	...
19	149	...	...	...	...	...	143	...	...	...
20	165°	...	...	...	...	...	(cloudy)	...	...	...

Mean of 7 days, $150^{\circ}7$

Mean of 7 days, $150^{\circ}1$.

And when it is considered that the temperature of the air has been decidedly lower here, it will appear that the Greenwich observations are not a bit too high. Perhaps, however, in the report for July, August and September last, the maximum extreme was put, instead of the mean maximum.

Once in last May, twice in June, and once this month, I have registered 160° or upwards; the highest being 162° on the 27th of June; the mean daily maximum in May, was $138^{\circ}3$, and in June, $146^{\circ}6$.

I have two thermometers here of the kind I have described, (one of them being destined for a friend, in South America); one with a rather large, the other with a very small bulb; and yet their readings agree most closely, because the loss of heat, by conduction, is avoided, by

carrying the lamp-black well up the tube. *Solar thermometers, so constructed, are, scientifically, comparable, but no others, except by the accident of the bulb being exactly equal in size.*

I trust these remarks may be useful. I apologise for their length, but I think details often make a subject more intelligible. It is to be hoped that many of your readers will procure such instruments, so that we may have really comparable observations.—I am, Sir, yours truly,

FENWICK W. STOW.

Tunbridge Wells, July 18th, 1868.

P.S. On looking over my papers, I found that the second series of observations was made upon a plain board, which I adopted to ensure uniformity; and that in the final series, other observations were made upon a board, which however gave similar results to those made upon carefully selected grass. When grass is burnt or scanty, or on the other hand unusually thick, there is no doubt some irregularities result. How would it be if all would agree to adopt a *plain black board laid upon the ground*, and place the thermometer upon its surface, preventing it from rolling by nails or studs?

To the Editor of the Meteorological Magazine.

SIR,—Perceiving a letter on the above subject from a gentleman at Holloway, in the July number of your valuable magazine, I beg to call your attention to the following table of highest readings taken in the sun at Greenwich and Southampton, in the latter town at the Ordnance Survey Observatory.—

Date.	Greenwich.	Southampton.	Southampton below Greenwich.
June 19.....	149°0	101°2	47°8
20... ..	165°3	101°4	63°9
21	128°0	87°0	41°0
22.....	110°0	87°1	22°9
23	149°1	81°6	67°5
24.....	135°0	83°4	51°6
25.....	127°0	85°5	41°5
26.....	145°0	90°1	54°9
27.....	157°5	100°2	57°3
Mean of 9 days ...	140°6	90°8	49°8

By the above it will be seen that the mean difference for nine consecutive days was very little under 50°, and on one occasion (the 23rd) the difference was 67½°. Can you, or any of your readers, assign a cause for the above fact. I presume that the distance, 1°24' west, would not account for it. What, then, is the reason, or can we place no reliance in the readings in the sun.

Trusting that the subject may be well ventilated, and receive the attention of some of your numerous correspondents,

I am, Sir, your obedient servant,

RICHARD TAYLOR.

Ryde, Isle of Wight,

To the Editor of the Meteorological Magazine.

SIR,—I enclose the readings of the two solar thermometers on grass plot. The grass was scorched, and the bulbs were close together, *i.e.*, two inches apart.—Yours truly,

W. B. KESTEVEN.

Holloway.

Date.	Hour.	D.	K.	Difference.
July 16	9 a.m.	120°	114°	—6°
„	10 „	130	127	—3
„	1 p.m.	133	127	—6
„	2 „	138	133	—5
17	9 a.m.	100	101	+1
„	11.30 „	109	107	—2
„	2 p.m.	118	116	—2
„	3 „	119	119	—0
18	10 a.m.	110	107	—3
„	11.30 „	127	122	—5
„	2.30 p.m.	132	128	—6
19	1 „	140	136	—4
20	12 noon.	130	128	—2
„	3 p.m.	134	130	—4
21	10 a.m.	119	115	—4
„	11 „	131	128	—3
„	4 p.m.	138	132	—6
22	11 a.m.	125	121	—4
„	2 p.m.	138°	133°	—5°

Mean difference, —3°·5

(D—Symons's. K—Kesteven's.)

REVIEW.

Commission Hydrométrique et des Orages, 1866, 23^{me} Année.

370 pages and 3 plates. [Second Notice.]

The remainder of the volume is occupied by two most valuable papers by the President of the Commission, M. Fournet. The first gives details of the ordinary track of storms across the Department of the Rhone, which is greatly elucidated by a good map. The introductory remarks are so eloquently truthful, that we cannot refrain from attempting to lay before our readers indications of the ideas, to the expression of which no translation could do justice.

During stormy weather the S.W. winds arrive in the Department almost saturated with vapour, which at times produce detached clouds around the mountain tops, at others banks of vapour, whose thickness varies according to the intensity of the operating causes.

In either case, owing to the currents of air, these clouds are so elongated that they may for distinction be called “storm columns,” from their resemblance to columns of troops.

Sometimes it happens that these bands are dissolved on passing from the mountains above the plains [*i.e.* away from the condensing influence of the cold mountain], while if the atmosphere is nearly saturated the elongation becomes considerable, and as our mountain

tops are close together, the celestial vault is carpetted with these columns, which remain parallel among themselves in a S.W.-N.E. direction. Lastly, if they are in a state of saturation, the vapour is condensed, all along the bands, then also, a very large dense and low stratus is formed, rain falls throughout, but traces of the columnar arrangement remain. Occasionally similar bands are formed from N. to S., when prolonged thunderstorms reign amid the peaks of our western mountains. Sometimes the phenomenon is confined to the south, sometimes to the north, and sometimes one or two bands alone are formed. Among the many interesting phenomena connected with these columns, motion is but one, the unequal distribution of wind force, of lightning, and of vapour, often appearing at intervals like waves, fully merit the notice of meteorologists.

The rain tables present such a remarkable contrast to those of 1865, that we have tabulated the values for both years, and the great difference between them, differences which the irregularly distributed rains of September 24 and 25 are insufficient to explain.

WATERSHED.	STATION.	Height above Sea. feet.	Depth of Rain.		
			1865. inches.	1866. inches.	Diff. inches.
Bassin de la Saone Supérieure	Courlon.....	1090	31.9	50.1	+18.2
	Vesoul	784	20.6	32.5	+11.9
	Gray	768	22.4	38.0	+15.6
	Dijon.....	869	21.5	33.6	+12.1
Bassin de la Saone Inférieure	Châlon	594	20.7	30.5	+ 9.8
	Bourg	919	39.0	49.9	+10.9
	Fort Lamotte	597	31.0	34.6	+ 3.6
	Fort de Joux	3281	35.7	27.6	— 8.1
Bassin du Doubs	Montbéliard.....	1273	47.9	22.2	—25.7
	Besançon	1191	30.1	68.2	+38.1
	Dôle	752	25.8	47.2	+21.4
Basin de l'Ardière	Monsoi	1926	34.2	56.4	+22.2
	Cercié	755	30.7	36.0	+ 5.3
Bassin de l'Azer- gues.....	St. Nizier d'Azergues.....	1309	26.8	43.6	+16.8
	St. Laurent d'Oingt	1810	28.6	41.4	+12.8
Bassin de la Bre- venne	Tarare	1312	30.9	39.3	+ 8.4
	L'Arbresle	742	27.7	36.4	+ 8.7
	Ste-Foy-l'Argentière	1418	30.4	40.7	+10.3
	Duerne	2703	27.2	35.4	+ 7.2
Bassin du Rhône...	Givors	592	31.6	34.1	+ 2.5
Bassin du Rhône Supérieur	St. Bernard	8173	43.7	49.0	+ 5.3
	Genève	1221	28.2	39.6	+11.4
	Les Rousses	3645	48.0	56.6	+ 8.6
Bassin du Rhins.....	Cublize	1525	29.6	40.6	+11.0
Littoral Méditer- ranéen	Marseille	158	17.3	17.7	+ 0.4

Marshal Bugeaud's rule comes in for close scrutiny in a letter by M. H. Lorenti, the opening paragraphs of which are as follows:—

“Gentlemen,—You know the want we have all experienced of the means of foretelling the weather long in advance. This aid science is not yet in a condition to afford; but numerous rules pretend to supply the deficiency of science, and to furnish to agriculture eminently valuable forecasts. In fact they would be of immense use, if, instead of contradicting one another as they generally do, they agreed in their general indications and were confirmed by actual observations.

"Among these rules there is one which has lately been promulgated under the authority of an illustrious name, and has to a certain extent received the benefit of this high patronage. The newspapers have discussed it, certain observers have affirmed its perfect accuracy, a scientific magazine designed to cultivate among the public a taste for the exact sciences, the knowledge of works accomplished and results obtained, has published it, calling upon all its readers to observe it, and test it by their own experience. This is the rule—

"The weather will be, eleven times out of twelve, during the whole lunation similar to that on the 5th day thereof if the 6th day resembles the 5th. And nine times out of twelve the weather will during the whole lunation be as the 4th day if the 6th day resembles the 4th."

M. Lorenti takes exception to a certain want of precision in the rule, then quotes instances entirely contrary to it, and concludes by illustrations of its failures.

NEW INSTRUMENTS.

To the Editor of the Meteorological Magazine.

SIR,—The statement of the two opticians, quoted in your editorial remarks on my last letter with reference to "new instruments" certainly surprises me greatly.

I have seen in this city dozens of thermometers *with shields welded to the top of the very bulb itself*, and as many with welds at distances from one-eighth to 1 inch therefrom. There does not appear to be the slightest difficulty, "owing to the unequal expansion of the different layers of glass." If the bulb, stem and shield be made of the same material, there can be no such objection as that advanced. Thermometers of the kind herein alluded to, with the exception of the vacuum, can be seen at any time at Mr. Yeates' place of business here; he says "it is no very extraordinary feat of glass-blowing."

I trust you will kindly insert this in your magazine, as the statement set forth in the last number might prevent experiments from being tried.—Yours truly,

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

69, Lower Mount Street, Dublin, 25th July, 1868.

[We are perfectly acquainted with the form of thermometer described, but believe it has not hitherto been made with anything like the accuracy requisite for meteorological purposes. Perhaps the simplest mode of bringing the question to an immediate issue will be for Mr. Festing to instruct Mr. Yeates to make some thermometers (enamelled tubes and divided on their own stems, of course,) such as he indicates; and if they can be produced, accurate, durable, and at no great increase on the ordinary price, Mr. Festing will receive the best thanks of all observers, and Mr. Yeates a more substantial return.—Ed.]

TO OUR READERS AND CORRESPONDENTS.

It will be seen that we have this month increased the size of the Magazine by a few pages, in order to avoid unreasonably deferring the insertion of many valuable communications. We shall willingly do so on future occasions, if by our readers' recommendation the circulation is proportionally increased.