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METEOROLOGICAL
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VOLUME THE THIRD.

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1868.  
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AND ALL BOOKSELLERS.

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SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXV.]

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INTRODUCTORY.

IN the introduction to our first volume, we expressed the hope that the *Meteorological Magazine* would be judged not by its promises, but by its performance ; and it is a source of great satisfaction to find, from the steadily-increasing circulation, that the performance has been considered equal, or superior, to the promises. As we said in the introduction above referred to, our maxim always is, "say everything in as few words as possible"—avoid verbiage ; for whatever may be the rule in diplomacy, it is certainly not true in science that "language was given to man to conceal his thoughts." We believe that the true characteristics of scientific literature should be precision, clearness, and terseness ; after that we strive, and we trust our correspondents will continue to do likewise. But, thanks to our many and valued contributors, in spite of all compression and condensation, the Magazine increases in bulk year by year, a most satisfactory state of things, and one which we trust our readers will perpetuate by the following methods :—(1) By prompt communication of intelligence likely to be of general interest to meteorologists ; and (2) by taking steps still further to increase its circulation, and so enable us to be even more liberal with illustrations, &c., than in the last year.

IS THE ROYAL CHARTER GALE PERIODIC ?

To the Editor of the Meteorological Magazine.

SIR,—In the January number of the *Meteorological Magazine*, you ask, "Is the Royal Charter Gale Periodic?" and you seem to anticipate an immediate negative reply to your query.

I, for one, have no hesitation whatever in giving the question an unqualified affirmative. I believe that there will be found a recurrence of stormy weather, and a low barometer, about the 25th October, in a considerably larger proportion of years than the "two out of three" that you suggest. Allow me to supply observations for some years not contained in your list. These observations were taken at Farnham, Surrey. The readings of the barometer are corrected for temperature, and reduced to sea level ; and I believe they may be accepted as reliable to the tenth indicated :—

Year.			Barometer.	
1826.	October	25 ...	29.1	Thunder and lightning on the 22nd.
1827.	"	23 ...	29.0	Very great rain.
1828.	"	23 ...	29.5	
1829.	"	22 ...	29.5	{ This was the lowest reading of the month. Previous to the 26th, the barometer was always <i>above</i> 30.20.
1830.	"	23 ...	29.7	
1831.	"	26 ...	29.3	
1832.	No low barometer at this period.			
1833.	October	15 ...	28.7	After the 15th the barometer did not exceed 29.5 until the 30th.
1834.	"	25 ...	29.5	A fall of 1 in. in 24 hours. Severe gale.
1835.	"	26 ...	28.8	
1836.	"	29 ...	29.1	
1837.	"	25 ...	29.3	Much rain
1838.	"	29 ...	28.4	
1839.	No low barometer at this period.			
1840.	October	28 ...	28.9	
1841.	"	24 ...	28.7	
1857.	"	22, 23.	29.6	Nearly 4 in. of rain in 30 hours.

You observe that in October "gales generally occur in the first or last week." In point of fact, there is a *double* periodicity of disturbed weather in October, viz., about the 10th and 25th. In the above list, I have carefully avoided mixing up the two periods; for both are often strongly marked in the same year. I suspect that it very rarely happens that *both* are absent; the period of the 10th was most distinctly marked in the two years in my list, when there was fine and calm weather about the 25th. These two periodicities, further, have each a character of their own—that of the 10th is more often marked by rain than by wind; that of the 25th is *more* conspicuous for its gales than for its rain, though the latter is often considerable.

I am glad to take this opportunity of asking the attention of meteorologists to the subject of "periodicities." The fact is, that the many abortive attempts which have been made to construct a "cycle of seasons," have brought so much discredit upon the idea, that a man needs some boldness to venture a hint that there is, after all, such a thing as periodical recurrence of any kind in our climate. Nevertheless, I am convinced that the double October period is only one out of several similar recurrences. Some of these are more strongly marked than others; and I will just indicate two or three which seem to me sufficiently established; and I would earnestly invite all persons who possess reliable registers of weather for ten years or more, to examine them carefully from this point of view; and I believe that they will find that they can fully corroborate the suggestions I have made.

Feb. 10. About this day a low barometer and strong gales, or heavy snow, may be safely expected.

July 17. Thunderstorms probably 9 years out of 10.

August 10. In August there is a double period, similar to that of October. The 10th is marked by thunder or great rain; while the second, on August 20, usually has a gale.

December 25. A gale, *generally accompanied with lightning*, often recurs just about Christmas day. This, however, does not seem to be so regularly annual as the above periods.

The cold period of about the 10th May has long been known ; but the even more certain cold period of the 24th April—the true “black-thorn winter,” has escaped notice.

My letter is already too long ; but, if you wish it, I shall be happy to furnish you with particulars concerning some of the “periodicities” above referred to.

I am, Sir, faithfully yours,

P. H. NEWNHAM, M.A., F.M.S.

Bournemouth, Feb. 4, 1868.

To the Editor of the Meteorological Magazine.

SIR,—The following Meteorological Phenomena, &c., are taken from my notes, and may be of use to you :—

- 1737. Oct. 12.—Furious hurricane at the mouth of the Ganges.
- „ Oct. 18.—Great flood at Canterbury.
- 1739. Oct. 30.—Gale at Newcastle-on-Tyne.
- 1757. Oct. 29.—Terrible hurricane at Malta.
- 1758. Oct. 14.—Gale in Great Britain.
- 1759. Oct. 30.—Earthquake at Tripoli. 6,000 persons perished at Damascus.
- 1760. Oct. 16.—Flood on Rhine.
- „ Oct. 21 to 28.—Gales in Great Britain.
- 1761. Oct. 12.—Violent gale at Copenhagen.
- „ Oct. 14.—Great gale and thunderstorm at Malvern.
- „ Oct. 16 to 21.—Violent N.E. gales in Ireland.
- „ Oct. 17.—Great flood at Newcastle-on-Tyne.
- „ Oct. 19.—Gale at Aberdeen.
- „ Oct. 21.—Great floods in Ireland.
- „ Oct. 22.—Violent Gales in Hispaniola.
- „ Oct. 23.—Most violent N.E. gale (for last 30 years) at Boston, U.S.
- 1762. Oct. 26.—Fearful gale and flood about London ; at Norwich great gale, and 3,000 houses laid under water ; very great flood at Cambridge.
- 1763. Oct. 1.—Violent gale in England and Scotland.
- „ Oct. 7.—Great flood in Lincolnshire.
- „ Oct. 12.—Large meteor at St. Neots.
- „ Oct. 16.—Gale in Irish Channel ; and earthquake in Algiers.
- „ Oct. 17.—Large meteor in Great Britain.
- 1767. Oct. 8.—Tremendous flood in Great Britain.
- „ Oct. 16.—Gale in Orkney.
- „ Oct. 19.—Eruption of Vesuvius (and earthquake), worst this century.
- 1768. Oct. 9.—Great flood, after 5 months drought, at Porto Ferraro, Rio.
- „ Oct. 15.—Hurricane in Havannah—nearly 1,000 persons killed, and 4,840 houses destroyed.
- 1769. Oct. 24, 25, and 26.—Aurora Borealis brighter than for 50 years.

1770. Oct. 17.—Great gale and thunderstorm in Great Britain.
 „ Oct. 20.—Most violent thunderstorm at Canterbury.
 1772. Oct. 6.—Thunderstorm at Harrowgate.
 „ Oct. 25.—N.E. gale at Borrowstanness.
 „ Oct. 29.—Gale at Yarmouth.
 „ Oct. 30.—Greatest flood known at Monmouth.
 1773. Oct. 10.—Hurricane, with fearful thunderstorm, at Bawtry.
 Gale at York.
 „ Oct. 12.—Gale at Thurlestow.
 „ Oct. 15.—Thunderstorm in Great Britain.
 „ Oct. 16.—Thunderstorm in London.
 „ Oct. 17.—Thunderstorm at Bristol.
 „ Oct. 18.—Thunderstorm at Cambridge and London.
 „ Oct. 25.—Eruption of Volcano of Gamma Courra—thunder
 and lightning. 80 shocks of earthquake in 24 hours.
 1774. Oct. 10.—Earthquake in Switzerland.
 1775. Oct. 19 and 20.—Great gale at Nottingham, and great floods in
 Yorkshire and Cheshire.
 1776. Oct. 27.—Large meteor in London.
 1777. Oct. 16.—Violent thunderstorm in Yorkshire.
 1778. Oct. 8 and 16.—Earthquake shocks in Smyrna.
 1780. Oct. 2 and 3.—Hurricane and earthquake in Jamaica.
 „ Oct. 10.—Hurricane in Barbadoes.
 „ Oct. 11.—Hurricane at Martinico.
 „ Oct. 15 (8 p.m.).—Fearful gale about London, with thunder-
 storm.
 1781. Oct. 9.—A great overflowing of the sea.
 1786. Oct. 13.—Earthquake at Aquila.
 1787. Oct. 26 and 30.—Great floods at Frankfort.
 1788. Oct. 12.—Hurricane at Martinico, and earthquake at St. Lucia.
 1789. Oct. 17.—Thunderstorm in England.
 „ Oct. 31.—Gale at Yarmouth.
 1791. Oct. 22.—Thunderstorm, and sheets of ice at Tunbridge-wells.
 „ Oct. 26, 27, and 28.—Gale and thunderstorm at Canterbury
 and other places; great damage by hail at Tunbridge-wells.
 1793. Oct. 5.—Earthquake at Shaftesbury.
 1795. Oct. 29.—Highest flood in memory of man at Bristol.
 1796. Oct. 16.—Earthquake at Ripon.
 „ Oct. 23.—Gale at Ilfracombe.
 1800. Oct. 19.—Earthquake and gale at Ongola.
 „ Oct. 28.—Fearful hurricane at Ongola, India.
 1801. Oct. 4.—Earthquake in Turkey.
 „ Oct. 26.—Earthquake at Constantinople.
 1803. Oct. 15.—Great floods in Madeira.
 1804. Oct. 22.—Aurora Borealis at Nottingham.
 „ Oct. 25.—Gale, with thunderstorm, at Truro.
 „ Oct. 30.—Gale at Portsmouth.
 1805. Oct. 22 and again in Oct. 23.—Meteor at York.

1808. Oct. 13.—Gale at Nottingham.
 „ Oct. 20.—Gale in Great Britain.
 „ Oct. 25.—Violent gale at Nottingham.
 1809. Oct. 5.—Earthquake at Lisbon.
 1810. Oct. 10, 19, and 21.—Gales at Nottingham.
 „ Oct. 24, 25, and 26.—Fearful hurricane in Havannah, and earthquake.
 1811. Oct. 13.—Great flood of Elbe.
 1812. Oct. 13.—Gale, with lightning, in Norfolk —Yours truly,
 E. J. LOWE, F.R.S.

To the Editor of the Meteorological Magazine.

SIR,—I have no notes between 1847 and 1861, but the following are at your service :—

1847. Oct. 24.—Brilliant aurora.
 1861. Oct. 28.—Aurora.
 1862. Oct. 20 — 23.—Barometer low ; high winds.
 1863. Oct. 29 — 31.—Rain, hail, lightning, and high wind.
 1864. Nothing remarkable.
 1865. Oct. 24 — 26.—Hail, rain, high wind, lightning, aurora.
 1866. Nothing.
 1867. Oct. 27.—High wind, rain, and hail.

T. BEESLEY, F.C.S.

5, High Street, Banbury.

THE FROST OF JANUARY ON THE CONTINENT.*

ALTHOUGH the mildness of the British Isles, as compared with the Continent, has long been known to those who have studied the subject, it is well occasionally to collect proofs thereof, in order that we may not forget how much we owe to that ocean-banked river, which brings to these northern shores some of the products, and some of the heat, of the Mexican Gulf.

MONTPELLIER.—Temperature steady at 18° ; the thick layer of snow which fell at the beginning of the month, is frozen hard, and covers the streets and roofs of the houses.

TOULOUSE.—The basin of the Garonne is one sheet of ice.

LYONS.—Nearly half the Rhone is frozen over.

At Dijon, Lons le Saulnier, and Bourg, the temperature fell to 5° ; at Grenoble to 15°. At Rouen all the maritime dock is frozen. The ships are immoveable, and the seamen perform much of their work on the ice. The general aspect, says the *Nouvelliste*, resembling on a small scale a scene of winter quarters in the Arctic regions.

At Honfleur the temperature fell to 14°, the docks and part of the outer harbour were frozen over, and enormous ice blocks floated about the bay.

At Orleans the Loire was frozen on the left bank, but flowed sluggishly on the right ; but higher up, at Tours, it was blocked for several days.

* All temperatures are in Fahrenheit's scale.

As for the Seine, it has not been so completely tied up for the last 20 years as it now is. A person curious in dates has found that the first mention of the Paris river being frozen over was in 821, when it remained like a solid mass for nearly a month. The same occurred during the winters of 1044, 1067, 1124, 1125, 1205, 1210, and 1325. In 1407 the cold was so severe that the greater part of the vines and fruit trees were completely destroyed. It was still more intense in 1420, when numbers of the population perished, and the wolves prowled about the streets in search of food. In 1434 it began to freeze on the 31st December, and continued with little intermission till the middle of March, and snow fell during 45 days without ceasing. In 1570 intense cold prevailed for three months. In 1608 the winter was so severe from the 21st of December, and fuel so scarce, that the smallest faggot of wood cost 35 sols. The cattle perished, and every species of game disappeared in the fields and forests. The ice was so thick on the Seine that waggons heavily laden passed over. In 1683 the cold was so intense during three weeks that numbers died. In 1709 the extreme cold caused a dearth of provisions, and in Paris and Versailles coarse oaten cakes were considered a luxury at the tables of princes and of the wealthiest inhabitants. In 1740 a scarcity occurred by the same cause, and was so great that, by order of the Parliament of Paris, public prayers were offered up in the churches, and the relics of St. Geneviève, the patron saint of the city and of St. Marcel, were carried in procession through the streets. In 1768 the large bells of many of the churches cracked from the cold. The winter of 1784 completely changed the aspect of Paris, and masses of snow and ice in the streets made them impassable. At the corner of the Rue Coq-St. Honoré a pyramid of snow was raised in honour of Louis XVI., who died on the scaffold nine years afterwards. On the 30th of December, 1786, the thermometer fell to zero, and the ice on the Seine was twelve inches thick. The other winters when the cold was most severe, and the river pretty nearly as it is now, were those of 1799, 1810, 1811, 1812, 1814, 1829, and 1846.

A letter from St. Petersburg of the 29th January, in the *Nord*, says:—"The severity of the winter increases. We have touched -30° Réaumur ($-35^{\circ}5$ F.). At Moscow the temperature has suddenly descended to -38° R. ($53^{\circ}5$ F.). The day before yesterday, at Valdai, between that city and this, the thermometer marked 42° below zero ($-62^{\circ}5$ F.). Mercury freezes, and only the instruments with alcohol show the temperature. You may imagine what is taking place on the railway between this capital and Moscow. Only by the most inconceivable efforts is the traffic carried on. The goods trains, when they stop at a station for any length of time, have the greatest difficulty in starting again. The frost attaches the wheels to the rails. Four or five locomotives are required to break them away, and sometimes this cannot be done; the engines or the coupling chains break. In short, there is a violent struggle with nature, in which man and iron have the worst of it."

FINE METEOR ON JANUARY 1, 1868.

AT 7.25, or 7.30 a.m., a very fine meteor passed south-east of England, in a course from N.E. to S.W., as may be inferred from the following notes, epitomized from various sources :—

HAMPSHIRE—ISLE OF WIGHT—*Freshwater*.—A most glorious meteor, of the size of the full moon, passed (at 7.30 a.m.) rather slowly from N.E. to S.W., left a trail of broad white light over 60° long, which was visible for more than half an hour. This band, originally straight, became wavy and zig-zag. The meteor did not burst, but disappeared behind clouds.—H. M. W.

HAMPSHIRE—SOUTHAMPTON—*Shirley Warren*.—A meteor, about the size of, and very like, a common rocket, seen at a quarter of a mile off, leaving a trail, but with a whiter nucleus, passed from E.S.E. to S.S.E. at 7.30 a.m., in a nearly horizontal course, about 10° or 15° above the horizon. The greater part of the train disappeared in about three minutes, but portions, gradually fading, remained, assuming the appearance of very narrow, thin, white clouds. One very short part—say about one-thirtieth of the whole course—was visible until 8.10—that is, for 40 minutes; and, even then, was only obscured by the light of the rising sun. This fragment had been very slowly moving to E., and, therefore, against the surface wind current.—F. L. WOLLASTON.

SUSSEX—NEWICK—*Ketches*.—At 7.30 a.m., a fine meteor, like a large cannon ball, passed from N. to S., showering down sparks as it passed along.—M. SHIFFNER.

SUSSEX—UCKFIELD.—About half-past seven in the morning of 1st a very brilliant and unusually large meteor was observed here. It first appeared from a point a little S. of E., and, passing nearly horizontally, at an elevation of 30°, disappeared behind a group of cumuli, situated a little W. of the meridian. What happened at its dispersion was not seen, but I am informed that it illuminated the clouds for nearly three minutes. It left a silvery line of phosphorescent light along its path, which remained visible for nearly *half an hour*. In size it was described to me as being about half the apparent size of the moon, and of a reddish colour. I was able to estimate the apparent height from its passage near the top of a tree, from the point where the person described to me its path. It was seen very generally in this immediate neighbourhood.—C. L. PRINCE.

KENT—ASHFORD—*Bethersden*.—At 7.25 a.m., a remarkable meteor travelled slowly from E. to W., its diameter about 8 in. [!] a globe of fire, followed by a bright light, and leaving a line of brilliant white smoke or vapour behind it, that could be plainly seen for 15 minutes. The meteor, which was accompanied by a fizzing sound [?], appeared about 45° above the horizon, traversed more than one-third of the heavens, and then burst into three pieces near the earth.—A. C. HILLS.

METEOR ON JANUARY 26TH.

To the Editor of the Meteorological Magazine.

A brilliant meteor was seen here about 8 p.m., on the 26th. Appeared to start from near "Alpha Cygni," and went in a N.E. direction, ending near the last star in the tail of Ursa Major. It consisted of a broad train of light, thicker than that left by an ordinary rocket, of a blue colour at first; but dying out in a deep red at last. Another small meteor was seen about five minutes afterwards traversing from S. to N.

W. WYNN WILLIAMS.

Menaifron, near Caernarvon.

ANOTHER SILVER THAW.

To the Editor of the Meteorological Magazine.

SIR,—We experienced a most beautiful sight here on Saturday 11th—one of the most splendid "silver thaws" I ever beheld. The morning broke dull and dark, with a sleety mist, wind S.W.S., thermometer, 30°, barometer, 29·78. The air felt raw and damp; and as the day proceeded, the rain increased, and was changed into ice immediately it found a lodgment on the ground, on walls, houses, fences, and on trees—which latter produced a most extraordinary effect, the branches being coated completely, and the leaves of all evergreens also, and both presenting at the points icicles an inch and a half to two inches long, resembling exactly the little crystal drops pendant around the bonnets of the present day, and bending the branches most gracefully; the weeping willows, and those shrubs with thin and tender branches, were especially handsome. At noon, the temperature rose one degree, and the rain returned to a mist, with the wind southerly; and, as the afternoon advanced, the mist became fog, and the ice began to drop off the objects it had so affectionately embraced, and had completely disappeared on the morning of Sunday, when the thermometers marked 35°, and I measured ·33 of rain.

Noon, to-day, is exceedingly fine—clear bright sun, with strong wind, and thermometer 52°; rain, at 9 a.m., ·10.—Yours faithfully,

HENRY ST. JOHN JOYNER.

Shortwood House, Staines, Jan. 13, 1868,

GALE OF JANUARY 18th.

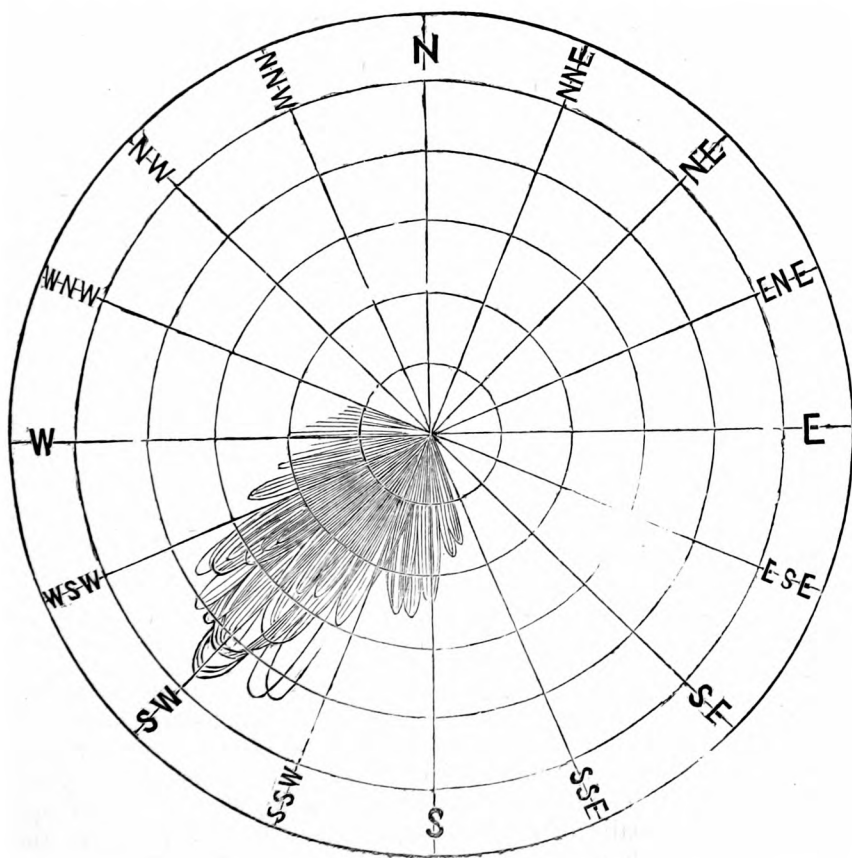
A RATHER severe gale occurred in the vicinity of London on the 18th of January. The most remarkable feature in connection therewith was the rate of fall of the barometer. The readings at Camden Town, reduced to sea level, were:—

				Rate of fall per hour.	
				in.	in.
January 18th,	9·0 a.m.	.....	29·645	.....	—
" "	11.15 a.m.	.....	·511	.....	·060
" "	1.25 p.m.	.....	·307	.....	·094
" "	1.30 "	.....	·296	.....	·132
" "	1.45 "	.....	·252	.....	·176
" "	2.0 "	.....	·238	.....	·056
" "	4.0 "	.....	·176	.....	·031

Thus, at 1.45 p.m., the rate of fall was very nearly 0·18 per hour,

The pressure of the wind, recorded by Mr. Cator's anemometer, at Beckenham, was 25 lbs. per square foot at 2.55 p.m. At the Royal Observatory, Greenwich, the reported pressure was 30 lbs. At Wisbech the greatest pressure was 16 lbs. Barometer very low in many places. The following are examples: Boston, 28.88; Deanston, 28.30; Aberdeen, "Barometer fell to 28.32, we had no gale, but over half an inch of rain;" Dublin, violent storm from S. about 2 p.m., bar. fell from 29.56 at 11.30 p.m. on 17th to 28.42 at 0.15 p.m. on 18th, which was the lowest point reached; at 9 a.m. the bar. was falling at the rate of 0.10 per hour.

By the courtesy of Mr. Segrave, we add copy of the diagram produced by Howlett's anemograph at his residence, in Dorset Square. The quadrant wherein the tracings are seen is that whence the wind blew, and the concentric circles denote each 4 lb. pressure; thus 4 lbs., 8 lbs., 12 lbs., 16 lbs., and 20 lbs., are the values of the several rings, whereby it will be seen that the maximum pressure recorded by it was 19 lbs. per square foot, the direction being S.W.



RECORD OF OSLER'S ANEMOMETER AT GUERNSEY.

To the Editor of the Meteorological Magazine.

SIR,—The new year was ushered in with cold and bitter N.E. wind, blowing until the 3rd, with a mean pressure of $1\frac{1}{2}$ lbs. on the square foot, a daily movement of the air of about 400 miles. Calm and light breezes from the same quarter, with continued cold, to the 10th. On Saturday, 11th, the wind veered from E., through S., as far as W., and since then has oscillated between W. and S.E., with a succession of gales of the cyclonic type, as is usual in this island with these winds.

Saturday, 11th.—A gale from S.E., veering to W., blew for 24 hours, greatest pressure 5 lbs. = 32 miles. Movement of air in 24 hours, 550 miles.

Monday, 13th.—After a calm of 36 hours, the wind again backed from W. to S.E., and a second gale veering through S. to W., blew for 24 hours—greatest force 8 lbs. = 40 miles. Movement of air in 24 hours, 670 miles.

14th and 15th.—After a lull of six hours, a third gale from S.W., for 48 hours; greatest pressure 7 lbs. = 38 miles; daily movement of air, 650 miles.

Thursday, 16th.—During an interval of six hours' calm, the wind again backed to S.E., and, veering to S.S.W., blew fresh for 48 hours; greatest pressure, 4 to 5 lbs., about 30 miles; daily movement of air, 400 miles.

Saturday, 18th.—During a lull of 3 to 4 hours the wind backed from S.W. to S.S.E. At 2 a.m., a fierce gale set in from S.S.W. to W., continuing until 5 p.m. on Sunday, about 40 hours; mean pressure, 7.5 lbs. = 38 miles, giving a daily movement of air of 750 miles. Rainfall .70. Much lightning on Sunday night.

Monday, 20th.—1 a.m. calm, wind backed from W. through S. and E., reaching N. at 2 p.m., a retrograde circuit of 270 degrees. Barometer, at 9 a.m., 28.9 sea level, having fallen 1 in. during the previous 48 hours. Rainfall .60.

Tuesday, 21st.—Calm. At 1 a.m. the wind suddenly shifted from N. to S., and through S.W., as far as N.W., direct arc of 315 degrees. Barometer risen, at 9 a.m., 7-tenths to 29.6. These wild oscillations of the barometer, and complication of the aerial currents, indicated the coming storm, and at 5 p.m. the wind, as usual, having backed to S.S.E., a furious gale set in. 9 p.m., S., pressure, 7 lbs. = 38 miles; midnight S.W., 10 lbs. = 45 miles; vivid lightning.

Wednesday, 22nd.—7 a.m., force, 16 to 20 lbs. = 57 to 63 miles; at 9 a.m. barometer fallen 4-tenths, 29.2 sea level; dark masses of cumulus, and gleams of sunlight; from 1 to 4 p.m., the storm culminated S.W., blowing steadily 25 lbs. = 72 miles, some of the gusts rising to 30 lbs. = 77 miles; barometer stationary, 29.2; dense canopy of low cloud, squalls of rain, sea and waves beaten down by the wind, covered with clouds of foam; 4 to 7 p.m., W.S.W., 14 lbs. = 53 miles; 7 to 8 p.m., 13 lbs. = 51 miles. At 8 p.m., the wind

shifted suddenly to W.N.W., when the gale immediately broke, and at 9 p.m. there was a perfect calm, which continued all night.

Thursday, 23rd.—At 6 a.m. the wind veered to N.E., light breeze ; 9 a.m. barometer risen 4-tenths, 29·6 sea level.

Yours very truly,

T. L. MANSELL, M.D.

Guernsey, Jan. 23rd, 1868.

EXAMINATION OF THERMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—Permit me to draw the attention of the readers of your valuable magazine to the desirability of occasionally verifying the zero points of their thermometers. It has long been known that the capacity of the bulbs of many thermometers undergoes a slow change, which, after the lapse of several years, produces errors in their readings amounting often to one, and sometimes even to *two*, degrees. I have lately tested five thermometers I have in my possession, and have found that, at a temperature of 32°, their readings require the following corrections :—

No.	1.—A spirit min. ther., by Negretti and Zambra.....	— 0·5
„	2.—A Phillips's max. ther.	— 1·7
„	3.—An ordinary ther., by Mr. Dancer	— 1·0
„	4.— do. do.	+ 0·2
„	5.—A solar radiation ther., by Negretti and Zambra	+ 0·2

It would be very interesting if some of your correspondents would test the thermometers they have in use, and favour your readers with an account of their results.

I may take this opportunity to point out a source of error in spirit minimum thermometers, which, I believe, is not generally known to meteorologists. It arises from the condensation of the vapour of the spirit in the extremity of the bore of the tube ; and, in a case which lately came under my notice, this condensation had gone on unchecked, until the error produced by it amounted to *five* degrees ! The spirit thus condensed was driven off by *heating* the end of the tube, and *cooling* the bulb ; but, fifteen days afterwards a fresh condensation had taken place, equivalent to *seven-tenths* of a degree. It is probable that this tendency of the alcoholic vapour to condense will be most apparent in a thermometer having a bore with a sharply-pointed extremity ; and, therefore, in selecting a spirit thermometer, it will be advisable to choose one in which the end of the bore is well rounded.

I am, dear Sir,

Yours very truly,

JOSH. BAXENDELL,

Cheetham Hill, Manchester,
Jan. 20, 1868,

REVIEW.

Results of Meteorological Observations taken at Christchurch and Hokitika, Canterbury, New Zealand, for the year ending 31st December, 1866. 6 pages, folio and plate.

THE observations at Canterbury are being steadily continued, under the care of Mr. Holmes, the Government observer. Those at Christchurch (lat. $43^{\circ} 32' 16''$ S.; lon. $172^{\circ} 38' 59''$ E.; distance from sea, 5 miles, and height above it, 25 ft.) for three years are epitomized in the report under notice; and, as the yearly results agree fairly with one another, it will be of interest to compare a few of the leading features with those of London:—

	Christchurch.	London.	Diff.
Mean Barometer reduced to 32° , and sea level	29·878 ...	29·953 ...	— ·075
Mean Temperature in shade	53·0 ...	50·0 ...	+ 3·0
„ max. „	61·9 ...	57·9 ...	+ 4·0
„ min. „	44·1 ...	42·3 ...	+ 1·8
Maximum „ „	89·4 ...	92·0 ...	— 2·6
Minimum „ „	25·3 ...	7·0 ...	+18·3
Maximum „ in sun	143·9 ...	— ...	—
Minimum „ on grass	17·3 ...	2·8 ...	—14·5
Mean Humidity	77 ...	83 ...	— 6
Total Rainfall (on ground).....	21·96 ...	24·20 ..	— 2·24
Days of Rain	102 ...	150 ...	—48

At Hokitika (lat. $42^{\circ} 41' 30''$ S.; lon. $170^{\circ} 59'$ E.), on the west coast, the air is damper, thunderstorms are rather more frequent, and the total rainfall at the level of the sea, in 1866, was 129·12 in. At Waikati, the total rainfall in 1866 was 20·52 inches.

From the above, the similarity of the climate of Christchurch to that of the British Isles is clearly shown, the principal difference being, that the temperature is more equable than that of London—resembling, perhaps, the climate of the Isle of Wight rather than that of the metropolis. Very many details are yet required, but, in the interim, the broad outline is very acceptable; and we hope Mr. Holmes will go on with the work he has well begun, and that no false economy on the part of the Colonial Government will prevent his pushing his stations into the interior. Irrespective of the immense practical utility of accurate knowledge of the climate of the province, we believe that in the vicinity of the southern Alps, results of high scientific interest are within Mr. Holmes' reach.

EARTHQUAKE IN SOMERSET.

ON January 4th, at 5.10 a.m., a slight shock of earthquake was felt throughout the southern part of Somersetshire—Taunton, Wellington, Langport, and other places. Beds and houses were shaken, lamps and windows rattled. A farmer armed himself, and searched for thieves, &c.

JANUARY, 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.			Deg.	Date.	Deg.	Date.		
I.	Camden Town	3·89	+ 1·94	·79	18	19	53·0	17	23·4	3	16	
II.	Staplehurst (Linton Park) ...	3·65	+ 1·59	·50	18	21	50·0	15	17·0	7	18	
	Selborne (The Wakes).....	5·73	+ 2·46	·99	18	18	49·0	28	17·0	3	18	
III.	Hitchen	2·98	+ ·84	·39	21	20	51·0	14†	21·0	2	17	
	Banbury	2·75	+ ·66	·43	18	20	52·0	17	22·0	2	15	
IV.	Bury St. Edmunds (Culford). ..	2·69	+ ·82	·49	24	14	53·0	17	23·0	2	15	
V.	Calne	4·27	...	·88	18	18	53·0	31	18·0	4	17	
"	Barnstaple.....	6·10	+ 2·58	1·63	11	19	...	...	...	...	...
"	Bodmin	6·48	+ 1·29	1·10	21	23	54·0	17	22·0	4	8	
VI.	Cirencester	4·68	+ 1·68	·75	11	13	50·0	16	25·0	3	6	
"	Shifnall	1·84	— ·06	·34	11	13	53·0	16	22·0	2, 4	12	
"	Tenbury (Orleton)	3·07	+ ·54	·47	24	21	57·0	14	21·8	2	15	
VII.	Leicester (Wigston)	1·71	— ·27	·39	13	8	53·0	17	20·0	1, 2	16	
"	Boston	2·27	+ ·56	·40	19	20	54·5	17	25·5	4	12	
"	Gainsborough	2·76	+ 1·34	·81	7	13	57·0	17	20·0	2	5	
"	Derby	1·81	+ ·02	·30	31	21	54·0	14	25·0	3, 4	11	
VIII.	Manchester	2·75	+ ·23	·45	31	21	55·0	14*	24·0	4	9	
IX.	York	1·86	+ ·28	·41	31	18	53·5	16†	24·0	4	11	
X.	Skipton (Arncliffe)	8·03	+ 2·39	2·02	31	24	...	...	...	...	...
"	North Shields	2·04	— ·08	·36	31	22	55·0	31	28·2	22||	10	
"	Borrowdale (Seathwaite).....	13·54	— 2·82	2·23	19	18	...	...	...	...	...
XI.	Abercarn	8·47	...	1·36	25	13	...	...	...	...	...
"	Haverfordwest	5·72	+ ·67	1·25	11	15	51·9	16	17·5	3	2	
"	Rhayader (Cefnfaes).....	...	...	...	...	...	...	...	...	...	...
"	Llandudno... ..	3·81	+ 1·27	·72	27	18	57·8	16	26·7	10	8	
XII.	Dumfries	3·64	— ·96	·58	18	15	52·0	16	24·5	4	11	
"	Hawick (Silverbut Hall) ...	4·00	...	1·18	31	23	...	...	...	...	14
XIV.	Ayr (Auchendrane House) ...	5·63	+ 1·11	1·20	24	17	55·0	14	22·0	1, 4	11	
XV.	Castle Toward	9·31	+ 3·02	1·52	25	19	52·0	16	25·0	22	12	
XVI.	Leven (Nookton)	3·68	+ ·71	·85	31	18	52·0	14	23·0	21	10	
"	Stirling (Deanston)	8·37	+ 3·65	1·48	24	23	52·2	17	18·0	21	12	
"	Logierait	5·35	...	1·20	31	19	...	...	...	...	...
XVII.	Ballater	4·09	...	·92	24	20	52·8	17	9·0	24	17	
"	Aberdeen	2·94	...	·60	18	18	53·2	14	22·0	21	10	
XVIII.	Inverness (Culloden)	5·58	...	2·64	31	...	50·0	14	24·4	4	12	
"	Fort William	18·69	...	2·81	30	20	...	...	...	...	...
"	Portree	12·82	— ·27	2·40	24	14	53·0	16	25·0	23	10	
"	Loch Broom	10·02	...	1·85	30	20	...	...	...	...	...
XIX.	Helmsdale	5·72	...	1·17	30	18	...	...	...	...	...
"	Sandwick	4·50	+ 1·21	·61	29	21	51·0	17	28·2	5	12	
XX.	Cork	6·82	...	1·40	21	20	...	...	...	...	...
"	Waterford	5·52	+ ·66	1·72	10	21	55·0	27	28·0	4	6	
"	Killaloe	3·93	— ·93	·40	24	18	53·0	31	22·0	4	10	
XXI.	Portarlinton	2·25	— 1·76	·31	11	22	51·5	13	22·0	3	12	
"	Monkstown	3·76	+ ·37	·93	10	20	58·3	16	26·5	4	7	
XXII.	Galway	5·29	...	1·08	31	21	54·0	17	21·0	3, 4	11	
"	Bunninadden (Doo Castle) ...	5·11	...	·53	31	17	51·0	31	17·0	4	12	
XXIII.	Bawnboy (Owendoon)	6·65	...	·93	10	21	54·0	13‡	25·0	2, 3, 4	6	
"	Waringstown	2·81	...	·52	24	19	55·0	16	21·0	4	12	
"	Strabane (Leckpatrick)	4·66	...	·83	24	21	53·0	16	18·0	4	20	

* And 31st. † And 17th. ‡ And 14th & 16th. || And 24th.

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

METEOROLOGICAL NOTES ON THE MONTH.

[A few alterations will be noticed in the stations whence the monthly returns are published in the preceding table. The causes have been twofold—the death of observers and our desire, as far as possible, to exclude all stations which do not possess the returns of the six years whereof the averages are taken as standards of comparison. We may here, perhaps, tender our thanks for the promptitude and care with which the returns are forwarded to us, from which the tables and following remarks are formed. A corrected list of the latitude and longitude of the stations, and height of the gauges, shall appear next month.—ED.]

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

ENGLAND.

LINTON PARK.—First twelve days frosty, with S on ground; remainder mostly wet and dirty. Fog on 12th, 15th and 28th. High winds on 13th and 18th. Bar. very unsteady; max. at noon on 29th; min. on 22nd.

SELBORNE.—Bar. and ther. very unsteady; on the whole a tempestuous month.

BANBURY.—Frequent S and high winds.

CULFORD.—S every day in the first week; the latter part of the month very mild, but with high winds, chiefly from the S.W. Gales on the 18th, 24th, and 31st.

BODMIN.—Gales on 18th, 23rd and 31st.

CIRENCESTER.—From 1st to 10th thick serene weather, sun and moon scarcely seen. Rain, sleet and snow on 11th; trees cased thickly in ice, which melted slowly in a S. wind for the first 24 hours, but all disappeared by 5 p.m. on 12th. Gorgeous sunrise on 24th; fresh cold wind, R commencing at 8 p.m. Wind chiefly N.E. to E. for first 10 days, then S. to S.W. to the 20th; fresh to a gale on 31st. Aconites and snowdrops show bloom; the quiet weather from the middle of December broke up on the 11th of January; an extraordinary rainfall with wind continued to the end of the month; the water rose rapidly in wells; the valley wells sunk in a gravel bed rose 2 ft. 10 in.; in a deep well on the hill, 100 ft. deep, the water rose 17 ft. 6 in., being nearly to its maximum winter height.

HAUGHTON HALL, SHIFFNAL.—Exceedingly variable in temp.; cold E. and N. and S.E. winds. Gorgeous sunset on 31st; a severe S storm commenced at 10 p.m., and lasted with little intermission till 5.30 p.m. on 1st of February. Wind W.N.W. Aconites up on 23rd; snowdrops on 27th; throstles begin to sing on 30th.

ORLETON.—Great wind on night of 31st. The first half of the month very cold, and remarkably cloudy from 3rd to 15th; very changeable afterwards, but generally warm, with much R and wind. Bar. very low on 18th, 19th, and 22nd. Violent winds on the 14th, 18th, 24th, and 31st.

WIGSTON.—Temp. very variable.

BOSTON.—Great fluctuations in the barometric pressure; remarkable depression on the 18th, when it fell as low as 28.878 corrected; temp. was low to the 12th; from then to the 19th it was much milder; from 19th to 25th the weather was cold and stormy, and during the last week the temp. was much higher, although the atmospheric disturbances were very great. Severe gales on 18th, 24th and 31st. L on 17th.

GAINSBOROUGH.—Weather unsettled throughout the month. Snow, rain, drizzle and fog, with an occasional fine day, were the characteristics of the month.

DERBY.—A dull, unpleasant month; very little S, and not one fine crispy day. The month ended with a gale of unusual force and duration.

ARNcliffe.—TS at 7 a.m. on 15th.

NORTH SHIELDS.—Dull, cloudy month. Plants in flower on 1st January: chrysanthemum, yarrow, pansy, stock, and wallflower; middle of month, furze

in bloom, polianthus in flower, Christmas rose, and white rock cress ; yellow primrose on 23rd, and lilac primrose on 28th.

SEATHWAITE.—Six days on which the fall exceeded an inch, though the total fall was nearly three inches below the average.

W A L E S.

HAVERFORDWEST.—January commenced with great cold and severe frosts, which lasted to the 11th ; from that date to the end of the month stormy, wet and wild. Severe storms on the 18th, 19th and 31st.

ABERCARN.—Severe weather, cold and frosty, from the 1st to the 11th ; afterwards wet and tempestuous.

S C O T L A N D.

DUMFRIES.—The first ten days frosty ; from 11th to 19th wet and stormy ; then four days frosty and fine ; the last eight days very stormy and wet. Violent gales on 18th, 24th and 31st. Snowdrops in bloom on 26th.

SILVERBUT HALL.—Heavy gales from the west in the middle and latter end of the month. TS on the night of the 15th ; dreadful hurricane, accompanied with H, S, and R on the 24th. Beautiful fleecy-like sky on 26th ; lunar rainbow on the morning of the 30th ; rivers overflowing on 31st.

AUCHENDRANE.—Generally it may be said that the mean bar. of this January is above the mean of the same month for the last three years, but the temp. is below the mean. In force of wind, however, this January has been more stormy than its predecessors. On the 18th a severe equatorial gale prevailed with great force ; also on the 24th ; and on the 31st a third began, and continued into February with great violence and heavy rainfall.

NOOKTON.—With the exception of 19th to 23rd, and 26th to 28th, the month was a continuation of storms of wind, and with little R to the 30th ; light R on 30th ; heavy during the night and 31st.

DEANSTON.—First part of the month dry, but very damp and dull ; after the 10th much R and heavy storms, but little S and frost. Bar. 28·92 on 14th ; gale of wind with S showers ; bar. 28·30 on 18th ; gale in London ; wet here, though not much wind ; bar. 29·0 on 24th ; very heavy gale from S., with S, sleet and R ; 2,500 trees uprooted at Lanrick Castle ; great floods in river on 31st ; none so heavy since 1834.

LOGIERAIT.—Stormy month ; with one exception the greatest rainfall in any one month for the last three years ; several heavy gales ; severe storm on 24th ; intense frost some days preceding ; month closed with heavy R, a low bar. and high temp. ; on 1st February the Tay was more swollen than it has been for 21 years previously.

BALLATER.—A month of very unsettled weather ; the range of temp. 43°, and bar. 2 inches ; very violent gale, with blinding S drift on 24th, merging into sleet and R towards night ; the month closed with a low bar, cloudy and wet, with a fresh westerly breeze.

ABERDEEN.—A month of very unsteady weather, with remarkable oscillations of bar. ; the remarkably low bar. of 18th (28·32) was attended by no gale, only a fall of 0·60 of R ; hurricane of 24th not so disastrous as either that of February 13th, 1864, or October 3rd, 1860, but scarcely less in pressure. Dee down in a spate on 1st February, 6 ft. above the average depth, probably heavy R in the hilly country on 31st January. L on 14th to 17th, and 27th. Auroræ on 13th, 19th, 23rd to 25th, and 29th.

CULLODEN.—L on 15th, 16th, 17th, and 29th ; aurora on 21st ; gales on 24th ; H and R all day on 31st, and boisterous weather on 25th and 30th.

ROSSE PARSONAGE.—The wettest month since observations were commenced here ; it began with clear frosty weather, but a change came before the month was half over, and the latter part was unprecedented for wind and R. In October last year the fact was recorded that the 26th of that month was the wettest day remembered, 2·57 in. fell ; in this January that amount was exceeded on the 30th, when 2·81 in. fell, and also on the 31st, when 2·67 in. fell, and upwards of 2 in. fell on 16th and 24th ; the total fall of the month 18·69, against 5·84 in

1867, 14·19 in 1866, and 9·18 in 1865. The hurricane of the 24th was frightful, and the last night of the month was very violent. TS on 14th, 15th, and 16th.

PORTREE.—The first ten days fine, clear and frosty, from which time to the end of the month it has been very stormy, S, sleet and H, and almost continual gales.

LOCH BROOM.—The beginning of the month was all that could be desired; until the 13th it was beautiful; from that date until the 18th it was stormy and wet; thence to the 23rd very fine, but the last nine days are not to be forgotten, and such days as the 24th and 25th, as well as the last three days of the month, are not in the memory of any living man; on five days we had more than 1 in., and the total fall for the month was the greatest I have ever recorded.

SANDWICK.—Auroræ on 13th and 23rd; TS on 14th, 15th, and 16th. January has been wetter and rather colder than the mean; the first 11 days, also with the last nine days of December, were particularly fine, dry, and moderate; during the last eight days there was a succession of gales; that of the 24th was particularly violent, blowing about 70 miles an hour from 10 a.m. till 3 p.m.; ground white with S on 19th and 20th.

IRELAND.

KILLALOE.—Frequent storms during the month.

MONKSTOWN.—This month has been a very wild one, and for a long time we have not experienced such a constant succession of fearful gales; on the 13th a stiff gale, which increased to a perfect hurricane from the W. on the morning of the 14th; again on 18th very wild at 9 a.m., wind S.; it gradually increased until 2 p.m., when it was blowing a fearful storm, such as we have not had for a long time. The bar. fell from 29·562 at 11.30 p.m. on 17th to 28·420 at 12.15 p.m. on 18th; this was the lowest point reached; at 9 a.m. on 18th it was alling at the rate of 100 per hour; so severe was the gale, that the mail steamer which usually leaves Holyhead at two p.m., was detained till about 6 p.m. On the 24th and 31st two more almost equally severe gales.

GALWAY.—L on 17th and 24th. Heavy storms prevalent during the month.

DOO CASTLE.—Hard frosts to the 10th, with very fine sunny weather; remainder, a few days excepted, wet, cold, and stormy; TS on night of 13th and morning of 17th; strong gales on 18th and 31st, latter culminating at night. Bar. lowest I have ever noticed on morning of 18th; several trees snapped on this day; in fact two-thirds of this month well deserves the name of tempestuous.

OWENDOON.—The long continued fine weather broke up on the 10th, with a fall of ·93, from which date every day, with the exception of the 22nd, has been wet. Gale at noon on 18th; bar. fell to 28·24.

WARINGTOWN.—The early part of the month very fine and unusually dry, so much so that water was scarce in some places. In the latter half we experienced a succession of violent gales, exceeding anything since 1839, though from their direction they did not do as much damage here as that memorable storm. On the 18th, at 1.30 p.m., the bar. fell to 28·202 (uncorrected), and though it never read so low again, the gales of the 24th and 31st were little less severe. L on 14th.

LECKPATRICK.—After nine days of frost at beginning of month, there was very stormy and wet weather; from 19th to 27th hard frost, which suddenly came to an end with a gale from S.W.; a perfect hurricane on 31st, trees blown down, &c. Range of bar. during the month nearly two inches.

LATEST INTELLIGENCE.

A violent gale occurred on February 1st, concerning which we purpose giving a few particulars in our next. Observers will oblige by communicating observations for January 31st, and February 1st & 2nd.

We are glad to see by the *Times* that the Senatus Academicus of St. Andrew's have conferred the degree of LL.D. on our esteemed Orcadian correspondent, the Rev. Charles Clouston, of Sandwick, in recognition of his valuable contributions to meteorology.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXVI.]

MARCH, 1868.

[PRICE FOURPENCE.
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THE GALE OF FEBRUARY 1st.

IN our last number we intimated our intention of collecting and inserting in the present a description of the above gale. The notes with which we have been favoured by our numerous correspondents are however so interesting and so much to the point, that it seems more advisable to let them appear as they are, than to attempt to consolidate them into a single consecutive narrative.

The special feature of the gale seems from them to be, the similarity of direction at all places and times ; there is not, so far as present evidence goes, the slightest trace of ordinary cyclonic rotation or progression : on the contrary, it seems to claim the title of a "straight line gale," blowing steadily, but with great strength, from W.S.W. Of course it *may* have been a circle, but if so its centre must have been nearly in the Faroe Isles, and remained there for some days. The barometric readings were very much lower in the extreme north of Scotland (28·35 in.) than elsewhere, but we need hardly say that that is of itself no proof of the existence of a centre.

Incredible pressures, of 70 or 80 lbs. per square foot, were reported from Liverpool Observatory, concerning which we have received a communication, which must stand over till next month.

To the Editor of the Meteorological Magazine.

SIR,—I send you, with pleasure, the record of Osler's anemometer for Jan. 31, and Feb. 1st and 2nd :—

Friday, Jan. 31st.—1 a.m., S.W., backing, force 2 lbs. on square foot ; 10 a.m., gale set in, S.S.E. ; barometer during previous 24 hours fallen 2-tenths, 29·9 sea level ; 1 p.m., S., 4 lbs. ; 8 p.m., S.S.W., 5 lbs. ; midnight, S.W., 7 lbs.

Saturday, Feb. 1st.—1 a.m. to 6 a.m., S.W., 8 to 9 lbs. ; 6 a.m. to noon, S.W., 12 lbs = 49 miles, barometer fallen 5-tenths, 29·4 sea-level ; 1 p.m., W., 5 lbs. ; 4 p.m., 3 lbs. ; midnight, calm.

Sunday, 2nd.—From 1 a.m. to 5 p.m., pressure under 1 lb., wind backing; at 6 p.m., a gale set in from S., veering to W.S.W., lasting 8 hours, greatest force, 10 lbs., pressure, 4·5 lbs.

Monday, 3rd.—1 a.m., calm, wind gradually shifting to N.W.; barometer, 9 a.m., 29·95 sea level.

This was a moderate gale compared with that of January 22nd, which reached 30 lbs., its extreme S. edge only passing over the island.

It is interesting to note that the wind on the south coast of England, during the storm of the 22nd, which swept over this island from S.S.E. to W.N.W., blew from the opposite quarters, shewing it to have been a cyclone progressing up Channel. Vessels since arrived here, report that on the 22nd, they ran across channel before a N.E. gale.—Yours very truly,

T. S. MANSELL, M.D.

*Grange Road, Guernsey,
Feb. 20th, 1868.*

BECKENHAM.—Very violent gale—maximum force, 28 lbs. per square foot at 1 p.m. on 1st; large elm trees, chimneys, tiles, &c., blown down; the direction of the wind between S.W. and W. throughout.—*C. O. F. Cator.*

To the Editor of the Meteorological Magazine.

SIR,—At 6 a.m. of 31st January the barometer stood here (corrected and reduced) at 29·99; at 6 a.m. of 1st February at 29·40; and at 6 a.m. of 2nd February at 29·81.

FLUCTUATIONS OF THE BAROMETER DURING FEBRUARY.

I have observed the following remarkable fluctuations:—

Between 6 a.m. of the 3rd, and 6 a.m. of the 4th, the barometer rose 0·67 in. Between the same hours of the 7th and 8th, it fell 0·51 in.; and between the same hours of the 8th and 9th, it rose 0·83 in. Between the same hours of the 18th and 19th, it fell 0·62 in.; and of the 19th and 20th, it rose 0·52 in.

TEMPERATURE OF 25TH FEBRUARY.

The minimum of the night of the 24th was 47·5, and the maximum of the 25th 62°·5. The mean of these was 55°, which, according to Mr. Glaisher's analysis of the mean temperature of 1814 to 1863, was the mean of the hottest day in 50 years on 9th February, 1831.

Yours truly,
D. A. F.

Upper Tooting, Feb. 27, 1868.

To the Editor of the Meteorological Magazine.

SIR,—The terrific hurricane of February 1st was very destructive; the number of large trees torn up by the roots was very great about here. The gale was at its height from noon till 3 p.m., after which it slightly moderated, but continued to blow with great violence till

7 p.m. At 11.35 a.m., there was a terrific storm of wind and rain, in which 0.12 fell in seven minutes. At sunset the sky presented a very peculiar appearance. The sky was of a pale watery yellow colour, and round the horizon it was a pale slate colour; there was no cloud, but the sun was only just discernible through this strange-looking haze.

The barometer commenced to fall on the morning of the 31st of January. At 9 a.m., on the 31st, it stood at 29.97 in.; at 9 p.m., at 29.69 in.; at 9 a.m., on 1st, at 29.29 in. The lowest reading was at 11 a.m., when it stood at 29.25 in.; and at 9 p.m., it had risen to 29.61. It was the heaviest, and one of the longest gales I have ever witnessed.

Hoping that these remarks may prove interesting,

Yours truly,

THOS. PAULIN.

Winchmore Hill, Feb. 19, 1868.

MONKMOOR, SHREWSBURY.—Night of 31st awfully stormy, with heavy driving rain; Feb. 1st, still stormy, with occasional showers, Severn bank-full, and covered with breakers.—*C. Lovett.*

HILLINGTON, LYNN, NORFOLK.—Gale began on night of 31st from S.W., and continued between S.W. and W. until 4th. The gale was very strong, but not, I think, equal in intensity to those of February 28 and Whit-Monday, 1860. Few trees were blown down, owing in part, of course, to their being bare; but stacks were blown down, and the hedges in several places were completely "matted" with straw. I was ascending a hill to high-exposed ground between 1 and 2, the time of the greatest violence; I got out of my dog-cart to walk up. Immediately I left my seat, the heavy waterproof apron was blown over to the back, and the driving seat, heavy, of wood, and covered with cushions, was removed and carried away to the middle of a common bordering the road. I had great difficulty, after picking it up, to regain the cart. The horse would hardly face the wind.—*Henry Ffolkes.*

KILLINGHOLME, ULCEBY, LINCOLNSHIRE.—The gale was very heavy here on the 1st. It blew down part of a wall, and a fine Austrian pine belonging to me, and rolled up much of the lead on the roof of the church.—*J. Byron.*

To the Editor of the Meteorological Magazine.

SIR,—We have had a tremendous gale here to-day; and the 5 in. and 8 in. 20 foot gauges came down with an awful smash, and are broken all to atoms. My anemometer stand was only saved in time; for, observing symptoms of weakness in its lower extremities, I had it propped and made safe. The gauge registered 835 miles in 24 hours; and, as the gale only commenced about 4 p.m., you can imagine what

it must have been in the night. The heaviest rain fell by my registering gauge between 3 and 4 a.m. was as follows :—

3	to 3.15 a.m.	.....	·140
3.15	to 3.30	„	·130
3.30	to 3.45	„	·125
3.45	to 4.0	„	·010
			·405

The receivers of the gauges when emptied contained much of this rain—if not the greater part ; so that they must have come down between 3 and 4 a.m.—Yours truly,

J. CHADWICK BATES.

Castleton Moor Vicarage, Manchester,
Feb. 1, 1868.

P.S.—Barometer's lowest reading, 28·414, unreduced; at 12.45 p.m. to-day (noon).

To the Editor of the Meteorological Magazine.

SIR,—The great gale we had on Saturday brought with it a considerable quantity of sea spray, which settled on the windows, &c., of my house, which is, at least 20 miles in a direct line from the coast in the direction in which the wind came. How much further (doubtless a good deal) inland that may have been the case, would be interesting to know, if, through your magazine, that information could be obtained. Doubtless, you will have abundance of communications respecting one feature or other of the gale ; but I trust you will excuse my troubling you with this.—Yours very respectfully,

JAMES G. HOLDSWORTH.

Heaton, Bolton, Feb. 3rd.

P.S.—I remember a similar occurrence at Wakefield, in Yorkshire in the gale of 1839, a much greater distance than this.

To the Editor of the Meteorological Magazine.

SIR,—I beg to send you a few particulars respecting the storm of Jan. 31st to Feb. 1st, as it was developed in this town :—

A violent gale, from W.S.W., commenced during the evening of the 31st, reached its climax at noon on Feb. 1st, and ceased about 5 p.m. of the same day. The lowest point reached by barometer during this storm was 28·927 inches ; rainfall registered on Feb. 1st was 26 inches. The force and velocity of the most powerful of the gusts of wind were estimated as 30 lbs. per square foot, or 78 miles per hour. Much damage to property.—Yours very faithfully,

CORNELIUS B. FOX, M.D.

South Cliff, Scarborough,
Feb. 24th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—I send you a few extracts from my weather journal, trusting they may be of service.

I may add a few remarks on the storm :—The wind was gusty on the Friday, as the S.W. wind usually is ; on Saturday, from noon to

3 p.m., it was not gusty, but more of a steady current—none of the usual tremendous gusts came even when highest. I always note the gusts during a high wind, and often count the number per minute. I sat near the barometer and anemometer sheets all day, and watched the pencils.

The oscillations of the barometer, even when the wind was at its height, were inconsiderable. I have seen the mercury move through three times the space with ordinary gales. This might be expected from the fact stated in the preceding paragraph.

On the 1st there was generally a very lofty sky of white bands and streaks of cloud, and this partook of motion of wind and lower sky, but moved much more slowly.

Date.	Hour.	Barometer. (Sea Level.)	Thermometer	Wind.		Rain, 30 feet above ground.
				Direction.	Velocity.	
		in.	deg.		miles.	in.
Jan. 29	9 a.m.	30·13	...	...	..	...
"	3 p.m.	·26	...	...	...	...
"	9 a.m.	·19	...	...	...	...
30	9 a.m.	30·08	39	W.S.W.!	15	...
"	3 p.m.	29·97	47	W.	20	...
"	9 p.m.	·91	46	...	20	...
31	9 a.m.	·73	47	W.S.W.	15	·15
"	noon.	·67	49	...	25	} No rain.
"	3 p.m.	·53	50	W.S.W.	35	
"	6 p.m.	·44	49	...	40	
"	8 p.m.	·40	...	W.S.W.	35	
"	9 p.m.	·40	49	W.S.W.	35	} ·40
"	11 p.m.	29·33	...	W.S.W.	35	
Feb. 1	9 a.m.	28·95	48	S.S.W.	37	·80
"	noon.	28·93	45	...	45	} Very slight
"	3 p.m.	29·05	46	W.S.W.	50	
"	5 p.m.	·33	43	N.W.	35	} rain.
"	9 p.m.	29·48	39	N.W.	25	
						Heavy hail.

Rain on the ground between 8 p.m. 31st and 9 a.m. on 1st, = 2·00 in.

- 30th, 9 a.m.—Windy; lower sky of thin cloud going briskly along; far aloft are white wisps.
 12 a.m.—Gloomy—overcast.
 3 p.m.—No upper sky visible; all sky a mass of driving cloud; fine rain.
 5 p.m.—Upper clouds in E. are red as sun is setting in W.
 9 p.m.—Windy, and damp evening. Sudden rise of temperature, from 9 p.m. to 3 a.m., 39° to 47°; at 9 p.m., still 46°, Anemometer going at about 10 miles an hour all night; red sky at sunrise.
 31st, 9 a.m.—Windy—fine rain; rain 0·150; upper and lower skies as at 9 a.m. on 30th.
 12 a.m.—Sun at times, then wild sky; sharp showers before 1 p.m.
 2 p.m.—Finer, flying clouds.

31st. 3 p.m.—Clouds less dense. } Wind high ; no rain ;
 6 p.m.—Temp. still 49° (45° at 9 a.m.) } wind vane blown away.
 8 p.m.—Rain now began.
 11 p.m.—Rain 0·400.

I am, Sir, your obedient servant,
 JOSEPH GLEDHILL.

*King's Cross, Halifax,
 Feb 24th, 1868.*

To the Editor of the Meteorological Magazine.

SIR,—As you like notices of excessive rainfall, I will give you some particulars of the late storm in Yorkshire :—

On the 31st, at Ripon, there was a red sunrise, and the day began with high wind and showers, and a very stormy appearance of the sky, and presently a fearful storm burst out, with torrents of rain.

The quantity collected by 9 a.m. on the 1st in my three gauges was—

12 inch, at 5 feet	5 inch gauges, 6 inches from ground.
	(1) (2)
1·37	1·40 1·30

The fall in the western moors must have been enormous. No wonder the floods were higher than for many years. I enclose an extract from a local paper.—Yours truly,

F. W. STOW.

Tunbridge Wells, Feb. 6th, 1868.

P.S.—I may remark that the difference between Ripon and Arncliffe would indicate nearly the amount of rain drawn down by the high Yorkshire Moors, which begin to rise a few miles to the W. of Ripon.

RIPON.

“Early on Saturday morning, owing to the heavy rain, accompanied by a violent wind from the S.W., the rivers Ure, Skell, and Laver overflowed their banks, the latter in its course doing considerable damage to the mill dam near the High Clough, and from which the water is brought which feeds three corn-mills, and supplies a portion of the city with water from the old waterworks. A large quantity of ground has been washed away opposite Bishopton Mill. The Skell, after its junction with the Laver, was higher than it has been known to be for many past years, and, in its course, did damage to the tannery of Mr. Wm. Yorke, and also to Alma Bridge. A small cottage between the North Bridge and the New Waterworks, named ‘Noah’s Ark,’ was surrounded by the river Ure, and the inmates were obliged to keep to the upper room, the lower apartments being several feet deep in water, till a boat was taken down on Saturday afternoon, when the mother and children were safely delivered from their perilous position. We have not heard of any loss of life.”

IS THE ROYAL CHARTER GALE PERIODIC ?

To the Editor of the Meteorological Magazine.

SIR,—Mr. P. H. Newnham, M.A., F.M.S., in your last impression gives *his* “Barometrical Readings” for certain dates in October, from 1826 to 1841. How Mr. Newnham obtained this data it is impossible for me to say ; but, when we compare his barometrical readings with those published in the Philosophical Transactions, date for date, for the same period, there is a terrible discrepancy—which, perhaps, Mr

Newnham can explain. The following are the barometrical readings, taken at 8 a.m. and 3 p.m., published by the Royal Society.

				A.M.		P.M.
1826.	October	25	...	29·42	...	29·40
1826.	"	23	...	29·18	...	29·25
1828.	"	23	...	29·73	...	29·82
1829.	"	27	...	30·39	...	30·32
1830.	"	28	...	29·94	...	29·88
1831.	"	26	...	29·53	...	29·57
1832.	"	13	...	29·93	...	29·98
1833.	"	15	...	29·22	...	29·12
1834.	"	25	...	30·08	...	30·13
1835.	"	26	...	29·13	...	29·12
1836.	"	29	...	29·47	...	29·70
1837.	"	25	...	29·70	...	29·84*
1838.	"	29	...	29·35	...	29·55
1839.	"	4	...	29·34	...	29·48

* Lowest reading 31st, p.m., 29·00 in.

I am, Sir, yours faithfully,

GEORGE SHEPHERD, C.E.

26, Throgmorton Street, E.C.
February 22nd, 1868.

To the Editor of the Meteorological Magazine.

SIR,—I observed Mr. Newnham's letter in the last number of the magazine, and having kept a register of the weather since 1857, I have been looking it over, and can corroborate as far as that period what Mr. Newnham observes as to the *double* periodicity in October. I observe, also, that the first of the periods is generally accompanied by heavy rain and winds from the south, while the later period is more generally with wind from the north and north west, and less or more rain. In February, also, I find a period of low barometer prevailing in the beginning of the month. The 5th is the day on which the lowest barometer has occurred here almost regularly for the last eleven years.—I am, yours faithfully,

JOHN MURRAY.

Woolplaw, Galashiels,
Feb. 22nd, 1868.

P.S.—I subjoin a note of the low barometer in February and October, in case you may like to see them.

Low Barometer in October, 1857—68. Two periods about 10th and 25th.

Height above sea, 880 feet.

	1st Period		Temp.		2nd Period.	
	Bar.			Bar.	Temp.	
1857	...	28·400	...	45	...	...
1858	...	28·500	...	45	...	...
1859	28·360	...	34
1860	...	28·750	...	45	28·400	...
1861	...	28·400	...	46	...	...
1862	...	28·450	...	48	27·900	...
1863	...	28·600	...	50	28·000	...
1864	28·000	...
1865	...	28·500	...	49	28·040	...
1866	28·900	...
1867	...	28·500	...	43	28·200	...

On 28th.
26th & 27th.

Low Barometer, February 5th, 1857—68.

1857	...	28·500	...	40	Wind strong.
1858	...	28·700	...	42	Wind do.
1859	...	28·300	...	37	Snow.
1860	...	28·700	...	38	Storm of snow.
1861	...	28·200	...	35	Wind.
1862	...	29·000	...	33	Sleet and rain.
1863	...	28·300	...	40	Thunder and rain.
1864	...	...	...	...	...
1865	...	28·500	...	28	Snow from S.E.
1866	...	28·300	...	38	Rain and wind.
1867	...	27·700	...	38	Heavy rain.
1868	...	27·820	...	41	Upon 1st, gale.
,,	...	28·800	...	43	Upon 5th, storm of wind and rain.

To the Editor of the Meteorological Magazine.

SIR,—Alluding to the storms current about the 25th October, I may state that in 1859, immediately after the Royal Charter gale, I sent a communication to the *Manchester Courier*, shewing that, from observations made from 1807 to 1858, a great fall of the barometer occurred in two years out of every three during this period of 52 years, the average date of the depression being the 25th October.

There seems to be some cause for great disturbances about the 25th October; and, most likely, occurring in this month, it has some connection with the fact that the monthly mean barometric pressure is lower in October than any other month in the year.—Most truly yours,

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

*Old Trafford, Manchester,
Feb. 19th, 1868.*

REVIEW.

Remarks on the Climate of Sidmouth, with Tables giving the results of Meteorological Observations. By J. INGLEBY MACKENZIE, M.B. Cantab., F.M.S. London: Churchill. 32 pp. 8vo.

WITH one exception to be presently noticed, this is a very impartially written treatise on the climate of a health resort well worthy of notice, situate in one of those sunny southern valleys where winter is often a name, and a name alone. A horse-shoe valley, somewhat sheltered from north, east, and west, by hills of 400 or 500 feet in height, we should have thought north-easters would have found it harder to find an entrance than seems to be the case. In fact, looking to the humidity of Sidmouth recorded by Dr. Mackenzie—viz., 83°·0—we are inclined to think that some of the winds recorded as E. and N.E. are deflected into that course by the set of the valley, and are not really possessed of the disagreeable attributes of genuine easterly winds.

Concerning temperature we scarcely know what to say, for we believe the different modes of placing thermometers, of reducing the observations, the slope, aspect, size of the garden wherein they are

made—nay, even the state of vegetation and the proximity of trees or houses—separately and collectively produce greater differences in the results than exists between the true characteristics of watering places many miles apart.

We are extremely glad to see that Dr. Mackenzie has set the excellent example of stating the kind of stand on which his thermometers are hung, and their distance from walls in each direction; for this capital idea alone we should welcome his brochure, and hold all writers bound to follow in his steps; but in the absence of similar information from other stations, and until we know the effect of the various conditions, we cannot draw accurate conclusions from temperature tables. But setting aside these considerations, we have a bone to pick with the Doctor anent the following table; the first two columns are reprinted exactly from his pamphlet, the subsequent columns we have added, to show what different results may be obtained.

Temperature at Sidmouth.

Year.	Greenwich M. T.	Sidmouth M. T.	Diff.	Greenwich M. T. 1814-63.	Sidmouth M. T. 1856-61, 63.	Diff.	Greenwich M. T. 1856-61, 63.	Sidmouth M. T. 1856-61, 63.	Diff.
Jan. ...	35.7	41.5	+5.8	36.9	41.5	+4.6	38.5	41.5	+3.0
Feb. ...	38.2	40.6	+2.4	38.7	40.6	+1.9	39.8	40.6	+ .8
March.	40.9	44.0	+3.1	41.6	44.0	+2.4	42.4	44.0	+1.6
April..	45.7	46.4	+ .7	46.2	46.4	+ .2	45.9	46.4	+ .5
May ...	52.6	52.2	— .4	52.9	52.2	— .7	52.3	52.2	— .1
June...	58.0	57.8	— .2	59.1	57.8	—1.3	59.8	57.8	—2.0
July ...	61.3	60.6	— .7	61.8	60.6	—1.2	62.0	60.6	—1.4
Aug...	60.5	61.5	+1.0	61.2	61.5	+ .3	62.5	61.5	—1.0
Sept...	56.3	56.9	+ .6	56.6	56.9	+ .3	56.6	56.9	+ .3
Oct. ...	49.3	53.3	+4.0	50.2	50.3	+3.1	51.9	53.3	+1.4
Nov ...	42.4	45.4	+3.0	43.0	45.4	+2.4	42.2	45.4	+3.2
Dec....	38.8	43.6	+4.8	39.8	43.6	+3.8	40.5	43.6	+3.1
Means.	48.3	50.3	+2.0	49.0	50.3	+ 1.3	49.5	50.3	+ .8
Sums..	...	...	+25.4 — 1.3	...	...	+19.0 — 3.2	...	...	+13.9 — 4.5

We do not know the source whence Dr. Mackenzie obtained the first column in the above table, but taking (as we must) Mr. Glaisher's determination of the mean temperature at Greenwich of every day for fifty years as the standard for that place, we find the true temperature is higher than that given by Dr. Mackenzie in every month, and in the winter months it is 1° higher. It may be thought unfair to compare seven years with fifty, we have therefore tabulated the mean temperature of the same 84 months at Greenwich and Sidmouth, the result being still more different from the Greenwich mean temperature in the work before us. This will be rendered very obvious, by noticing the relation between the temperatures of January and July, the latter being taken as 100. January (according to the table quoted by Dr.

Mackenzie) is 58 at Greenwich, and 69 at Sidmouth ; but the 50 years give January = 60, and the seven identical years give Greenwich = 62, and Sidmouth = 69, a difference of 7 instead of 11.

Take, again, the rainfall. On page 16, the rainfall of the three years, 1864-1866, is correctly given as 23·55, 37·88, and 37·63. The mean of these is 33·02 ; and those years being about 5 per cent. below the mean, the true fall is about 35 inches. Yet, on pages 26 and 32 the mean rainfall at Sidmouth is given at 27·9. How this value has been arrived at, we are curious to know. A table, stated to be quoted from a pamphlet on the "Climate of Torquay," by E. Vivian, Esq., is given on page 32, which is frightfully incorrect—for instance, the annual rainfall is given for—

Torquay as 28·9 in. instead of 42 in.	Oxford as 25·5 in. instead of 25 in.
Exeter „ 27·3 „ „ „ 33 „	Ventnor 27·7 „ „ 30 „
Clifton „ 29·3 „ „ „ 33 „	Greenwich 22·2 „ „ 24 „

but, of course, for these errors (the authority being given) Dr. Mackenzie is not responsible.

After thus severely criticizing this pamphlet, we fear our readers may conclude that it is an untrustworthy guide. We believe that the reverse is the case—that it is far superior to many similar treatises—that it justly advocates the claims of the driest of the Devonshire watering-places ; but we wish to see great improvements in similar publications in future, and we know not how this is to be obtained without severe criticism.

RAINFALL AT SIERRA LEONE.

Rainfall each month at Military Hospital, Freetown, Sierra Leone, from 1847 to 1851.

Months.	1847.	1848.	1849.	1850.	1851.
	in.	in.	in.	in.	in.
January.....	No ob- serva- tions.	0·50	2·30	...	...
February .....	...	...	1·57	...	...
March	0·02	...	...	1·36	1·20
April	2·92	3·36	1·99	6·56	5·03
May	5·59	11·55	10·18	8·92	5·67
June	13·21	10·73	13·31	10·93	16·44
July	6·91	26·18	30·39	42·54	15·05
August	18·74	22·46	37·35	29·33	21·33
September.....	18·17	42·40	30·26	35·66	19·36
October.....	14·35	10·02	9·15	19·09	9·82
November.....	4·22	8·17	5·28	5·74	4·99
December	3·83	2·41	1·36	0·17	0·27
Totals	87·94	137·80	143·14	160·30	99·16

There was no observation in January, 1847 ; during February and March there was no rain.

The observations were made with a tin funnel about eight inches in diameter (but this was carefully determined, though the record has

been mislaid); the receiver was a two gallon earthenware jar, with a narrow neck. The water was measured every morning at 9 a.m. by a pint measure, and for smaller quantities by a half pint graduated glass measure. The capacity of them was determined by ascertaining the weight of the water they contained, and their relative value in depth to the area of the funnel calculated.

The surface of the funnel was about two feet above the ground, quite open to the rain bearing winds, and with no bush or tree in the neighbourhood.

The same instruments were employed during the whole period, and the gauge remained in the same position. The hospital was about half a mile from the river and about 250 ft. above its level.

Rainfall at Sierra Leone in 1828.

Day.	June.	July.	August.	Day.	June.	July.	August.
1	Quantity not ascertained.	4.35	4.25	18	3.00	6.10	...
2		3.00	4.25	19	3.10	2.00	3.15
3		3.25	4.25	20	3.75	2.25	4.00
4		4.00	4.10	21	2.10	..	5.10
5		5.00	4.00	22	2.25	4.25	10.00
6		1.25	...	23	3.10	2.00	16.00
7		4.00	2.15	24	4.25	3.25	8.10
8	1.10	4.25	...	25	2.25	6.25	2.15
9	2.10	6.00	2.10	26	3.25	1.10	3.10
10	2.00	14.10	3.00	27	4.00	2.00	1.10
11	4.40	10.50	3.25	28	4.25	3.00	1.10
12	1.10	4.00	4.10	29	3.25	2.25	1.00
13	3.00	4.25	6.00	30	3.00	3.00	2.10
14	2.10	5.10	3.00	31	...	3.00	6.00
15	1.10	9.50	3.10				
16	3.00	1.00	6.25				
17	3.10	1.25	7.00	Total ...	64.55	125.25	123.7

This table is taken from the Statistical Reports on Sickness and Mortality of Troops in Western Africa, p. 4, from 1817 to 1836.

Another table, from same Report, p. 5, for 1819, is as follows :—

July	...	...	...	...	45.47
August	...	...	...	...	46.07
September	...	...	...	...	29.70
October	...	...	...	...	10.73
November	...	...	...	...	5.60
December	..	...	...	...	6.94

Total 144.54

[In the second of the above tables, the position of the decimal point has surely been mistaken. The mean of the other returns for June is 13 in. ; July and August about 27 in. each month ; and for the three months 67 in., with which 31.4 will agree far better than 314 in. —though in either case the discrepancy is very wide.—ED.]

POSITIONS OF GAUGES,
WHENCE MONTHLY RETURNS ARE PUBLISHED.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs]	RAIN GAUGE.			Latitude.	Longitude.
		Diameter. in.	Above Ground. ft. in.	Above Sea Level. feet.		
I.	Camden Town	8	0 4	100	51°33'N	0° 8'W
II.	Staplehurst (Linton Park)..	8	0 6	296	51 13 N	0 31 E
III.	Selborne (The Wakes)	6	4 0	400	51 6 N	0 56 W
IV.	Hitchin	9	1 6	240	51 57 N	0 17 W
V.	Banbury	6	7 0	350	52 4 N	1 20 W
VI.	Bury St. Edmunds (Culford)	5	1 2	...	52 17 N	0 42 E
VII.	Bridport	8	0 8	80	50 43 N	2 45 W
VIII.	Barnstaple	8	0 6	31	51 4 N	4 4 W
IX.	Bodmin	8	2 6	325	50 28 N	4 45 W
X.	Cirencester	10	1 2	446	51 43 N	1 58 W
XI.	Shiffnal	4	3 6	450 ?	52 40 N	2 22 W
XII.	Tenbury (Orleton)...	5	0 9	200 ?	52 18 N	2 27 W
XIII.	Leicester (Wigston)	8	0 6	220 ?	52 35 N	1 6 W
XIV.	Boston	5	1 0	20	52 59 N	0 3 W
XV.	Gainsborough	12	0 8	30	53 24 N	0 47 W
XVI.	Derby	5	5 0	180	52 55 N	1 28 W
XVII.	Manchester	8	2 7	106	53 28 N	2 17 W
XVIII.	York	5	0 6	50	53 58 N	1 5 W
XIX.	Skipton (Arncliffe)	8	3 0	750	54 9 N	2 6 W
XX.	North Shields	8	1 0	124	55 0 N	1 26 W
XXI.	Borrowdale (Seathwaite) ...	5	1 0	422	54 30 N	3 12 W
XXII.	Cardiff	5	1 1	20	51 28 N	3 11 W
XXIII.	Haverfordwest	5	2 0	60	51 48 N	4 55 W
XXIV.	Rhayader (Cefnfaes)	5	2 0	880	52 18 N	3 32 W
XXV.	Llandudno	8	0 6	99	53 20 N	3 50 W
XXVI.	Dumfries	5	0 5	70	55 5 N	3 36 W
XXVII.	Hawick (Silverbut Hall) ...	5	4 0	512	55 26 N	2 46 W
XXVIII.	Ayr (Auchendrane House)..	8	2 3	94	55 27 N	4 37 W
XXIX.	Castle Toward	5	4 0	65	55 52 N	4 57 W
XXX.	Leven (Nookton)	5	0 6	80	56 12 N	3 0 W
XXXI.	Stirling (Deanston)	6	0 0	130	56 11 N	4 4 W
XXXII.	Logierait	5	1 0	250	56 38 N	3 41 W
XXXIII.	Ballater	5	0 10	656	57 4 N	3 5 W
XXXIV.	Aberdeen	5	4 8	115	57 9 N	2 6 W
XXXV.	Inverness (Culloden) .....	..	3 0	104	57 30 N	4 7 W
XXXVI.	Fort William	5	0 8	20	56 47 N	5 7 W
XXXVII.	Portree	3	0 4	60	57 24 N	6 13 W
XXXVIII.	Loch Broom	5	0 8	48	57 47 N	5 5 W
XXXIX.	Helmsdale	5	1 0	34	58 7 N	3 38 W
XL.	Sandwick	11	2 0	78	59 3 N	3 17 W
XLI.	Cork	10	6 0	65	51 54 N	8 30 W
XLII.	Waterford .....	..	4 0	60	52 16 N	7 6 W
XLIII.	Killaloe	10	5 0	128	52 48 N	8 26 W
XLIV.	Portarlington	5	1 2	236	53 10 N	7 10 W
XLV.	Monkstown	10	0 6	100	53 17 N	6 8 W
XLVI.	Galway	10	6 0	25	53 17 N	9 3 W
XLVII.	Bunninadden (Doo Castle).	5	1 0	...	54 3 N	8 38 W
XLVIII.	Bawnboy (Owendoon)	5	1 3	218 ?	54 6 N	7 44 W
XLIX.	Waringstown	8	0 4	191	54 26 N	6 18 W
L.	Strabane (Leckpatrick)	8	0 5	260	54 53 N	7 28 W

FEBRUARY, 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.									
I.	Camden Town	1·21	—	·01	·50	29	10	62·5	25	26·6	9	6	
II.	Staplehurst (Linton Park)	1·35	+	·16	·47	29	12	61·0	25	26·0	9	8	
	Selborne (The Wakes).....	2·19	+	·48	1·23	29	12	58·5	25	27·0	9	6	
III.	Hitchen	1·49	+	·23	·70	29	11	58·0	25	26·0	8	6	
	Banbury	2·13	+	·70	·95	29	15	58·5	25	26·0	9	11	
IV.	Bury St. Edmunds (Culford) ..	1·65	+	·23	·43	2, 29	10	58·0	25	24·0	8	4	
V.	Bridport	1·91	—	·15	·84	29	11	60·0	25	24·5	16	8	
"	Barnstaple	2·23	+	·15	·41	29	18	...	...	...	...	...
"	Bodmin	2·37	—	·42	·59	28	23	53·0	28	30·0	16	1	
VI.	Cirencester	2·03	+	·42	1·02	29	...	47·0	29	31·0	9	1	
"	Shifnall	2·17	+	1·28	·40	29	14	58·0	25	24·0	9	8	
"	Tenbury (Orleton)	2·21	+	·64	·56	29	22	60·5	25	24·5	9	8	
VII.	Leicester (Wigston)	1·64	+	·30	·64	29	...	59·5	25	24·0	8	4	
"	Boston	1·40	+	·19	·35	29	13	60·0	25	27·5	9	2	
"	Gainsborough	1·42	+	·35	·49	29	10	63·0	25	25·0	8	9	
"	Derby	2·58	+	·70	·90	29	17	62·0	25+	26·0	9	5	
VIII.	Manchester	2·11	+	·16	·28	2	18	60·2	25	25·8	9	7	
IX.	York	·96	—	·42	·23	7	13	55·0	25	26·0	9	4	
"	Skipton (Arneliffe)	4·82	+	1·15	·78	20	16	...	...	...	...	...
X.	North Shields	1·82	+	·29	·62	18	13	56·0	25	28·0	9	3	
"	Borrowdale (Seathwaite) .....	...	...	...	...	...	...	...	...	...	...	...
XI.	Cardiff (Town Hall).....	5·69	...	...	1·21	10	18	...	...	...	...	...
"	Haverfordwest	2·22	—	·64	·45	2	13	53·0	23+	25·7	11	5	
"	Rhayader (Cefnfaes).....	3·10	+	·12	·50	14	19	55·0	...	23·0	...	...
"	Llandudno	3·01	+	1·79	·76	18	14	54·2	24	32·2	9	...	
XII.	Dumfries	4·37	+	1·82	·71	18	24	58·5	25	27·5	9	3	
"	Hawick (Silverbut Hall)	3·48	...	...	·40	18	20	...	...	...	...	10
XIV.	Ayr (Auchendrane House) ...	5·99	+	2·64	·76	20	25	60·0	24+	27·0	9	3	
XV.	Castle Toward	6·03	+	2·29	·94	9	25	55·0	24+	24·0	9	4	
XVI.	Leven (Nookton)	2·28	+	·58	·33	1	18	57·0	25	27·0	9	5	
"	Stirling (Deanston)	5·37	+	2·37	·78	20	26	59·0	13	25·5	5	8	
"	Logierait	4·03	...	...	·59	3	19	...	...	...	...	...
XVII.	Ballater	2·26	...	...	·50	27	16	57·5	25	25·0	9	9
"	Aberdeen	1·70	...	...	·84	27	17	59·2	26	25·6	9	5
XVIII.	Inverness (Culloden)	3·88	...	...	·82	28	15	59·0	26	31·4	4	2
"	Fort William	20·13	...	...	1·84	20	29	...	...	...	...	...
"	Portree	20·17	+	9·94	2·30	20	25	51·0	15	30·0	10	3	
"	Loch Broom	12·72	...	...	1·21	20*	29	...	...	...	...	...
XIX.	Helmsdale	5·04	...	...	·51	4	22	...	...	...	...	...
"	Sandwick	5·81	+	3·33	·65	9	27	50·0	14+	27·6	9	3	
XX.	Cork	2·16	...	...	·59	19	14	...	...	...	...	...
"	Waterford	2·81	+	·78	·51	20	21	60·0	24	30·0	9	1	
"	Killaloe	4·41	+	1·50	·64	18	21	57·0	26	27·0	16	4	
XXI.	Portarlington	2·27	+	·24	·65	19	21	51·5	25	30·0	9	6	
"	Monkstown	1·57	—	·06	·54	18	15	58·3	25	29·0	9	1	
XXII.	Galway	5·25	...	...	·99	27	25	56·0	19	31·0	11	1
"	Bunninadden (Doo Castle) ...	3·69	...	...	·71	27	20	54·0	25	27·0	10	2
XXIII.	Bawnboy (Owendoon)	3·81	...	...	·53	20	24	54·5	25	29·0	3, 8	4
"	Waringstown	2·49	...	...	·61	18	20	57·0	25	29·0	8	8
"	Strabane (Leckpatrick)	3·31	...	...	·38	20	23	59·0	25	29·0	8, 9	12

* And 23rd. † And 26th. ‡ And 24th.

+ 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.

STAPLEHURST.—A remarkably mild dry month. Wind mostly W. and S.W. Half the R. of the month fell on the first and last days; high wind on 1st; bar. generally high, but often unsteady.

SELBORNE.—Wind tempestuous all day from W.S.W. on 1st, and continued high during the 2nd and 3rd; a few flakes of S on the 8th; bar. rose six-tenths in 24 hours on 20th, and five-tenths during the night of the 22nd. Violent R from 10 a.m. to 8 p.m. on 29th, with high wind from S.W. to S.E. On the whole a fine dry month. More R fell in 10 hours on the last day than in the whole of the month previous.

BANBURY.—Very high wind on 1st; walls and trees blown down; slight H and S on the 8th; fog on 18th; wind on 20th, 22nd, and 28th; continuous R on the 29th.

CULFORD.—A tremendous gale on 1st, and on several occasions high winds prevailed, but the month on the whole has been remarkably mild, and on the 28th the weather was quite summer like. Bees at work on the crocuses, &c., by thousands.

BRIDPORT.—North-westerly gale on 19th; from 9th to 17th bar. stood very high, being 30·65 on 10th, 11th, 12th, and 16th; 79 in. of R fell between 9 a.m. and 5 p.m. on 29th, with a gale from S.W.

BODMIN.—Heavy westerly gale on 1st; one from W.S.W. on 2nd; on 19th heavy gale, first from W.S.W., and then from N.W. This month has been remarkable for its high temp. and high bar. The gale of the 19th, so disastrous in many parts of England, was not severely felt here.

CIRENCESTER.—This may be considered a dry month, and very good for agriculture, as, excepting the 2nd and 29th, the R was very trifling, and appeared due to the fitful motion of the wind from S.W. to N., and the change of temp. thereby occasioned. The great rains of the 2nd and 29th were clearly due to the Atlantic. Sulphur butterfly on 21st; violets gathered at the end of the month; the deep hill well sank from 38 ft. to 21 ft. 5 in.; the gravel well only sank 9 in.

SHIFNALL.—Heavy storm of wind for 18 hours on the 1st; snowdrops up on 9th, and open on 12th; crocuses began to flower on 24th, on which and following day the temp. was unusually mild; thrush singing at times during the whole month.

ORLETON.—Generally fine and pleasant, but changeable, with frequent falls of R and high winds. Temp. about 3°·5 above the average. Violent gales on 1st and 22nd, also on 5th, 19th and 20th; the last week very fine, warm and pleasant.

WIGSTON.—An extraordinary high wind on the 1st, amounting to a hurricane, did much damage; an unusually fine month, temp. being 4° or 5° above that of many years past; vegetation forward.

BOSTON.—Severe gale on 1st, chiefly from W.S.W.; gales also on 20th, 22nd, and 29th; lunar halo on 6th; temp. high; vegetation forward; elm in bud on 16th; lime and sycamore on 17th; oak, hawthorn and horse chesnuts on 24th; during the last week rose bushes were in leaf, and gooseberry trees almost so. Ozone moderately developed; bar. very unsteady during the month; it was 30·506 (corrected) on the 11th, and 29·025 on 1st.

GAINSBOROUGH.—Slight S on 3rd and 8th; the first few days were unsettled, then fine till the 29th, when continuous R fell from 1 p.m. to 5.30 p.m.

DERBY.—A remarkable month, as unlike "fill dyke February" of our experience as can well be imagined; warm, genial, and sunny, forcing vegetation alarmingly forward, fruit trees being as advanced as we usually find them in the middle of May.

MANCHESTER.—H, R, and storm on 1st; temp. greatly in excess, the last week having been 7° above that of the last 19 years.

ARNCLIFFE.—A dull, rainy month, but weather open.

NORTH SHIELDS.—Lunar halos on 3rd, 6th, 8th, and 10th; aurora on 10th.

Blue hepatica in flower on 1st, also the dark red primrose, drab auricula, and snowdrop in flower on 7th, small blue perriwinkle in flower on 19th, yellow crocus and yellow aconite on 21st, and many others by the end of the month.

W A L E S.

CEFNFAES.—Temp. mild, though the wind was chiefly N.W., and occasionally strong and very boisterous.

LLANDUDNO.—Bar. high during the month; max. on 11th, 30·554; min. on 1st, 28·972. The weather was beautiful and mild during the last week.

HAVERFORDWEST.—The terrific gale of the last of January was continued till the evening of the 1st of February. The month was on the whole mild and damp; winds chiefly north-westerly; a violent gale from that direction on the 19th, doing much damage, and not wholly abating till the evening of the 22nd.

S C O T L A N D.

DUMFRIES.—This month has been wet and stormy, only five days on which no R or S was measured; both tem. and R above the average—the weather mild; and, at the close of the month, the fruit-trees beginning to burst their blossom; the whinn in bloom.

HAWICK.—S flakes prodigiously large on the 1st. The whole month has been remarkably free from frost; lunar halo on 8th; hurricane from the west on 19th and 27th; beautiful rainbow on the morning of the 23rd; gardening and husbandry in a forward state.

AUCHENDRANE.—A warm, wet, and stormy month, with great oscillation of bar. and ther. Abnormally large rainfall, and number of rainy days, and some severe equatorial tempests; no ice during the month, and the S and H quite trifling, and not measureable.

CASTLE TOWARD.—Stiff gale on 1st. The first eight days were rather stormy; but, since that time, it has been too mild for so early a part of the year. Apricots and jargonell pears are almost in flower; the spring garden has been quite gay with ericas, hepaticas, primulas, crocuses, snowdrops, &c., while in the American garden the rhododendrons and laurustinas have been finely in flower; gooseberries and fuschias getting green; clay soil too wet for working.

NOOKTON.—The high winds of last month continued through this, with intervals of days only; tem. mild for the time of year.

LOGIERAIT.—Very boisterous month; heavy gales, with much R.

BALLATER.—A month of very changeable weather, with frequent strong winds from the west; the temp. being mild, any S that fell was soon melted, so that out door work was but little interrupted.

ABERDEEN.—Rainfall below the average; temp. nearly 5° above it; winds more frequently from W. and N.W. than usual, and rather boisterous. L on 1st, 3rd, 19th, and 20th.

ROSSE PARSONAGE, FORT WILLIAM.—It was recorded last month that the unprecedented amount of 18·69 in. of R was registered. That amount is no longer unprecedented; for it rained every day in February, and the amount registered was no less than 20·13 in. In January, upwards of 2 in. fell on four different days; in February, there was no day on which 2 in. fell, but there were seven on which more than 1 in. fell. For wetness and wildness, nothing has been known like this winter. From the 10th of January (with the exception of the 21st and 22nd of that month) R fell on every day to the end of February, and the month ended with S; violent S.W. winds prevailed during the early part of the month, and occasionally afterwards.

PORTREE.—The stormiest February on record, gales and heavy R nearly every day; more than 1 in. fell on six days, and more than 2 in. on the 20th.

LOCHBROOM.—We have not had one fine day this month, and only two since the 9th of January, viz., 21st and 22nd. This month has far exceeded in the amount of R any since I have recorded; and, for the constant severity of its storms, and the ever varying "airs" of the wind, it will long be remembered.

SANDWICK.—This has been the wettest and most stormy February on record—indeed, it was such a succession of storms as I do not remember, while the temp. was 2·26 above the mean, perhaps one may be considered the cause of the other. On the 2nd there were S rollers again all over the parish. I saw thousands of them on my way home from church. The circumstances formerly mentioned

as essential to their formation were all present. There had been a gale of S the previous evening. On the morning of the 2nd, S flakes fell softly for some time, balling under my horse's feet, showing that the temp. was about 32°. The largest roller on my lawn measured 13 in. long, and 11 in. diameter. Auroræ on 20th and 29th; lunar halo at 8 p.m. on 6th; TS on 4th; and L on 15th.

I R E L A N D.

KILLALOE.—A most violent storm on 18th, increasing towards night, with furious gusts of wind; indeed the whole month was remarkable for the frequency and violence of its storms.

MONKSTOWN.—Cold at the commencement, but warm at the end. The whole month almost a succession of gales. On the 1st the most fearful storm we have had for some time; it commenced at 5 p.m. on 31st of January, and continued till 3 p.m. on 1st February. Bar. fell to 29·034; on 19th, at 12.15 a.m., a sudden hurricane burst forth, with H and R, which almost threatened to break the windows; at first it seemed to be on every side, but afterwards blew from N.W.

DOO CASTLE.—Fierce gales on 1st and 21st. Open month; spring work much advanced; continued breezes during the month; T on 22nd.

OWENDOO.—On the whole the month has been very mild, and the buds and other indications of spring are very forward.

WARINGSTOWN.—A succession of gales, all (with the exception of one on the 3rd from N.N.W.) being from S.W.; the wind blew from W. or its compounds on every day but one (the 8th, N.E.), and there were only five on which it had any N. in it.

LECKPATRICK.—The month began with the greatest storm for many years. The bar. had been falling rapidly during the previous day and night; at 9 a.m. on 1st it was at 28·672 (corrected), but had probably been lower, as from that point it rose rapidly; much damage done to houses; several large trees, stacks, and a garden wall blown down. The whole month very stormy, and the weather very unsettled, but the season has been favourable for ploughing and other farm operations.

RAINFALL IN NORWAY.

To the Editor of the Meteorological Magazine.

SIR,—I have just received from Ex-Consul J. H. Beer, his account of the rainfall in 1867 at Oje, near Flekkefiord (lat., 58° 5' N.; lon., 6°50' E.). The gauge is 12 Norse inches square; it is 8 ft. above the ground, and 15 ft. above the sea, from which it is only 300 yards distant.

The monthly amounts, converted into English measures, are as follows:

January	1·11	July	3·86
February	4·31	August	3·18
March	2·89	September	7·12
April	3·73	October	5·04
May	1·52	November	2·57
June	1·77	December	4·60

The following is a translation of the remarks appended to the register:—

May 21st.—At 5.30 p.m. a thunderstorm, with lightning and snow—afterwards for an hour and a half bright. The sun shone on the snow-covered mountains in the east; the evening, was like a fine winter one.*

Nov. 8th to 14th.—Very fine, like summer weather.

The rainfall for the year was below the average, and the snow likewise. Total fall, 41·70 in. (English).—Your truly,

C. O. F. CATOR.

Beckenham.

* Simultaneous with the English snow-storm referred to on pp. 58–60 of *British Rainfall*, 1867.—Ed.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXVII.]

APRIL, 1868.

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

METEOROLOGY IN ABYSSINIA.

[We have much pleasure in presenting the following interesting note and table from an officer of considerable meteorological experience attached to the Abyssinian expedition. Our readers being aware of the extreme difficulty of transport, and the consequent impossibility of employing any bulky apparatus, will perhaps be interested in learning the extremely small bulk into which the following instruments have been compressed :—

Phillips' Maximum Thermometer.	Hypsometrical Apparatus.
Rutherford's Minimum „	Rain Gauge.
Dry and Wet Bulb „	

The whole set only occupy about one-third of a cubic foot, and both for accuracy and portability reflect much credit on the maker (Mr. Casella.) The accuracy of the observer is also incidentally proved by the remarkable agreement between the altitude of his tent at Senafé, as determined by his own observation, and that given by Mr. Markham, the geographer to the expedition, the difference being only 16 ft. in 7500 ft.—scarcely 1 in 500.]

To the Editor of the Meteorological Magazine.

SIR,—I send you a few observations I have been able to make. They are not quite so regular as I could wish, but I believe the readings to be correct and reliable. This country is much in want of rain for the crops, as very little rain has fallen the last three years, and the locusts have been very numerous. In fact, but for our arrival, the natives would probably have been near starvation. They say rain ought to fall in February, and as you see a few drops have fallen, and there has been evidently rain within 50 miles ; but now there seems little likelihood of more rain—all appearances of it have gone off. The climate on these highlands appears to me to be much like that of Poona and the Indian Deccan, with exceptions due to greater height above the sea level. The rains probably fall in sharp severe storms, with intervals of fine weather too, as they do there. It is certainly at present a delightful climate, as long as one has thin clothing for the day and warm clothing for the morning and evening. It is also very healthy. The rarity of the air makes one very short of breath in ascending anything of a hill. I hear very good accounts of the climate further on, where I hope to be sent in a day or two, and then I can judge for myself.—Yours truly,

R. H. F.

Senafé, February 23rd, 1868.

Observations taken at Senafé, Abyssinia, in February, 1868. Height above sea { By Mr. Markham, geographer, 7,464 feet.
Own tent, by own observation, 7,448 feet.

[illegible]

REMARKS.

There is almost invariably heat-lightning every evening after sunset.
 2nd—Heavy mist and fog night of 2nd–3rd.
 3rd—Mist came up at 6 p.m. ; very heavy dew.
 4th—Clouds disappeared except in the W. at sunset ; no mist driving.
 5th—No mist at night ; heavy cloud.
 6th—Mackerel sky at even ; no mist at night.
 8th—Mist driving up at 6 p.m. ; heavy mist all night.
 9th—Heavy mist at night.
 10th—Strong E. wind at night.
 11th—Clear sky 9 p.m. ; very heavy dew, tent wringing wet.
 13th—On the march.
 14th—Very heavy dew night of 13-14th. Heavy thunder clouds at 3 p.m. ; thunder and a few large drops of rain ; a few drops twice during night.
 17th, 18th, and 19th—Heavy clouds with thunder and lightning after sunset, and a few drops of rain.
 20th—Fine sunset ; a few heavy clouds.

N.B. The S. R. thermometers were placed in a stand on my tent-pole. The wet and dry bulb thermometers were slung, so that the dry bulb was freely suspended in the air. The tent was always open throughout the day at bottom and door. The min. was always exposed on a tent-peg at 1 ft. above the ground at night. The wind at Senafé must have been much affected by the hills round and passages between, by which it swept round. The ground there was rocky, but there was grass at Goose Plain, hence the min. showed greater cold at night at the latter.

R. H. F.

HAIL SHOWER AT SIDMOUTH.

To the Editor of the Meteorological Magazine.

SIR,—On the 22nd inst., we were visited with several hail showers. One of peculiar severity, though of only 10 minutes' duration, fell at 6:30 p.m. The sound against the windows which faced north (the direction of the wind) was as if a continuous discharge of marbles was being fired against them. Before they had time to melt, I weighed some of the hailstones. Some weighed 7 grains ; but the largest I found was 9 grains in weight. Their form was that of an irregular sphere. Though they did not break windows, I presume from striking obliquely, they were very destructive to hot-houses, &c., on which they fell directly. The quantity of melted hail registered was .19 of an inch.—I am, Sir, truly yours,

J. INGLEBY MACKENZIE,

M.B. Cantab., F.M.S.

Sidmouth, Devon, Feb. 29, 1868.

“WHAT IS A FROST?”

To the Editor of the Meteorological Magazine.

SIR,—I possess two spirit minimum thermometers (Casella's) of precisely the same pattern. When similarly situated, they read exactly alike ; but seldom, or never, correspond when placed—as I usually keep them—the one down on the grass on my lawn, the other at an elevation of 4 ft. above it (both, of course, exposed in shade). The upper one almost invariably registers in this position in excess.

Now, under these circumstances, I should very much like to know how a frosty night is to be accurately ascertained and noted?

By the scientific and practical meteorologist this point is, I dare say, thoroughly understood ; but, to many a simple amateur like myself remains, I fear, a mystery. It strikes me, therefore, that by the insertion in the pages of your *Monthly Meteorological Magazine*, either of these few lines, or of a more able effusion from your own pen, a great boon would be conferred on many of its readers, by leading, most likely, to the elucidation of a matter about which they at present find themselves at fault.

I am perfectly aware that the subject of spirit minimum thermometers has been frequently alluded to in the columns of your highly-interesting publication, but more, I think, in discussion of the relative merits of certain instruments—of the advisability of using mercurial minimums and blackened bulbs—or of the radiating powers of grass, &c., than in explanation of the point I seek a reply to.

With an apology (which the cause, I trust, will sufficiently excuse) for intruding on your valuable time and labours,

I am, Sir, yours very truly,

F. BONNYCASTLE GRITTON.

*West Tytherton, Chippenham, Wilts,
Feb. 20th, 1868.*

P.S.—Extract from meteorological register kept at Tytherton :—

Jan. 6th, 1868.—9 a.m., minimum thermometer in air (4 ft.), $33^{\circ}5$; on grass, $31^{\circ}0$; snow on the ground.

Jan. 11th, 1868.—9 a.m., minimum thermometer in air, $32^{\circ}5$; on grass, $31^{\circ}0$; thawing, but snow on the ground.

Jan. 16th, 1868.—9 a.m., minimum thermometer in air, $36^{\circ}3$; on grass, $32^{\circ}0$; no visible signs of a frost during the night.

Feb. 18th, 1868.—9 a.m., minimum thermometer in air, $34^{\circ}0$; on grass, $30^{\circ}0$; a white frost on lawn and adjacent fields.

[Major Gritton has struck one of the many weak points in meteorology. Uniformity in a faulty practice would be preferable to the anarchy which at present prevails, and the idea of a scientific magazine discussing "What is a frost?" is sufficiently disgraceful. Our own practice has always been to count as frosty days those only on which the minimum temp. recorded by a thermometer 4 ft. above ground and sheltered from radiation is at or below 32° . But we are conscious of no instructions on the point, and think that the sooner our readers express their opinion upon it, and some agreement is come to, the better, and the more to the credit of all meteorologists.—Ed.]

IS THE ROYAL CHARTER GALE PERIODIC?

To the Editor of the Meteorological Magazine.

SIR,—Mr. Shepherd seriously impugns the accuracy of the barometrical readings with which I furnished you. He also enquires how I obtained "this" data.

A sufficient answer to his question was contained in my letter, wherein I stated that the observations were taken at Farnham, Surrey. I may add that they were made by a relative of mine, of long experience

in professional life and scientific study, and I have no reason to doubt their general accuracy. That I did not claim absolute accuracy for them is sufficiently shown by their being expressed only to the first decimal, and by my cautious statement, that I believed they might be accepted as reliable to the tenth indicated.

The discrepancies between my readings, and those furnished by Mr. Shepherd, when fairly examined, are not quite so "terrible" as he thinks. In copying my letter for publication, an error was made in the day of the month in 1834—it should have been the 23rd instead of the 25th. For this error I am very sorry; but the error of my critic is far more reprehensible, when in 1829 he makes an apparent discrepancy of 0.9 in. between our readings: his reading being given for the 27th, whereas mine was on the 22nd. On the 27th the reading at Farnham was the same as he indicates.

I do not know why Mr. Shepherd records a fairly high reading on October 13th, 1832, or a low one on October 4th, 1839. These dates clearly belong to the period about the 10th, whereas my letter was exclusively devoted to the discussion of the period of the 25th.

After eliminating these years, I still find that there is a difference, on the average, of *about* two-tenths of an inch between the two sets of readings. In explanation of this discrepancy, I offer two remarks.

Any one who studies the daily weather report in the papers, must be familiar with the fact that, in periods of rapid oscillation of the barometer, a difference of one or two tenths, between places 20 or 30 miles apart, is quite a common occurrence. Farnham is nearly 40 miles from London, and it is not to be expected that, in stormy periods, the readings of the barometer at the two places should more than approximately coincide.

Probably, however, the chief cause of the discrepancies lies in the fact that the readings given by Mr. Shepherd were taken at fixed hours, whereas those furnished by myself represent the extreme reading noticed at any part of the day, by an observer who was rarely in bed before 3 a.m. or after 7 a.m., and thus enjoyed opportunities of recording sudden fluctuations, such as few meteorologists can command. Mr. Shepherd's readings shew rapid movement of the mercurial column in a large proportion of cases. Two or three hours' difference in the time of observation may well account for two or three tenths of an inch discrepancy. Thus, in 1838, my reading is nearly an inch below that of the Royal Society; but between 8 a.m. and 3 p.m. it seems that their barometer rose 0.23 in.; and this accords with my register, which records a rise of 0.9 in. from the extreme depression, which, no doubt, was observed during the first hours of the day.

In conclusion, I may remark that, omitting Mr. Shepherd's wrong quotation in 1829, and correcting my own error in 1834, these records of the Royal Society, fairly interpreted, fully confirm that recurrence of a low barometer about the 25th October, which it was the object of my letter to discuss. *This* is the real point at issue. If the barometer

be low (or, if not below 29.5, yet have experienced a large and sudden fall) about the period named, it appears to me that the question whether the true reading at a given place was 28.8 or 29.1, is a matter of very little importance from this point of view.—Yours truly,

P. H. NEWNHAM.

Bournemouth, March 20th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—I have no idea whether your correspondents will or will not make out a case for a gale in the last week of October, but I fancy they are rather going off the scent in getting up barometer tables, because a storm, if I am not mistaken, depends on the *difference* of pressure between closely adjacent places, and as we know a generally low pressure over a large area does *not* involve a gale; it is only when the wind can run spirally from a high to a low pressure, that a sufficient velocity to be called a gale is produced. If this idea is correct, readings at stated hours and in one place should surely produce almost a negative result. One more crotchet and I'll go to the purport of my letter. Mr. Shepherd has run full tilt against Mr. Newnham, and seems to have knocked his readings over to his own satisfaction, if not to Mr. Newnham's; probably the latter is quite able to fight his own battles, but I beg to suggest that inasmuch as you, sir, have intimated that most of the cyclonic storms cross these isles in a S.W. to N.E. course, over Lancashire, it would result therefrom that the pressure in such storms would often be less at Farnham than in London.

I have been looking over Trusler's Chronology, 7th edition, published 1774, and the following are all the notices of storms or hurricanes I can find.

"Storms of wind, terrible, November 26th, 1703, when Admiral Beaumont, four ships, and more than 1100 men were lost in the Goodwin Sands; ditto November 1, 1740; an uncommonly dreadful one at Malta, that killed and wounded near 200 persons, October 29th, 1757; very dreadful in the Caribbee Islands, August 31st, 1772.

"1091.—On the 17th of October there happened a storm of wind at S.W., the same that blew in the late tempest, [a thunderstorm on October 5th] so dreadful to the whole nation. In London it threw down 500 houses and unroofed Bow Church. At Old Sarum the steeple and many houses were blown down.

1330.—At Christmas, a westerly wind overthrew several houses and public edifices, tore up trees by the roots, and did a vast deal of mischief.

1438, November 25th.—A gust of wind blew off the leads of the Grey Friars Church, and almost beat down the whole side of a street called the Old Exchange.

1658, September 3rd.—The day Oliver Cromwell died, there arose a storm so violent and dreadful, that it extended all over Europe, and seemed to threaten a wreck of nature."

Well, sir, there are only seven English gales, but out of the seven three are set down between October 17th and November 1st, so I take it this shows that the end of October is not by any means the calmest part of the year. Perhaps some one else with better opportunities will work up similar chronologies,—Yours truly,

C. T. K.

VERIFICATION OF THERMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—In your number for February last, Mr. Baxendell draws the attention of your readers to the subject of the index errors of thermometers. Most purchasers of first-class thermometers are satisfied with the Kew verifications, and continue to apply the corrections given in them, for years afterwards.

About twelve months ago, I thought I would verify the zeros of my thermometers, chiefly out of curiosity, and the results satisfied me that a year or two is sufficient time for an alteration, and a very sensible one too, to take place.

I entirely buried the instruments in a mound of snow, that had existed for two or three days in air at a temperature *above* 32°, so that it was improbable that any portion of the snow used was at a lower temperature than that. To make certain, I kept them four days in the snow, which was very slowly melting all the time, and read them several times each day with the help of a magnifier: the columns remained absolutely stationary the whole time.

The thermometers are all by Casella, viz., mercurial, *standard*, 4064, bulb cylindrical; Nos. 4279, 4287, 3679, mercurial, bulbs spherical; Nos. 3534, 2192, spirit, spherical; 4137, 3753, mercurial, cylindrical.

	KEW.			
M 4064	Aug., 1864	0°·0	March, 1867	—0°·3
M 4279	Nov., 1864	+0·1	„ „	0·0
M 4287	Nov., 1864	0·0	„ „	—0·1
M 3679	Jan., 1864	0·0	„ „	—0·3
S 3534	Nov., 1863	0·0	„ „	0·0
M 4137	.....	—	„ „	0·0
M 3753	.....	—	„ „	0·0
S 2192	Feb., 1863	0°·0	„ „	—0·2

Thus it appears that the zero point had advanced in five out of six thermometers, on an average, the fifth part of a degree, a very important quantity in hygrometrical observations.

Being anxious to know if the change was identical all along the stem, I placed four of them in a large tub of water, in such a manner that there were several inches of water above and below them, and carefully adding warm water, stirring well, giving plenty of time, and, in short, using every precaution, I obtained very accurate comparisons up to 70°, beyond which point I found it difficult to pass from the rapid cooling of the bath, which, however, contained at least two gallons of water.

The exact temperatures of the water were, of course, unobtainable, but if the change of index error was constant at all temperatures, by applying the Kew corrections, and a second correction for change of

index at zero (32°), the thermometers should all read alike. The following table shows the results of these comparisons.

No. 4064	$44^{\circ}25$	...	$54^{\circ}3$	$68^{\circ}05$	$69^{\circ}6$
3679	$44^{\circ}15$	$47^{\circ}50$	$54^{\circ}5$	$68^{\circ}00$	$69^{\circ}6$
3534	$44^{\circ}07$	$47^{\circ}35$	$54^{\circ}3$	$68^{\circ}10$	$69^{\circ}7$
2192	$44^{\circ}10$	$47^{\circ}50$	$54^{\circ}4$	$68^{\circ}10$	$69^{\circ}85$

It may be inferred from these experiments, that the actual temperature of the air or of liquids at ordinary temperatures, may be obtained with care, *exact to the fifth or sixth part of a degree.*

Thermometers intended to be used at ordinary temperatures, should never be immersed in freezing mixtures or in very hot water, as either might alter the position of the zero point to a large amount, and, therefore, after severe cold in winter, the errors of all the exposed thermometers should be determined again.

It may be worth while to mention that in making these comparisons every portion of the scale, if attached, must be thoroughly covered, the least possible portion being exposed for the purpose of taking the reading, which must be immediately covered up again, especially if the mountings are metal. Unless the graduations are engraved on the stem itself, the time spent in making accurate comparisons would be all thrown away.—I am, Sir, your obedient servant,

G. L. TUPMAN.

*Artillery Barracks, Eastney, Portsmouth,
23rd March, 1868.*

ANEMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—In your last volume you gave valuable and detailed descriptions of several anemometers, but you confined yourself to mechanical details, did not pit one against another, though perhaps we may trace a preference for Cator's, and did not criticize the remarkable results reported from the Royal Observatory during the last year or so.

Leaving the Greenwich returns for the present, I wish to call the attention of your readers to a recent report from Liverpool:—

“At 8 a.m. 30th [January], the wind was moderate, but at 9 o'clock it began to blow strongly, and from that time gradually increased in violence until 11.30 p.m. 31st, when there was one gust of wind which registered 51 lbs. on the square foot. From this time till noon on Saturday the gale rapidly increased with a severity quite unparalleled in this country. The anemometer which has been erected at the Bidstone Observatory is made to register up to 60 lbs. on the square foot, the idea being that no gale would reach that degree of violence. Between eleven and one o'clock, however, the registering pencil was driven far beyond this limit, and Mr. Hartnup calculates that at several periods the pressure could not have been less than 70 lbs. or 80 lbs. on the square foot. Previous to Saturday last the severest gale registered by the anemometer at the Liverpool Observatory was in December, 1863, when there were three gusts of wind which registered 45 lb. to the square foot.”

Subsequently a letter appeared in the *Morning Post*, drawing attention to these “wonderful pressures,” from which I will make another quotation, as the writer quite expresses my own views on the matter.

"A few considerations will suffice to show their improbability. For instance, take a fair sized man of 12 stone weight ; he would probably present a surface of at least six square feet to the wind. The total pressure on him would therefore be 480 lb., or about 34 stone, which would be enough to whisk him off as if shot from a catapult. Again, if we take the weight of a cubic foot of ordinary brick-work as 112 lb., we see that the force of the wind would be nearly enough to lift it, and would be decidedly more than enough to upset every house it came across."

I am not competent to endorse the accuracy of the last line of the extract, but have always understood that when wind force entered into architects' consideration at all, about 25 lbs. only was prepared for ; how three times 25 came to produce such slight accidents I should be glad to hear.

One word as to the velocity equivalent to "70 or 80 lb." No existing table goes beyond 55 lbs. per square foot, and as that equals 110 miles an hour, it seems needless to enquire what 70 or 80 lbs. would equal.—Yours &c.,

AN OLD OBSERVER.

REVIEWS.

Commission Hydrométrique et des Orages, 1866, 23^{me} Année.
370 pages and 3 plates.

THIS excellent work has waited sadly too long for the notice to which it is not only entitled, but which it is a satisfaction and a privilege to accord. M. Fournet and the colleagues whom he has trained to assist him, are working steadily and successfully at the two subjects implied by the title of the Commission.

In addition to the ordinary contents of the volume, we have from the pen of M. Fournet several valuable contributions to meteorology. In reviewing the year 1866, he remarks on the prevalence of east winds, which he had referred to in 1864 and 1865, "and which has also begun to fix the attention of other meteorologists" ; justly remarking that it would be presumptuous to pronounce on the cause of this phenomenon, he suggests the possible influence of polar ice, giving various extracts illustrative of its increase in the Arctic and Antarctic regions. Incidentally, he also mentions the fact, that in the glaciers of the Alps the reverse process is going on.

"During ten years our Alpine glaciers melt throughout the summer and only increase during the three months of December, January, and February. At the close of winter, the high ridges of gravel, which mark the ancient glacier beds, are now as bare as the banks of a river whose bed is too large for the volume of its waters ; and likewise, in September, my colleague of the Academy of Lyons, M. Hénou, was astonished at this extraordinary diminution."

He then recounts some of the more singular and striking glacier "lions" (if we may so term them) which have been destroyed, "to the great disappointment of tourists coming to visit them."

Although we do not quite see how the diminished area of the glaciers is to influence the direction of the winds at Lyons, we have thought the fact of the diminished area sufficiently important to merit some examination.

Having no thermometric records bearing on the point, we are com-

pelled to employ rain records alone, but they seem to support, and in turn themselves supported by, this glacial diminution. A glance at the diagram in "*Rain, How, When, Where, and Why it is Measured*," p. 60, will show that during the decade referred to, the rainfall had been considerably below the average in England, and we find from Professor Raulin's *Observations Pluviométriques*, that the same has prevailed at Geneva, and to a still greater extent at the Hospice on Great St. Bernard; the following are the per-centages.

	England.	Geneva.	St. Bernard.
1826 to 1835	101·7	94·5	96·4
1836 to 1845	100·6	106·3	143·0
1846 to 1855	101·0	104·2	89·6
1856 to 1865	96·7	94·9	70·8
1826 to 1855	101·1	101·7	109·7
<hr/>			
Decrease 1856-65	4·4	6·8	38·9

We are not prepared to maintain the accuracy of the St. Bernard observations about the year 1840, but there appears no reason to doubt more than two or three years out of the 40, and making full allowance for errors in the years 1838 to 1841, we still arrive at the fact that the aqueous deposit, be it snow or rain, which in this country decreased $4\frac{1}{2}$ per cent., and at Geneva 7 per cent., decreased more than 25 per cent. at the altitude of St. Bernard (8000 feet). Is this diminution of rain and snow the cause of the diminished glaciers?

M. Fournet next refers to the attempts to connect terrestrial phenomena with meteoric showers, in the following terms:—

"Independently of that which occurs on the surface of the earth, there are certain celestial phenomena which some have tried to connect with atmospheric disturbances. Foremost among these are the showers of shooting stars, to which M. Coulvier-Gravier is devoting himself. Here I may add, that from time immemorial, those called burning tears of St. Lawrence, grilled alive as we know, have been famous among the Irish, on account of their periodic appearance on the festival of the Saint, August 10th; and moreover, if I take this date and examine its correspondence with my curves, I find that it precedes by only three days the most stormy period of the year, which occurs between the 13th and 14th of August. There exists then in this case, a correspondence not unworthy of attention, although in 1866 a tempestuous invasion from the north-west has disturbed the regularity of the manifestation.

"On the other hand, the grand aurora of August 28th, 1859, was very evidently connected with a flight of shooting stars, with the disturbance of my magnets and of the electric telegraphs, complicated with a severe storm, not less remarkable than periodic, wherefore I was permitted to investigate this synchronism. Now, on searching my records, I find that the aurora of November 17th, 1848, and August 29th and October 12th, 1859, present points of resemblance which it may be convenient to describe subsequently in detail."

"Ozone even, seems henceforth entitled to a place in the list of prognostics. The observations of M. Rassinier, made on the heights of Tarare, at Sauvage, have shown a remarkable decrease in the colouration of the paper, simultaneously with the appearance of the beautiful aurora of September 14th, 1866, and as, besides, this preceded the great inundations from which France suffered between the 24th and 25th of the month, I am bound to point out the coincidence."

Passing the details of the ozone observations, and the daily records

of the Observatory of Lyons,* we come to an analysis of the observations made between 1828 and 1865 at Ahun (Creuse), which is especially valuable from the scarcity of observations in that part of central France. The winds are given in great detail, and they corroborate the remarks of M. Fournet as to the decrease of S.W. winds, which again is consistent with diminished rainfall; unfortunately, no details of the instruments are given, hence we can only take the information *quantum valeat*. The mean reading of the barometer is 28·467 in., and as the height of Ahun above the sea is 1470 ft., this would become about 30·04 reduced to sea level, whence it is probable the observations are not corrected for temperature. The mean temperature is 50°·3; the hottest month, July, averages 65°·5, and the coldest, January, 36°; the mean annual fall of rain is 33 inches, the wettest year, 1860, having 45·7 inches, the least, 1864, 23·3 inches.

(To be continued.)

Weather Facts and Predictions, by G. F. CHAMBERS, Esq., F.R.A.S.

Published by the author, Bickley, Kent. 16 pages, large 8vo.

THE introduction so well describes the aim and character of this pamphlet, that we will let the writer speak for himself:—

“Some seven years ago I commenced the gathering up of every kind of weather prediction which I could meet with, intending eventually to prepare a comprehensive digest for general use. The first part of such digest is now presented. Brevity has been deemed essential to its extended usefulness, and this consideration has excluded all references to authorities. The strict accuracy of every proposition advanced is not guaranteed; everything must be taken *quantum valeat*, still nothing palpably unsound will be given.

When a rule has any known exceptions, such exceptions are not treated of unless they have some reference to England.

The section devoted to the barometer has been largely drawn from Admiral FitzRoy's voluminous writings, whilst Buchan's *Meteorology* and Steinmetz's *Weathercasts* have furnished some useful points in other sections.

Corrigenda or addenda, addressed to Gordon Lodge, Bickley, Kent, will be received with pleasure from any quarter.”

The pages are large, the type small, and the author adheres to his rule of brevity—hence this is a large collection of laws, saws, and maxims, interspersed with useful explanations. We think that Mr. Chambers should pursue his labour with all diligence, and give us, not a pamphlet, but a book, and a big book too, containing not only a selection, but all obtainable predictions and predictive rules. We believe that a really comprehensive, standard work on this subject would not only be useful, but would also prove to be profitable. Mr. Chambers, by his “*Astronomy*” and by the present pamphlet, has given proof of ability, and if he will only work up weather facts and predictions from Aratus (B.C. 287) to Steinmetz, (A.D. 1867); from the Comanchees to Admiral FitzRoy; from the Shepherd of

* We make take a useful hint from the following note:—“The number following the word ‘fog’ indicates the greatest distance in metres at which objects were perceptible, and consequently the intensity of the fog.”

Banbury to Alexander Buchan ; the meteorologists, not only of England and America, but of all countries, will owe him a debt of thanks not readily discharged.

On the Quantity of Rain measured in the Lake District, by PROFESSOR PHILLIPS, M.A., F.R.S., &c. (Proceedings of the Ashmolean Society, New Series, No. 1.) 4 pages, 8vo.

MAINLY devoted to a discussion of the influence of elevation on the amount collected. Professor Phillips finds that in the Scawfell group the maximum fall is at an elevation of 1463 feet, but that in other parts of the district the influence of elevation is very slight. It is extremely satisfactory to find that Professor Phillips' investigations have resulted in the above mean altitude of greatest rainfall, inasmuch as it agrees very fairly with that deduced by an entirely different method in *British Rainfall*, 1867, which gave 1000 to 1500 ft.

Second Annual Report on the Sanitary Condition of Merthyr-Tydfil, being for the year 1866, by T. J. DYKE, Esq., F.R.C.S., &c. Merthyr-Tydfil: M. W. White & Sons, 118 pages, 8vo.

A CAREFUL and well written report. We should have been glad to see the section devoted to the weather extended, as it is much to the purpose, and appears faultless except one entry ; speaking of temperature, Mr. Dyke has, "the lowest range -24° , was in the night of the 14th." The entry as it stands looks like the formidable temperature of 24° below zero, or 56° below freezing. It is only a stroke, but as it is not required, and might puzzle, it would be better omitted.

We are very glad to see that over nine thousand houses in Merthyr are supplied with nearly pure water of only three and a half degrees of hardness. When will London fare equally well ?

MACKENZIE'S "CLIMATE OF SIDMOUTH."

To the Editor of the Meteorological Magazine.

SIR,—I am aware that it is very bad taste to attempt to reply to a critique, and especially to one so very just as that with which you favoured my little pamphlet last month.

The error in the first column referred to is not my own, I obtained the Greenwich mean temperature from "Drew's Meteorology," p. 76, which runs thus :—"From all the observations combined, the mean temperature of each month at the Royal Observatory, Greenwich, is"—(then follows the figures I quoted, viz., January, 35.7, &c., &c.) "The mean of all the monthly results, or mean temperature for the year, is $48^{\circ}.3$."

I do not for a moment write in self-justification, but simply to show that I used such data as I had at hand ; I had not the results of Mr. Glaisher's observations for 50 years ; had I been in possession of them I should assuredly have made use of them.

I am, Sir, faithfully yours,

JOHN INGLEBY MACKENZIE, M.B. CANTAB., F.M.S.

MARCH, 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.		Deg.		Date.	Deg.	Date.		
				Dpth	Date.							
inches	inches.	in.										
I.	Camden Town	1.29	— .79	.44	25	16	60.5	15	29.2	25	4	
II.	Staplehurst (Linton Park) ...	1.29	— 1.20	.41	26	12	59.0	14*	28.0	25	18	
III.	Selborne (The Wakes).....	2.21	— .59	.68	11	14	62.0	31	24.0	30	8	
III.	Hitchen	1.52	— .55	.46	7	17	55.0	13†	25.0	24	6	
IV.	Banbury	1.90	— .30	.35	11	18	56.5	14	25.5	25	9	
IV.	Bury St. Edmunds (Culford).	2.05	— .15	.70	8	16	58.0	13	26.0	24	8	
V.	Bridport	1.39	— 1.48	.23	9	17	61.5	21	27.0	30	8	
"	Barnstaple.....	3.23	+ .08	.57	8	22	...	...	...	...	...
"	Bodmin	3.38	— .37	.58	9	20	58.0	16	34.0	30	0	
VI.	Cirencester	2.56	— .04	.86	8	12	...	...	...	...	...
"	Shifnal	1.36	— .58	.31	7	15	57.0	13	24.0	25	7	
"	Tenbury (Orleton)	1.76	— .66	.44	7	19	59.0	21	25.0	25	8	
VII.	Leicester (Wigston)	2.56	+ .45	.45	8	14	64.0	30	24.0	24	7	
"	Boston	1.61	— .17	.43	25	17	60.2	13	28.5	25	4	
"	Gainsborough	1.21	— .30	.32	25	15	63.0	13	27.0	24	3	
"	Derby.....	2.32	+ .08	.32	7	20	58.0	21+	27.0	25	4	
VIII.	Manchester	4.00	+ 1.31	.61	4	18	59.6	27	26.0	25	7	
IX.	York	1.47	— .52	.29	25	15	60.0	13	28.0	25||	4	
"	Skipton (Arncliffe) ...	8.19	+ 3.28	2.85	4	22	57.0	31	28.0	25	2	
X.	North Shields	1.14	— 1.21	.32	22	13	58.5	13	27.0	25	4	
"	Borrowdale (Seathwaite).....	27.24	+ 13.84	4.13	13	25	...	...	...	...	...
XI.	Cardiff (Town Hall).....	...	...	...	...	...	...	...	...	...	...
"	Haverfordwest	3.03	— .42	.72	11	16	56.5	26	30.0	29	2	
"	Rhayader (Cefnfaes).....	4.21	+ .37	.90	10	21	58.0	...	26.0	...	...
"	Llandudno.....	3.26	+ 1.00	.50	22	18	58.0	30	32.0	25	0	
XII.	Dumfries	4.72	+ 1.74	.58	22	21	61.0	27	27.5	25	3	
"	Hawick (Silverbut Hall) ...	3.67	...	.73	4	19	...	...	...	...	...
XIV.	Ayr (Auchendrane House) ...	6.49	+ 2.76	1.04	16	24	60.0	29	26.0	24	4	
XV.	Castle Toward	6.57	+ 1.98	1.01	11	24	61.0	29	25.0	24	4	
XVI.	Leven (Nookton)	1.90	— .17	.41	25	14	57.0	31	26.0	25	5	
"	Stirling (Deanston)	4.88	+ 1.35	.76	4	21	61.0	28	24.7	25	12	
"	Logierait	3.67	...	.93	11	16	...	...	...	...	...
XVII.	Ballater	2.95	...	1.66	11	18	61.5	30	21.0	25	8	
"	Aberdeen	1.78	...	.56	11	21	62.2	31	27.4	25	8
XVIII.	Inverness (Culloden)	2.05	...	.75	26	...	58.1	13	30.3	24	2
"	Fort William	10.97	...	1.07	4	26	...	...	...	...	...
"	Portree	12.62	— 3.58	1.82	13	27	55.5	28	28.7	24	5	
"	Loch Broom	5.55	...	.56	7	26	...	...	...	...	...
XIX.	Helmisdale	3.60	...	.51	2	20	...	...	...	...	...
"	Sandwick	4.27	+ .94	.72	11	23	56.5	13	27.2	24	3	
XX.	Cork	3.28	...	.85	10	16	...	...	...	...	...
"	Waterford	3.63	+ .74	.87	10	19	61.0	31	34.0	8	0	
"	Killaloe	5.12	+ .80	.93	4	23	61.0	30†	31.0	9	1	
XXI.	Portarlington	2.71	— .60	.35	23	24	52.5	28	31.0	8	1	
"	Monkstown	2.10	— .48	.44	4	...	63.0	...	29.0	24	2	
XXII.	Galway	5.38	...	1.28	4	25	58.0	30	37.0	7	0	
"	Bunninadden (Doo Castle) ...	4.24	...	.46	4	25	58.0	27||	31.0	8	2
XXIII.	Bawnboy (Owendoon)	4.81	...	.72	4	24	61.0	29	50.0	23	3
"	Waringstown	3.06	...	.45	22	22	60.0	29	27.0	23	7
"	Strabane (Leckpatrick)	4.68	...	.53	4	24	60.0	29	26.0	29	7

* And 21st & 31st. † And 27th. ‡ And 31st. || And 29th. ¶ And 21st

+ 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.—H on 6th, 8th, 12th, and 23rd; dense fog on 10th and 31st.

LINTON PARK.—Month remarkable for the absence of high winds; the early part mild and dry: fog on 16th. The morning of the 26th very wintry, while the afternoon was very mild; the whole month favourable for out-door work.

BANBURY.—Slight S on 1st, 8th, 17th, and 25th; H on the 8th and 23rd.

CULFORD.—The mean temp. of the month the same as February, viz, 43°. T with H on 5th, 8th, and 23rd; TS on 17th.

BRIDPORT.—Unusually mild, with no cold easterly winds, but the potatoes were cut by the frost at the end of the month; heavy storms of H and sleet on the 8th.

BODMIN.—Very mild, and vegetation remarkably forward.

CIRENCESTER.—Wind, from 1st to 25th, W. or its compounds, on the 28th it went to the E., and was cloudless and serene, with moderate hoar frosts and warm days; the ground dried rapidly, and the roads became dusty. To the prevalence of S.W. wind during the three past months, we owe the early spring. The hawthorn was found in leaf in the middle of March, earlier than I ever knew it before; violets are nearly over; however delightful thus to lose the winter, we may dread its return, and its devastating effects; in 1830 we had a week of sunshine and warmth from the E. succeeded by a deep snow and hard frost on 1st of April; we know nothing of what is to come, but there appears a strong probability of the coming summer being dry, from the fact that in the last three years and three months the rainfall has been in excess of the average (of 24 years) by 20·70 in.

HAUGHTON HALL, SHIFNALL.—Ground white with S on the 1st, weather suddenly changed to calm and mild on 3rd. Although the nights were cold, the day temp. by no means low for the season, owing mainly to the absence of E. winds. Vegetation at least a fortnight forwarder than usual; wild violets in flower on 6th, celandine or crowfoot on 16th, blackbird heard on 3rd, chaffinch on 10th, wood pigeon first coo on 21st; gooseberry in leaf on 7th, hawthorn hedges partially so on 20th, blackthorn and damson began to blossom on 26th; humble bee (yellow tipped) on 18th.

GAINSBOROUGH.—Unsettled throughout the month till the 26th, then clear to the end; ozone at intervals, most fully from the 7th to the 12th. Lambing season most prolific. Vegetation forward; gale on 23rd, high wind on 25th, H on 12th, 17th, and 23rd, S on 8th and 25th.

DERBY.—Another month of remarkable beauty, with a few slight frosts but not severe enough to injure vegetation; the mean temp. precisely the same as February. N.E. wind only recorded twice.

ARNcliffe.—Early part of month unusually wet, latter part fine, the last week like June. Butterfly on 14th, wild narcissus flowered on 15th; R on every day from 1st to 16th.

NORTH SHIELDS.—Lunar halos on 1st, 2nd, and 6th; TS on 17th.

SEATHWAITE.—More than twice the usual fall for March; 4·13 in. fell on the 13th, and more than 1 in. fell on each of 11 days.

WALES.

HAVERFORDWEST.—Temp. high throughout; stormy on 1st and 2nd and from 7th to 14th. First three weeks constantly wet, with the sky overcast, wind W. or N.W., last week fine and very mild to the 28th, when the wind veered to the N.E. and depressed the temp. for the fourth time to freezing point; vegetation very forward. At sunset on the 30th extraordinary reddish purple column like a fiery pillar, stretching upwards from the setting sun about 10°, visible for nearly 15 minutes.

CEFNFAES.—The month generally wet and cold, many H storms, and a little S; from 24th to end fine and dry, frosts at night with bright sunshiny days, wind generally N.W. or N.E. Vegetation forward, and the early spring flowers very abundant and fine.

LLANDUDNO.—The early part of the month rather dull, with cold W winds; the last week or ten days beautifully fine; E. wind only on three days; vegetation generally forward.

SCOTLAND.

DUMFRIES.—The weather wet with occasional gales of wind up to the 25th, the close of the month dry and very fine; temp. very mild, mean being 6°·7 higher than last March; S on 1st, 5th, 6th, 8th, 17th, 19th, and 23rd. Vegetation three weeks earlier than usual; the end of the month very favourable for seed time.

HAWICK.—Weather seers here are unanimous in declaring that this has been the most lamb-like March they have ever seen. There was a hurricane from the west on the 13th, which blew off slates and chimney cans and tore up trees; a heavy fall of S accompanied by keen frosts on the 22nd and 23rd.

AUCHENDRANE.—This March has been above the average in rainfall, temp., atmospheric pressure, amount of cloud, and force of wind; the winds have been almost exclusively equatorial. R measured on every day except on the 25th and the last six days of the month.

CASTLE TOWARD.—The first 16 days were warm, wet, and stormy; although the ther. fell to 25° on the night of the 24th, it would seem to have been only for a short time as the advanced vegetation is not much injured. Peaches and apricots have flowered profusely, and other fruit trees are well set with flower buds.

DEANSTON.—Heavy S storm on 1st, 4 in. of S on the 8th, and 1½ on 23rd, very stormy on 14th; month generally wet and stormy till the 24th, after that fine, dry, and mild. No E. winds and no March dust.

BALLATER.—A fine open month, and vegetation unusually advanced for the season; some strong gales about the middle of the month, and a remarkable fall in the temp. from 23rd to 25th, the ground having a coating of S. Both bar. and ther. rose steadily during the last week, the weather remaining beautiful to the close. Curlew heard on 7th, sea pie on 10th; aurora on 22nd; apple and gooseberry in blossom on 28th.

ABERDEEN.—Barometric pressure, wind force, and rainfall below the average, temp. above it. A month of fine pleasant weather, though the winds were often boisterous during the first fortnight; during the last four days, immediately after the sharp storms of 23rd, 24th, and 25th, the heat was remarkable.

FORT WILLIAM.—At the close of the month the weather became mild and comparatively dry, but the month was one of unusual wetness; although the fall was only half that of February it rained more or less on 26 days, and on four of these more than 1 in. fell; out of the 91 days of this year R has fallen on 74, and the total amount registered is no less than 49·79 in., this is not much less than the aggregate fall of the corresponding period of three preceding years.

PORTREE.—This month has followed pretty close in the path of its predecessor, both as to wetness and storms of wind. TS from W. on night of 13th. Field labour has been kept very much behind; altogether the past three months have been the worst experienced in Skye during the memory of the oldest inhabitant.

LOCH BROOM.—In comparison to the last, this month has been delightful; no frost, fine and open for agricultural purposes. Though wet it was very warm, and stock in the open air were never in better condition; we have had two dry days only for 77 continuous days, viz., from 10th January to 26th of March, both inclusive; since then the weather has been beautiful.

SANDWICK.—March has been wet, warm, and windy, the R, the temp., and the wind above the average, indeed, the wind has not only been greater than in any previous March, but greater than in any month of previous years, except December on three occasions and February this year. Auroræ on 5th, 14th, 22nd, and 23rd; ground white with S on 1st and 23rd; gale 60 miles an hour from 7 to 9 p.m. on 3rd, one of 50 miles an hour from 9 to 10 a.m. on 11th, and another almost as strong on the 23rd.

I R E L A N D.

DOO CASTLE.—A severe and ungenial month to the 25th, from which time to end beautiful weather.

OWENDOON.—Constant wet retarded all farming operations till after the 25th, when dry weather set in ; very cold N.W. wind with H, sleet, and S, on 21st and 22nd, and frost on 23rd. All plants three weeks early this spring.

WARINGSTOWN.—Stormy, with more than average rainfall ; prevailing winds, from N.W. to S.W. ; temp. high, especially on the ground. Grass very forward, labour rather the reverse.

LECKPATRICK.—Very wet month, incessant R until the 25th when fine weather set in very favourably for sowing oats ; grass unusually early ; the cattle are generally out in the fields, at least three weeks earlier than last year ; fewer nights of frost in this than in any preceding March for 6 years. Mean temp. is higher, and fall of R greater than in any March since 1861.

PERIODIC HAIL BALLS.

To the Editor of the Meteorological Magazine.

SIR,—It will, I am sure, interest you and your readers to know that the ? attached to the above heading in previous years may now be omitted, since 1868 corroborates your suggestion of periodic hail and snow on March 8th. At 5.55 a.m. on 8th inst. the wind suddenly shifted from S.S.W. to N.W., and at 6 a.m. we had a gust of 21 lbs. pressure, with rain and hail. At 0.30 p.m. we had another squall of 11½ lbs. pressure, with snow, hail, and rain. The rest of the day was fine and clear.—Yours truly,

C. O. F. CATOR.

Beckenham, March 12th.

To the Editor of the Meteorological Magazine.

SIR,—Snow fell on 5 days in March—very heavily on 8th, 25th, and 26th. A heavy shower of soft hail and snow at 2.20 p.m. on 8th. Hail on five days.

Heavy storm at 2 p.m. on 23rd. Ground covered nearly an inch, which remained in sheltered places till midday on 25th.—Yours truly,

THOS. PAULIN.

Winchmore Hill, April 1st.

To the Editor of the Meteorological Magazine.

SIR.—I enclose some notes, which may be of interest.

March 8th.—Heavy rain, ending in snow, (0.67) from 1 till 9 a.m. ; dense snow storm at 1.30 p.m., followed by strong N.W. gale for 16 hours.

March 17th.—Gale from W. at 9 a.m. till 2 p.m. ; heavy storm of hail and rain, with frequent vivid lightning and thunder at 4 p.m.

March 23rd.—Strong N.W. squalls, with frequent dense snow and hail storms, from 2 till 5 p.m.—Yours truly,

G. WARREN.

Cambridge.

[We have no desire to occupy more space on this subject, but reference to the two preceding pages is sufficient when combined with the above.—ED.]

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXVIII.]

MAY, 1868.

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THE THUNDERSTORMS OF APRIL.

WE do not know *why* April, 1868, has had more than its share of electrical phenomena, thunderstorms, large falls of hail, and diminutive but very violent *rushes* of wind, but there can be no doubt that a careful collation of such notes as have reached us will assist those who may be induced to undertake the enquiry, inasmuch as in most cases good materials well arranged will tell their own tale. We make, therefore, no apology for giving in detail an account of the storms of April. To save space the following abbreviations are uniformly used:—**T** thunder, **L** lightning, **T S** thunderstorm, **H** hail.

APRIL 20TH.

OWENDOON (IRELAND).—**T** and **H**.

APRIL 21ST.

HAWICK (SCOTLAND).—**T S** and **H**.

APRIL 23RD.

SELBORNE, violent storm in E.; BURY ST. EDMUNDS, **T S**; LYNN, **T**; ULCEBY (LINCOLN), slight **T S** in morning; CIRENCESTER, **T**; DUMFRIES, **T**; ABERDEEN, **T**, **L**, and **H** from 4 to 5 p.m.

APRIL 24TH.

PONTEFRACT.—On Friday afternoon we were visited by a heavy **T S**, when the Dandy wind mill, belonging to Mr. Higgins, was struck, and considerable injury done. One sail was smashed to pieces, the bottom floor of the interior of the mill was torn up, and some scales which were in the same room were destroyed. The bottom of the mill seems materially injured, and there is scarcely a whole pane of glass in the building. Fortunately no one was in the mill at the time.

YORK, **T** at 4.30 p.m.; DUMFRIES, **T**; GLASGOW, **T**; LOGIERAIT, **T**; ABERDEEN, **T**.

APRIL 25TH.

SELBORNE, **T**; BANBURY, **T S**; CIRENCESTER, **T**.

TAUNTON.—At Orchard Portman, near this town, a gigantic oak tree was struck by **L** a few days ago, (25th?) and every limb was torn off and carried a distance of 20 yards. The trunk was stripped of its bark, and was split from top to bottom. A man who witnessed the circumstance was struck down by the **L** and remained unconscious a whole day.

LEOMINSTER.—About 1 o'clock on Saturday (25th), the weather was fine and the ground dry, but there were threatenings of a TS in the north, and there had been one clap of T; about 2 o'clock the storm commenced with heavy T and L, and the H was incessant for one-and-a-half hours, many of the stones appeared to be as large as small marbles. When it ceased the ground was covered to the depth of about two inches, as though it had been a covering of snow; notwithstanding the great quantity which had run off as water, much of it melted in the afternoon, but there was some remaining the next morning in sheltered places; the ground under the fruit trees was covered with leaves and blossoms and the early peas were sadly injured; such was the force of the H that it went through the large leaves, such as rhubarb, &c. The barometer (uncorrected, 230 feet above sea level) that morning was 29·77—58—the maximum thermometer 64°, and the amount of rain 1·66 in the bottle; what may have been lost by splashing I do not, of course, know, but I do not think that the funnel was overfilled at any part of the storm. It does not appear to have extended more than about 2 miles round here, but the storm seemed to go off to the north, in the direction of Ludlow; I have not heard whether it was felt there.—*E. P. Southall.*

SHIFFNAL.—TS at noon.

NEWPORT, SALOP.—On Saturday at mid-day a heavy TS passed over this town. So dark did it become that gas was lit in many houses. A number of trees on every side of the town have been struck, but no injury or loss of life has been reported. At Vauxhall the L struck a poplar tree close to the house of Mr. Taylor, butcher, shattering it entirely, and hurling large pieces a distance of 50 yards. Mr. Taylor's children were in the house alone, and were thrown from their seats by the shock, but were unhurt.

TAMWORTH.—About 2 o'clock on Saturday afternoon (April 25th) a severe TS with heavy rain, broke over this town and neighbourhood. The L was unusually vivid, and the peals of T very loud. 23 sheep, belonging to Mr. Kendrick, of Weeford, which with 70 others were under a thorn bush, were killed. The L struck a cottage at Whately and broke in the roof.

ORLETON.—Distant T all round till 4.30 p.m.

BROMSGROVE.—Violent T and L on 25th, commencing at 1.30 p.m.

LEICESTER, T and H; DERBY, brief but very violent TS.

LITTLE CHESTER, DERBY.—During the TS on the afternoon of 25th a pinnacle of St. Paul's Church, upwards of 14 feet high, was struck; stones hurled in all directions, the roof damaged, and the lead torn up. Some of the stones were flung a considerable distance.

RHAYADER, T and vivid L from 3 to 4 p.m.; OWENDOON, T.

APRIL 26TH.

SELBORNE, T; N. SHIELDS, TS; ABERDEEN, T.

APRIL 27TH.

HACKNEY.—On Monday afternoon (April 27th) considerable damage was wrought to buildings by the great force of the wind accompany-

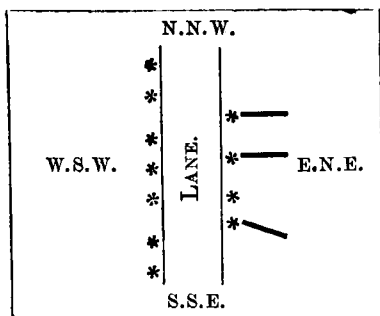
ing the short storm of **H** which at a little after 4 o'clock passed over the metropolis. In all parts of London the rain was very heavy, and, mixed with great hailstones, it lashed the earth violently; but the wind was not generally of extraordinary power. At Cambridge Heath, however, over a comparatively small area, a partial hurricane raged for a short time. It appears to have been confined to one large block of buildings and 150 yards around. At the corner stands Tudor House School. A stack of chimneys was blown from this house; the mass crashed through the roof into the rooms below, and nearly killed an old gentleman and a child. A baker's shop near was partially blown down; bricks, tiles, and falling slates, some of which were cast for a distance of 15 or 20 yards, fell around. While the wind lasted there was great alarm among the inhabitants. At the same time there were two very vivid flashes of **L** accompanied by a peal of distant **T**.

CAMDEN TOWN.—**T S** at 4.35 p.m., with a sharp shower, and moderate **W**. wind.

WINCHMORE HILL.—This neighbourhood was visited yesterday afternoon by a terrific hurricane from the S.W., with **T**, **L**, **H**, and rain, which was remarkable for its brief duration and the narrow limits to which it was confined. The storm commenced at 4.30 p.m. with a tremendous fall of **H**; at 4.35 p.m. there was a very vivid flash of **L**. The greatest fury appears to have passed about 200 yards to the eastward, where ten large elms were torn up within 500 yards of each other. The hail ceased at 4.40., when the fall was 0.11 in. The storm was accompanied by a very great decrease of temperature, viz., 10° in as many minutes; the barometer stood at 29.95 inches having fallen from 30.22 inches at 9 a.m.; at 10.30 p.m. there was a most magnificent display of aurora borealis: a brilliant arch of yellow-red light extending from N.E. by N. to N.N.W., and rising about 20° into the sky; at 10.45 the arch gave place to long streamers of light blue light which continued till 11 p.m., after which it became much dimmer. The light was so bright as to completely eclipse that of the moon.—*T. Paulin*.

[Having visited the spot shortly after, we can add our testimony, and a few additional facts, to Mr. Paulin's note. In the first place we may point out that in the vicinity of London, the wind force was simultaneous, or nearly so; that it was principally felt at three places in a perfectly straight line, S.S.E. to N.N.W., and at nearly equal distances on either side of Bruce Castle, Tottenham, where the maximum force was developed. (Mr. Hill having kindly promised a description of the desolation wrought in his grounds, we leave *that* till our next.) That at intermediate places there were no casualties to be heard of, and the inhabitants would hardly believe what their neighbours had suffered. The whole of the evidence from personal testimony and fallen trees shows that the direction at each locality was W.S.W. At Winchmore Hill every tree fell with its head to some point between E. and N.N.E., and this was also the general direction of the air current in that part of the country. Contrary to general experience, there was nothing like a track to be discovered, it was quite frequent to find a tree laid

down with its root at B, its head at c, and yet to windward at A, perhaps not 15 ft. off, another tree untouched. How did the wind, blowing as it certainly did in the direction B c, avoid injuring A.



In one case, a lane with banks about 6 ft. high, and tall trees growing out of the banks, was at right angles to the gale—the wind blew from W.S.W. to E.N.E., but not a branch was touched on the west side, while on the E. side three large trees were thrown down, the roots being so bound into the bank that several cart loads thereof were torn up with each tree. We have attempted to

make our meaning quite clear by the annexed diagram, wherein the original positions of trees are shown by asterisks, and the direction of fallen ones by lines from the asterisks which show the position of their roots.]

SELBORNE, violent H storm with T at 3 p.m. ; BANBURY, H.

ORLETON.—H and rain at 1.30 and 3.30 p.m.

BROMSGROVE.—A sudden and terrific gale of wind at 2.50 p.m., 27th, which only lasted about five minutes ; its violence was so great as to make it difficult for persons to keep on their feet, those near trees and fencings gladly seized on them to prevent their losing their equilibrium.

BOSTON, T S, and H as large as marbles ; ULCEBY, T S and H in p.m.

LINCOLNSHIRE.—A terrific T S broke over the northern part of this county on Monday, doing immense damage to the large orchards between Barton and Grimsby. At East Halton the L struck a young man named Elm, employed by Mr. Slight, miller. The unfortunate youth, was attending to the brake of the mill when the electric fluid struck him on the face under the left ear. Death was immediate.

ARNCLIFFE, T S ; LLANDUDNO, T and H ; LOGIERAIT, T ; ABERDEEN, T.

NEW INSTRUMENTS.

MESSRS. W. & J. BURROW, of Malvern, have recently brought out self-registering thermometers, good looking, very legible, tested at Kew, and all things considered, very cheap, though we dissent from the opinion that they are "half the price charged for standard thermometers of the same accurate quality." The amount of error indicated by the certificate is a partial guide to the accuracy of a thermometer, it guarantees the purchaser against any large error, but if the thermometer is blown, filled, graduated, and verified within a short period, the verification will, perhaps, give a maximum error of 0.2, and yet if re-verified a year afterwards, it may be half-a-degree or a degree in error. We by no means wish to intimate that any such haste has occurred with reference to these thermometers, but simply to point out the practical lesson of Captain Tupman's letter in our last number, which cannot be too widely known, and amounts to this, that verification *per*

se is not a proof of permanent excellence in a thermometer. We believe it to be the practice of some of the best opticians to keep their thermometers *three years* after they are filled before dividing them, thus as far as practicable guarding against future alteration. The value of verification depends on two elements—the care with which the examination is conducted, and the time which has elapsed since the thermometer was filled; the latter condition is not alluded to in the present Kew certificates, but we hold that the makers should mark on the tubes the date of filling and date of dividing, or keep a record against the number in a book. These data being marked on the certificate, its real import would be known and its value doubled. We beg to submit to the Kew authorities the following note appended to a verification certificate by Mr. Glaisher, dated 1856, to show that this is not a new idea nor one which has always been ignored.

“As mercurial thermometers are liable to read higher by age, it will be desirable at some future time to take a few simultaneous readings with this instrument and one whose index errors then are known, and to alter the number in the last column by the amount of difference thus found, but as the tubes were filled about three years previous to pointing it, it is probable that no such error will take place.

“JAMES GLAISHER.”

To return, however, to the thermometers under notice; they are mounted on handsome porcelain slabs: the maximum is on Phillips' principle, the minimum on Rutherford's, and though for some reasons we do not think them equal to first-class standards, there is no question that their substitution for half the thermometers in use would be a comfort to the observers and a benefit to science.

Mr. Casella, of Hatton Garden has (if we mistake not, at the instigation of the Rev. F. W. Stow) brought out a new *spirit* minimum thermometer for radiation temperatures. This will be a surprise for some, inasmuch as Mr. Casella has been to a considerable extent identified with efforts to abolish *spirit* thermometers for all ordinary purposes; we presume he has found his patent mercurial minimum as difficult to make, as some observers have found it to manage.

Fig. 2.



Whatever may have been the cause of its production, there is no doubt that it is the most sensitive spirit minimum thermometer yet constructed, the temperature rising and falling with every passing cloud. As will be seen from figure 2 this sensitiveness is gained by having a narrow tube and two long cylindrical bulbs, so as to render the exposed surface large in proportion to the amount of spirit contained.

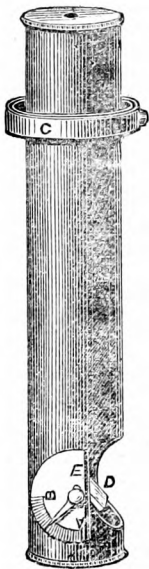


Fig. 3.

Messrs. Pastorelli, of Piccadilly, have recently constructed the little instrument shown in figure 3, and which was thus described in *British Rainfall*, 1867:—
 “It consists of a brass tube, 6 in. long, and three-quarters of an inch in diameter; near the top are double gimbals (c), by the outermost of which the instrument is suspended between the fingers, when, of course, the body assumes a truly vertical position. At the lower end is a small mirror, (D), turning on a horizontal axle, whereof one end is prolonged at (E), and carries a pointer on the graduated arc (A B). If the mirror is (as represented) at an angle of 45° , objects level with the mirror will be seen in its middle, by looking through the small eye-hole at the top; but if objects are above its level, the mirror must be turned by the axle (E) into a more horizontal position, and when the objects are seen crossing the centre of the mirror, the index will be found as many degrees towards (A) as the objects are above the instrument.”

DESIDERATA.

Before leaving the subject of instruments, we wish to draw attention to two matters wherein improvement is necessary. When a thermometer is divided (as all should be) on its own stem, the divisions are simply very shallow cuts, we might almost say scratches, on the glass; in order to render them visible some black substance, usually a compound of lamp-black or ivory black and oil, is rubbed in; however, be the compound what it may, and be the maker who it may, constant exposure to the weather soon fetches it out. Will some chemist or optician introduce a means of rendering these divisions clearly and *permanently* legible? In figure 2 it will be seen that the stem of the thermometer is protected by a Leach's shield, the end nearest the bulb being stopped with india rubber; after a time dependent on the humidity of the room wherein the shield was put on, and the tightness of the packing, moisture is deposited on the inside of the shielding tube, and so bedews it as to render the reading a matter of difficulty; can anyone suggest how this is to be avoided?

THE PERIODICITY OF THE ROYAL CHARTER GALE.

To the Editor of the Meteorological Magazine.

SIR,—In the present discussion respecting the periodicity of the Royal Charter Gale, the following remarks may not be out of place:—

It is a generally received opinion that in these latitudes there are two principal currents of air continually interchanging their relative position—an equatorial and a polar, and I propose making use of this principle in explaining the autumn gale. By using the terms equatorial and polar, I only wish it to be understood that these winds originate in the direction of the Equator and North Pole respectively

and may vary considerably on both sides of the south and north points, more particularly on account of the rotation of the earth on its axis, towards the south-west and north-west. I proceed, then, on the hypothesis that there will be in certain latitudes an upper saturated current flowing from the Equator, and a lower dry one flowing from the North Pole, and that the velocity of these currents may at some place be considered equal. It is evident that the moisture of the upper stratum will be gradually imparted to the lower, and this vapour, having the velocity of the equatorial current, will, when it enters the polar, tend to diminish its velocity. There must, therefore, be necessarily some place where the polar current is moving slower than the equatorial. Hence more air will be carried off in one direction than brought in in the other, and a partial vacuum will be somewhere produced, which will be filled by the saturated equatorial current rushing in from above; this will then part with some of its moisture in the shape of rain. But in the meantime a part of it has been left to flow on by itself overhead, thus creating another partial vacuum which is filled by the polar current, this, therefore, receiving a fresh impulse. After a time the colder polar again comes in contact with the warmer equatorial air and descends, causing a polar wind. These variations are continually taking place in temperate climates, producing the frequent changes in the direction of the wind.

During the summer months the equatorial current becomes saturated with moisture at a high temperature; when the temperature declines this moisture either descends in the shape of rain, or if a less saturated current, like the polar, which is comparatively dry, presents itself, part is discharged into it till its velocity is sufficiently diminished, in the way above-mentioned, when the equatorial current comes to the surface of the earth.

Now the temperature changes most rapidly in the autumn months of September and October, and especially in the latter, when the difference between the mean temperature of the air at the beginning and end of the month is no less than two degrees greater than that of any other month of the year. Hence in this month the greatest amount of loss of vapour on the part of the equatorial current and gain on the part of the polar takes place, which accounts for more frequent and heavier gales with greater rainfall in October than in any other month of the year.

Fixing a particular day or week for these gales to take place is entirely out of the question, as the statistics on this subject produced by your correspondents sufficiently prove.- Yours obediently,

J. S. W.

St. Alban's, March 30th.

COLONIAL RAINFALL.

[Collected from various colonial papers, which have been kindly placed at our disposal by Messrs. S. W. Silver & Co., of Cornhill and Bishopsgate, E.C. We shall always be glad to find space for similar

information, believing that a correct knowledge of the meteorology of our vast colonies is of the highest importance.]

Total Rainfall in 1867 at South Australian Stations.

Stations.	Observers.	Days.	Depth.
			inches.
Adelaide Observatory	C. Todd, Esq.	113	19·05
Angorichina	Mr. H. C. Swan	60	12·41
Kanyaka	Mr. J. Watson	50	13·10
Port Augusta	Mr. H. Mildred	55	14·33
Poonindie, Port Lincoln	Rev. Dr. Hammond	81	15·11
Burra Burra Mines	Mr. W. H. Challoner	86	18·57
Clare	Mr. J. Bastard	97	26·56
Walleroo	Mr. J. Beaton	60	14·12
Auburn	Mr. W. Rossi	78	23·86
Hamilton	Dr. Engelhart	103	31·92
Kapunda	Mr. W. H. Darwin	100	23·14
Gawler	Mr. W. H. Hopkins	108	19·12
Brookside	Mr. J. A. Scott	127	21·03
O'Halloran Hill	Major O'Halloran	133	22·76
Clarendon	Mr. F. Wood	73	24·30
Willunga	Mr. H. R. Pounsett	136	29·31
Goolwa	Mr. A. Baldock	107	15·98
Sunnyside	Hon. W. Milne, M.P.	110	23·83
Mount Barker	Miss Gower	142	32·11
Charleston	Mr. J. W. Disher	95	39·64
Strathalbyn	Mr. H. G. Watson	85	17·68
McGrath's Flat	Mr. J. S. Wood	102	18·29
Guichen Bay	Mr. J. A. G. Little	160	25·24
Mount Gambier	Mr. G. H. C. Mann	123	28·70
Penola	Mr. J. Fletcher	129	29·87
Mount Lofty	Mr. A. Hardy .....	...	41·99

Rainfall at Adelaide, 1863 to 1867 inclusive.

Year.	Days.	Depth.
1863	145	23·68
1864	123	19·80
1865	108	15·51
1866	115	20·11
1867	113	19·05

TASMANIA.

Rainfall at Westbury, near Launceston, observed by F. Belstead, Esq.

1866	121	30·89
1867	132	35·08

WHAT IS FROST ?

To the Editor of the Meteorological Magazine.

SIR,—This very proper inquiry by a correspondent in your Magazine for March is not so easily solved as some may think. Take for example some cases occurring in the past month (April), in the middle of which we had a period of dry, chilly, cold days and nights, when on more than one occasion the thermometer sank below 32°—once to 30°—and yet there was no visible appearance of frost on the ground, while on another occasion, when the atmosphere was more loaded with moisture, damp cloths, wet mats, leaves, &c., showed unmistakable tokens of frost, when

the thermometer stood at 33° ; the instrument, it is proper to say, was about 3 ft. from the ground. Now, in recording such things, I am of opinion that both these cases should be set down as frosts; in the one case the instrument denoted it, and in the other a more natural token indicated the same. In great elevations we are told it is not unusual for the thermometer to sink several degrees below freezing point, without any appearance of a frost, but it is not often so in this country, and in the few cases in which it is, I think we are justified in booking by the instrument (if it be an accurate one), and when slight ground frosts occur, not detected by the thermometer, I yet think we are right in noting them as frosts also. I would certainly do so. A much more knotty point in connection with meteorology is, "What is shade?" On that head many of us are certainly wide at sea.—Yours truly,
JOHN ROBSON.

[Mr. Robson's decision is exactly the reverse of our own, but we are quite willing to abide by it, if it meets general approval. It is evident that in all the above instances, a minimum thermometer on the grass would have been below 32° . The point at issue is simply this—Is the thermometer in the air, or that on the grass, to be our standard of frost? We shall be glad to hear the opinions of observers.—Ed.]

Abstracts of Meteorological Works.

PUBLISHED A.D. 1857.

The Recurring Monthly Periods and Periodic System of the Atmospheric Actions, with Evidences of the Transfer of Heat and Electricity, and General Observations on Meteorology. By W.H.B. WEBSTER, Surgeon, Royal Navy. Large 8vo, 286 pages, one plate. London: Simpkin.

WE believe a work was published some years since with the title of "The Poetry of Science," and that now under notice might almost be termed the Poetry of Meteorology, so frequent are the poetical quotations, added to which the author has a peculiar way of writing which is to us very unpleasant. The following description of Madeira illustrates the style to which we object:—

"It is a garden of nature, and a fruitful vineyard, detached from the world, where the sick may resort and find comfort and ease, with much to delight and to please, until they sink into rest, and take up their abode in mansions more blest, and where only saints immortal reign."

Having entered our protest against this style of writing we dismiss it from further consideration, and proceed to examine the facts and theories set forth. The former appear to have been carefully collected, and generally well support the theories based upon them.

To us, however, it appears unfortunate that the first proposition in the volume breaks down utterly on examination. The author desires to prove the "transfer of heat and electricity," and his first instance may be condensed into the following statement. In England the winter of 1849 was very mild, but "in Canada of extreme rigour,

and at Newfoundland of unprecedented severity;" this, however, is unsupported by evidence, unless the following extract from a letter from New York, dated February 20th, 1849, can be so considered—

"These regions appear more like Greenland and the people like Esquimaux. The cold is so rigorous and intense that most of the men wear long beards for warmth, and incapacity to hold a razor to shave themselves. The thermometer has sunk below the scale usually adapted to habitable lands. At a village called Deposit, at which your correspondent endeavoured to sleep last Friday night, 16th of February, the thermometer was at 21° below zero; and at Bangor in Maine, on the 13th, it was 28° below zero."

If the winter was *remarkable* for its severity, it is rather odd that a single short period of cold should make "the people look like Esquimaux;" the assimilation must have been very rapid; and as to wearing long beards to keep them warm, it was very kind of the beards to grow suddenly long just when they were wanted. Mr. Webster evidently did not take into account the *constant* difference between the climate of the centre of the North American continent and our own sea-girt isles. We may as well prove that the winter of 1849 was not "unprecedented" at any of the following stations, whatever it may have been reported to be at Newfoundland. Mr. Webster does not say what period he takes as winter, but we assume December, January and February: the following table explains itself:—

Stations.	State.	1848-9.		1835-6.		1851-2.	
		Dec.	Jan. Feb.	Dec.	Jan. Feb.	Dec.	Jan. Feb.
Cambridge	Massachussets..	24°·6		27°·0		23°·7	
New Bedford ...	"	26°·1		24°·7		25°·9	
New York	New York	26°·6		25°·9		33°·0	
Baltimore	Philadelphia ...	35°·6		27°·1		32°·1	
Charleston	South Carolina.	53°·4		52°·4		48°·2	
New Orleans....	Louisiana	58°·8		49°·6		56°·5	
	Mean	37°·5		34°·5		36°·6	
Greenwich		42°·4		36°·3		41°·1	
St. Petersburg.		15°·5		15°·6		...	

Means :—Greenwich, 37°·8; St. Petersburg, 18°·2.

We have not the mean temperatures at the North American stations, but allowing it to have been a cold winter, it was evidently not unprecedentedly so, since 1835-6 and 1851-2 were both colder. However, the three above-named winters were all cold in America, our table shows they were also rather cold in Russia. To support Mr. Webster's theory they should have been warm in England—two out of the three were rather so—but the winter of 1835-6 was the coldest in America for many years; it was severe also at St Petersburg, and, contrary to the theory, it was also cold in the British Isles.

Mr. Webster then waxes more bold, and tries to prove the "transfer of heat from the Persian Gulf to us, although 3,000 miles apart," by accidental coincidences like the following :—

"In 1848 March 31st and April 1st and 2nd were very bright, and hot as

summer; in short, such days so early were perhaps never before recorded in England. The thermometer stood from 72° to 76°. But hear what the 'Jewish Intelligencer' gives from the journal of the Rev. A. Stern, a missionary in Persia, under the head of 'A Missionary Cruise in the Persian Gulf, latitude 27° N. and longitude 53° E, in the Honourable Company's ship Clive, Commodore Hawkins.' 'Friday, 31st March, the wind suddenly changed and blew furiously from N.W., and raged incessantly during the night; the thermometer fell from 94° to 54°, and bitter cold. This terrific commotion lasted until Sunday, 2nd of April, when the sun again shed his cheerful beams.' "

Need we remark that isolated facts of this kind prove nothing; if the heat, for instance, which we experienced on April 1, 1846, did come from Persia in 24 hours we think its progress should have been, and might have been, tracked. We dismiss this theory with the Scotch verdict "not proven." Mr. Webster has placed it in the first chapter, hence we are obliged to begin in rather a severe strain, but the bulk of his work is upon the short title by which it is known, "Recurring Atmospheric Periods," and is, we think, too little appreciated by meteorologists. In the first place, we will let Mr. Webster give his definition of the term.

"By the designation 'Recurring Monthly Periods of Atmospheric Action,' it is intended to denote a 'mean period of 30 days 12 hours,' corresponding very nearly to a solar month, or that space of time in which the sun passes through one sign of the zodiac. There is a variation of two days on either side of the mean, so that we have the following series:—

"28-29th, 30th, 31-1st days of the month, and so on throughout. Any state or condition of the atmosphere recurring in succeeding months within two days of the same time of each other is included in, and constitutes, a recurring monthly period.

"For convenience and propriety, the specific points of highest and lowest state are taken for standard reference and exemplification, and not that they are the only recurring points or conditions.

"The mean period was deduced from the 'Greenwich observations,' in which alone the precise hours of the highest and lowest states are given in the comprehensive and useful abstracts. It was not a fanciful conjecture in taking this period, which so remarkably accords with the assigned solar month; and when I so uniformly and constantly found the recurring monthly periods to be the same in all the tables of fifty years, and all places from which I could obtain tables, the evidence appeared irresistible."

By taking two days on each side of the true date, five days are evidently included, and as the occurrence of either the highest or lowest reading within that period is held to prove a "recurring period" the chances (irrespective of law) are that that they will recur once in three times; when we add to this that breaks in the series are admitted, it is not surprising that an apparently overwhelming frequency of recurring periodicity is established. Instead of testing the question by the examples given in the work before us, we will take some of the Greenwich observations at hap-hazard, say 1858 and 1865.

1858.—BAROMETER.

Highest	17	25	22	22	26	23	3	7	25	30	9	6
Lowest	20	4	6	8	1	17	25	18	30	7	27	23

THERMOMETER.

Highest	9	5	24	16	31	16	15	12	12	3	26	21
Lowest	6	26	11	2	7	28	29	29	25	30	24	7

A mere glance at the barometric dates given above, shows that in this chance selected year the 25th was a frequent date, and analysis shows that dates between 22nd and 26th are just twice as frequent as might have been expected. The thermometric dates are not nearly so accordant, but they are about 28 per cent. in excess.

Thus 1858 confirms the theory; now let us try 1865.

1865.—BAROMETER.

Highest	7	10	3	6	20	8	26	30	23	3	12	15
Lowest	14	1	6	3	10	30	31	23	8	27	22	29

THERMOMETER.

Highest	10	28	31	27	21	23	15&27	27	8	2	24	7
Lowest	22	15	21	2	1	12	12	3	23	20	5	24

This case seems also evidence that there is something more than *chance* in the frequent recurrence of similar dates. We will take a third year—from Icelandic returns—observations made at Reikiavik in 1830.

BAROMETER.

Highest	11	17	31	1	9	15	3	18	3	26	23	17
Lowest	25	7	14	19	1	12	21	1	9	20	9	15

Here the indications of a recurring period are slight, though an enthusiast might point out the sequences 11, 17, 14, 19, 9, 15, 21, 18, 9, 20, 23, 17, or again 31, 1, 1, (12,) 3, 1, 3.

Need we remark that all our readers have the means of further examination in their own hands, both in their observation books and in our own pages.

In concluding these notes we should not omit to mention that a chapter is devoted to the various celestial phenomena supposed to influence the weather, such as the Metonic cycle, Howard's 18 year cycle, new and full moon, and lunar influence generally, none of which are believed by Mr. Webster to accord with recurring periods. He quotes, however, one paragraph from the Greenwich observations which had previously escaped our notice, and which, being of considerable interest, we transcribe:—

“The general fact of a daily lunar tide is indicated, by the mean readings increasing from six hours W. to six hours E., and diminishing from two hours E. to six hours W., hour angles respectively.*

“It appears that the mean height of the barometer is increased by the moon's position in south declination.

“When the moon was at or near her mean distance, and particularly when coming nearer to the earth, the mean height of the barometer was greatest. It would seem that the mean pressure of the atmosphere was greatest when the moon was about 14 days old.

Mr. Webster's work contains much other matter, among which may be noticed a description of the frost fair on the Thames in 1814, of the meteorology of Melville Island, Mauritius, Madeira, and other places, and many short and interesting notes.

* On reference to the Greenwich volume, we find Mr. Webster has not quoted the whole of the sentence, and thereby given it a different value. In the original the sentence concludes—“but these times are not in accordance with those deduced from the observations of previous years.”

APRIL, 1868.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 1/4 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	1.49	+ .36	.66	20	12	68.8	30	30.5	12	1	
II.	Staplehurst (Linton Park) ...	1.21	— .01	.36	20	11	72.0	4	27.0	12	4	
	Selborne (The Wakes).....	2.85	+ 1.35	1.09	19	12	68.0	28	23.0	12	8	
III.	Hitchen	1.65	+ .65	.50	20	13	64.0	30	25.0	11	5	
	Banbury	1.58	+ .42	.51	20	15	64.5	30	23.0	13	5	
IV.	Bury St. Edmunds (Culford) ..	1.68	+ .93	.37	20	15	65.0	7, 30	28.0	11+	9	
V.	Bridport	2.00	+ .52	.74	19	12	68.0	16	24.0	13	10	
"	Barnstaple.....	2.50	+ .49	.61	20	14	...	...	...	...	...
"	Bodmin	3.85	+ 2.15	1.08	19	12	62.0	4	32.0	11	0	
VI.	Cirencester	2.20	+ .91	.65	21	12	55.0	30	40.0	13	0	
"	Shifnall	1.51	+ .36	.44	20	13	61.0	15	26.0	13	8	
"	Tenbury (Orleton)	1.80	+ .26	.44	19	13	68.2	15	24.0	13	9	
VII.	Leicester (Wigston)	1.27	— .03	.48	21	9	70.0	4	22.0	12	9	
"	Boston	1.75	+ .78	.52	8	18	66.0	30	29.0	13	1	
"	Gainsborough	1.37	+ .55	.36	19*	11	67.0	2+	25.0	12	4	
"	Derby.....	1.55	+ .12	.51	20	14	65.0	15	26.0	13	2	
VIII.	Manchester	1.68	— .08	.49	15	14	66.0	26	27.0	12	6	
IX.	York	1.82	+ .72	.58	20	17	64.5	15	27.0	13	2	
"	Skipton (Arncliffe)	3.83	+ .79	.76	20	19	66.0	17	30.0	12	1	
X.	North Shields	3.04	+ 1.73	.81	7	17	65.6	16.	29.5	12	1	
"	Borrowdale (Seathwaite) .....	...	...	...	...	...	...	...	...	...	...
XI.	Cardiff (Town Hall).....	2.48	...	.70	20	12	...	...	...	...	...
"	Haverfordwest	2.03	+ .17	.92	19	7	61.1	16	25.0	10	9	
"	Rhayader (Cefnfaes).....	2.79	+ .90	.90	20	13	65.0	...	24.0	...	...
"	Llandudno.....	1.46	— .04	.42	20	11	65.2	15	32.0	11	0	
XII.	Dumfries	3.01	+ 1.34	.47	20	18	67.0	24	28.5	11	4	
"	Hawick (Silverbut Hall)....	3.39	...	.91	7	15	...	...	...	...	8
XIV.	Ayr (Auchendrane House) ...	3.52	+ 1.30	.91	22	15	61.0	15	26.0	10	4	
XV.	Castle Toward	3.52	+ 1.02	.62	7	16	67.0	24	26.0	10	5	
XVI.	Leven (Nookton)	2.89	+ 1.64	.76	22	12	65.0	16	31.0	14	3	
"	Stirling (Deanston)	3.91	+ 2.16	.95	22	18	60.8	26	25.0	10	5	
"	Logierait	4.02	...	1.63	19	14	...	...	...	...	...
XVII.	Ballater	4.19	...	1.50	19	18	65.5	16	25.0	11	5	
"	Aberdeen	2.55	...	.38	22	19	65.2	15	29.2	11	2
XVIII.	Inverness (Culloden)	2.26	...	.67	30	11	60.3	16	33.4	10	...
"	Fort William	4.23	...	.69	29	18	...	...	...	...	...
"	Portree	5.61	+ .34	1.12	4	19	56.2	13	28.0	10	2	
"	Loch Broom	2.48	...	.53	28	20	...	...	...	...	...
XIX.	Helmsdale	2.55	...	.83	29	15	...	...	...	...	...
"	Sandwick	3.31	+ 1.57	.80	29	20	53.0	2	33.6	9	0	
XX.	Cork	2.97	...	.76	22	11	...	...	...	...	...
"	Waterford	3.04	+ .81	.80	19	14	72.0	16	38.0	1, 9	0	
"	Killaloe	3.22	+ 1.09	.71	22	16	66.0	15	30.0	9	2	
XXI.	Portarlinton	2.14	+ .13	.59	23	14	54.0	14	34.0	9	0	
"	Monkstown	1.86	+ .22	.67	22	13	68.5	15	29.3	2	4	
XXII.	Galway	2.28	...	.53	6	16	58.0	2	36.0	8	0
"	Bunninadden (Doo Castle) ...	1.49	...	.32	20	14	57.0	2	28.0	1	1
XXIII.	Bawnboy (Owendoon)	2.27	...	.34	27	16	65.0	1	35.5	8, 27	0
"	Waringstown	2.19	...	.46	22	12	66.0	16	26.0	10	2
"	Strabane (Leckpatrick)	2.11	...	.64	7	14	66.0	15	31.0	24||	2

* And 27th. + And 15th, 16th & 24th. ‡ And 13th. || And 28th.

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

METEOROLOGICAL NOTES ON THE MONTH.

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

ENGLAND.

CAMDEN TOWN.—Lunar halo on 6th; TS on 27th at 4.35 p.m.; aurora on 27th at night.

LINTON PARK.—A fine, dry month, the beginning and end especially; fog on 7th and 17th; sharp frost on 12th, with dull, cold weather before and after that time. Great promise of fruit, the blooming of which is early; cuckoo not heard till 21st, delayed no doubt by the preceding cold.

SELBORNE.—Cuckoo first heard on 19th; swallow first seen on 22nd; T and H at 2 p.m. on 23rd—violent storm some miles to eastward; violent H storm at 3 p.m., with T, on 27th; T on 25th and 26th; bright aurora extending far to W. on 27th; diffused aurora on 28th; dense fog on 26th. Agricultural operations retarded by damp state of ground until the latter part of the month.

HITCHIN.—Heavy snow storms on 9th.

BANBURY.—S on 8th and 9th; H on 25th, and 27th; T and L on 25th.

CULFORD.—H on 8th and 9th; TS on 23rd.

BRIDPORT.—Swallows seen on 9th; cuckoo heard on 20th; horse chesnut in leaf on 10th; cowslip out on 11th; elms in leaf on 18th. Very sharp frost on 13th; ther. 8 deg. below freezing point; potatoes cut, and taps in open air frozen up; heavy westerly gale on the 19th, bar. at 9 a.m. stood at 29.40, at 10 p.m. 28.95. First half of the month fine and dry, the latter wet and stormy.

BODMIN.—Cuckoo first seen on 8th; first heard on 29th. A mild month.

CIRENCESTER.—The weather until the 19th was dry, with E. and N. winds; perfect weather for the farms; serene and sunny, with slight night frosts; afterwards it became windy; S.W. gales and R to the end; T on 23rd and 25th. On 16th appeared at sunset, and half an hour after, a sun column, which, agreeing with my note of April 9th, 1852, will describe it: "Saw a little before sunset a column of light rising perpendicularly from the sun to 25°, and visible half an hour after sunset; no cloud at sunset." April 19th, 1852: "Saw the sun column again." A similar appearance in March last was noticed by a correspondent of yours. I only notice it as unusual; I have no faith in its indicating the character of the coming summer, still the fact of 1852 was that it preceded the wettest summer ever known, commencing in June with 6.82 in. of rainfall, and a total of 38.25 in. in the seven last months of the year, instead of 19.13, the average of 24 years. [Probably the zodaical light.]

SHIFFNAL.—Very dry the early part of the month, so much so that the red spider attacked the young gooseberry leaves. Great absence of E. winds, as in last month, but many white frosts injured unprotected wall fruit. Latter end of the month April weather—sunshine and showers. Heavy TS at noon on 25th, but little R. White butterflies first appeared on 3rd; cliff-chaff first heard on 7th; sand martens first seen on 14th; swallow first seen on 24th.

BOSTON.—Dull and mild up to the 8th, with cloudy skies; to 15th cold and dull, rest of month showery, but favourable to the progress of vegetation; crops of wheat, &c. looking better than they have done at this time for several years. Cuckoo heard on 25th; swallow seen on 10th. Horse chesnuts and poplars in leaf on 20th; hawthorn on 15th; lime and sycamore on 24th; S fell on 8th, 9th and 10th, and H on 8th, 9th and 27th; on the latter date H fell during a TS at 4 p.m., and the pellets of ice were as large as small marbles, causing great damage to fruit trees. Lunar halo on 5th.

GAINSBOROUGH.—The month was generally fine, but squally. S and H on 8th. Plums in full blossom, but nipped on the nights of the 11th and 12th. Ozone very freely developed from 7th to 10th, and also from 17th to the end of the month. Swallows first seen on 19th; cuckoo first heard on 23rd; lilac in flower on 25th.

DERBY.—The weather during the month remarkably fine; very few frosts recorded, and N.E. winds only on 4 days. TS on 25th, violent, but lasting only

a few minutes ; a church was struck, doing considerable mischief ; the concussion burst open doors and shook windows throughout the town, like a little earthquake.

YORK.—S on 9th ; T at 4.30 p.m. on 24th ; fine aurora at 10.30 p.m. on 27th.

ARNCLIFFE.—T S on 27th.

NORTH SHIELDS.—Lunar halo on 3rd and 6th ; H on 8th and 9th ; S on 8th and 9th ; T S on 26th.

W A L E S.

HAVERFORDWEST.—First fortnight bright, clear, and sharp night frosts ; then change of weather, with milder temperature for a few days. Tremendous gale, commencing on the night of the 18th ; great fall of R, and very low barometric pressure, lowest at midnight, 28.525 on the 19th ; storm abated a little during the 20th ; blowing harder than at all during the night of the 20th, and on the morning of the 21st wind shifted from N.W. to S.E., from which point it again blew tremendously ; the weather continued unsettled, stormy and cold to the end of the month.

CEFNFAES.—A dry month, nights cold and frosty, hot sunny days ; early fruit trees in blossom much injured by the frosts ; hailstorms frequent ; T and vivid L between 3 and 4 in the afternoon of 25th.

S C O T L A N D.

DUMFRIES.—There was little R the first part of the month ; the latter half showery. Very fine growing weather, and the season three weeks earlier than usual ; a fine seed-time at beginning of the month, and the brairds of oats and barley very strong. S on hills on 8th and 28th ; T on 23rd and 24th ; cuckoo heard on 24th ; swallows seen on 20th. The country looking very fresh and beautiful ; the rainfall 1.21 in. above the average of 5 years.

HAWICK.—Hills white with S, accompanied with biting frost, on the 8th and 10th ; T, H, and L on 21st. Bats out in the twilight on the 23rd ; swallows first observed on the 25th. Heavy gales on the 27th, 28th, 29th and 30th. The month on the whole has been genial, and most favourable for the sowing of seeds, and the country bears a greener mantle than usual on the 1st of May. T on 26th.

AYR.—Rainfall in excess of the mean 12 years for April. Like the preceding three months of this year, the bar. pressure is about the April mean of last three years, but the bar. range is greater than said mean. Vegetation, &c., three weeks in advance.

CASTLE TOWARD.—The first six days mild ; wind S. and S.W., with S on the hills ; the wind changing to E., N.E. and N., the ther. fell to 26° on the 10th. Many of the rhododendrons which were in flower had their flowers destroyed, and fruit blossom, which was very abundant, much injured ; since the 12th the wind kept into the S. and S.W., and has been mild and rather wet. The spring garden is quite gay with hundreds of plants flowering profusely. Aurora on 28th from 9 to 11 p.m. ; strong gale on 29th, breaking down branches, and stripping the trees of their tender foliage.

DEANSTON.—Very dry till 19th, but some frosty mornings, though doing no injury to vegetation. Latter part of the month very wet and boisterous, especially on 28th and 29th, very stormy and chilly ; brilliant colourless aurora on night of the 27th.

LOGIERAIT.—A favourable month for vegetation, though not towards the close ; severe gale on the night of the 28th ; T on 24th and 27th ; aurora on 27th ; cuckoo heard on 26th ; swallow seen on 27th.

BALLATER.—A month of unsteady weather ; about an inch of S covered the ground on the morning of the 8th, but notwithstanding occasional sharp frosts during the month, fruit trees and bushes promise well ; the fields look remarkably fresh and beautiful.

ABERDEEN.—Rather wet, but warm, quiet, genial month ; crops fully a month in advance of last year. S on 7th, 8th, and 9th ; H on 7th, 8th, 9th, 10th, and 23rd ; fog on 12th, 13th, 19th, 20th, 21st, and 22nd ; T and L from 4 to 5 p.m. on 23rd ; T on 24th, 26th and 27th ; auroræ on 10th, 12th, 13th, 15th, 20th, 26th, 27th, and 29th.

FORT WILLIAM.—A pleasant and genial month till near the end ; S low on hills on 7th.

LOCHBROOM.—The month has been the best and most beautiful April remembered. Vegetation and agricultural works are in a very forward state, and until the end of the month it was more like summer than spring. The 28th gave indications of an approaching change, but the 29th was a terrific stormy day from W. and S.W.

SANDWICK.—April has been wet and warm, so that from this, and the extra warmth of the preceding months, vegetation and agricultural operations are far advanced. There was a gale at 40 miles an hour from 12 to 6 a.m. on 6th, and two on 29th, one of them 40 miles and the other 50 miles an hour. Auroræ on 10th and 28th; solar halo on 30th.

I R E L A N D.

DOO CASTLE.—From 25th of March, and entire of April, have been unequalled for years for farming operations. The farmers are luxuriating in this long spell of good and favourable weather, and look forward for an abundant harvest. We would just now have no objection to more moisture, grass, &c., suffering slightly, but the tables of the few last springs have been so completely turned in our favour, that we cannot reasonably complain.

OWENDOWN.—S on mountains on 7th; T on 20th and 25th; H on 20th; very early growth, fully three weeks more forward than last year; old men say it has been the most favourable April they can remember.

WARINGSTOWN.—One of the finest months I ever recollect, especially the first three weeks. Spring forward, and labour getting on well.

LECKPATRICK.—Fine month; very warm from 12th to 17th; gale of wind on 28th from S. Swallow last of the month.

FLOOD ON THE SPEY, FEBRUARY 1st.

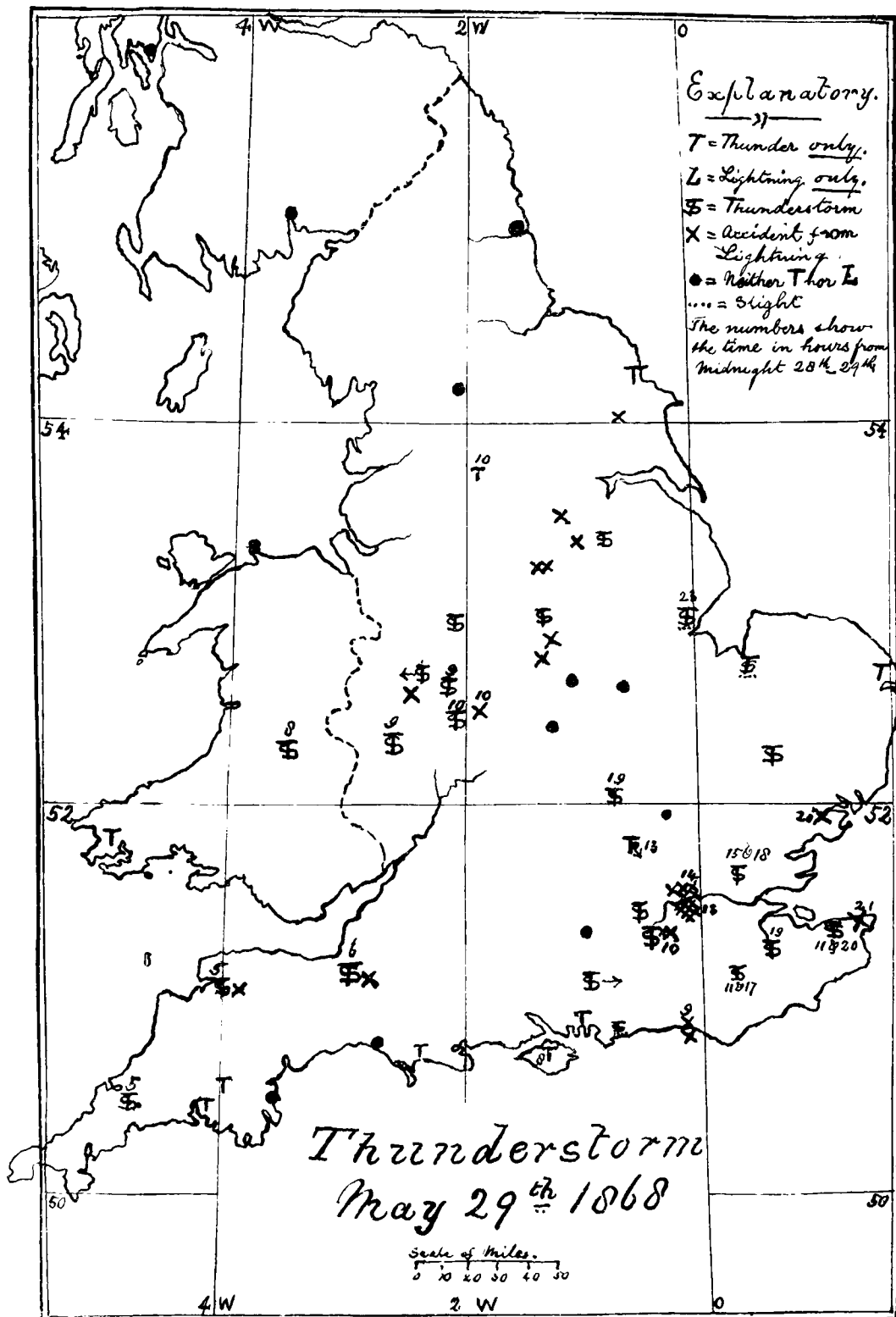
To the Editor of the Meteorological Magazine.

SIR,—During the latter part of January there had been hard frost, and much snow collected on the mountains. Between 9 p.m. January 30th, and 9 a.m. 31st, 0·48 inches of rain fell; 1·00 inches followed in the next 12 hours, and 44 in the next: so that the total in 36 hours was 1·92. This rainfall was preceded by a stiff breeze from the west, which melted the snow on the Cairngorm range, and on Friday, January 31st, the Spey came down with all the suddenness of a dam let off and with the speed of a race-horse, spreading far beyond her usual flood marks. The embankments gave way in many places, and from Ballifurth to Boat of Gordon (?), a distance of six miles, a fleet of steamers might have plied, without once entering the channel of the river. Looking westward from Ballifurth (where the valley of the Spey is about a mile in breadth) all was one unbroken sea, and appeared as navigable as the Firth of Forth. On Saturday, February 1st, the river rose to within 19 inches of the memorable flood of August, 1829, so graphically described by the late Sir Thomas Dick Lauder, of Fountainhall. The rainfall on that occasion (as registered by the gardener at Huntly Lodge) was, however, $3\frac{3}{4}$ inches in 24 hours. Since the spate of February 1st we have had heavy rainfalls: 0·89 inch was registered on the morning of February 28th, and the river has several times overflowed the injured embankment. While I write several hundred acres are under water, and fears are entertained lest the ground must remain fallow during the ensuing season.—Very truly yours,

WM. DUNCAN.

Grantown, Strathspey, N.B.

[Several important communications must stand over till our next.]



G. F. Symons, Litho.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXIX.]

JUNE, 1868.

[PRICE FOURPENCE
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THE THUNDERSTORMS OF MAY 29TH.

HAVING by the courtesy of numerous correspondents been favoured with copious details of the violent thunderstorms of May 29th, we have grouped them in counties, and laid down most of the particulars on the accompanying map, careful examination of which, coupled with the letter-press accounts, will render lengthened comment quite unnecessary.

The earliest note of any electrical disturbance is from Dartmoor Prison, where **T** is mentioned on the night of the 28th; it seems to have been confined to Cornwall and Devon during the early morning hours of the 29th; between 8 and 9 a.m. it was in Wales and Sussex, having split in two, or a second storm having started in the latter county, both storms seem afterwards to have gone to N. or N.E. at about 25 miles an hour—the former one dying out before it reached the coast, the latter hanging about the mouth of the Thames until late at night.

We have very little doubt that not half the accidents are reported, but the following analysis is somewhat formidable.

Men struck.....	16	Houses struck	10
„ killed	4	Barn „ ..	1
Beasts „	13	Oak tree „ ..	1
Sheep „	?12	Lamp post „ ..	?1
Churches struck.....	5		

BUCKS.

NEWPORT PAGNELL.—Heavy **T S**, with excessive **R** in evening— $1\frac{1}{4}$ in. of **R** fell in $1\frac{1}{2}$ hours.

CORNWALL.

BODMIN.—Terrific **T S** at 5.30 a.m., and .90 of **R** in 15 minutes.

DERBY.

CHESTERFIELD.—Oak split in two in morning. House struck and much damaged in Gladstone-street.

DERBY.—**T S** and .82 of **R**.

DEVON.

PLYMOUTH.—**T** early.

TORQUAY.—No storm.

BARNSTAPLE, SWIMBRIDGE.—Mr. Burden, of Kerscott Farm, had five young bullocks, worth £50, killed by **L** on Friday morning.

BARNSTAPLE.—T S 4 to 6 a.m. ; total R, .76.

DARTMOOR.—[On night of 28th] T and a shower of R, .08.

DORSET.

WEYMOUTH.—T before 9 a.m.

ESSEX.

BRENTWOOD.—Heavy R 1 to 4 p.m., and R from 6 to 7 p.m. ; total, 1.62 in.

WOODFORD.—The temporary Congregational Church at Buckhurst-hill was struck by L during the very severe storm, and the top of the roof was instantly in a blaze. Fortunately some workmen near immediately extinguished the fire.

To the Editor of the Meteorological Magazine.

SIR,—On Friday last, May 29th, a T S commenced within sight and hearing of this place, and lasted without intermission, I might say, for 8 hours, *i.e.*, from before 11 a.m. to near 7 p.m. I hardly think that one minute elapsed without the roll of T being heard or a flash of L being seen more or less near. The storm came from the S.E. or S. There was no heavy R here till about 3 p.m., when several sharp and near claps were heard, and the cloud passed off to the N.E. Another cloud with heavy R and sharp claps came up about 5 p.m., succeeded by others almost continuously till 6.30., when the storm began finally to pass off towards the N.E., during which time a rainbow was seen for about half an hour. I did not wait till the next morning to look at the rain gauge, but that evening measured the fall, which proved to be 1.74 in., the most of which fell in less than 4 hours, and the whole within 8 hours. The above fall, 1.74 in., exceeds by almost half an inch the greatest quantity that I had previously measured in 24 hours, viz., that of June 21, 1866, which was 1.25 in.—Yours truly,

EDWARD MAXWELL.

High Roding Rectory, Dunmow, Essex, 1st June, 1868.

HANTS.

I. OF WIGHT (NEWPORT).—Slight T at 8 a.m., and .03 of R.

SELBORNE.—Distant T and L in the E. in evening.

HERTS.

BERKHEMPSTEAD.—Distant T in S. and S.E., between 11 a.m. and 2 p.m., and L in the evening. No storm here.

HITCHIN.—No R.

KENT.

DOVER (EWELL).—Excessive R ; roads flooded and a wall washed down.

HERNE BAY.—T and slight R at 11 a.m. ; heavy T S from 8 to 9 p.m. R, .55.

SEVENOAKS.—Only the skirt of the T S, and .18 of R.

BROMLEY.—R, .35.

TUNBRIDGE WELLS.—At 11 a.m., T, L and slight R ; 4.30 p.m. L in E.

MARGATE (BIRCHINGTON).—Between 9 and 10 p.m. three men were at work in a brickfield between Margate and Birchington, when they were all struck down, and one was killed on the spot.

To the Editor of the Daily Telegraph.

"SIR,—The fall of hail continued for about fifteen or twenty minutes, and the whole of my garden was covered with stones of great size. After the fury of the storm had somewhat abated, I collected a number of the stones, and found them to be three-quarters of an inch, and in some instances one inch in diameter. Some were completely buried in the earth. I did not measure any for at least ten minutes after their fall, and they had lain on a table in the house three or four minutes. All the leaves of the flowers and plants are completely riddled, and large pieces of the branches and stems broken. Several of the hailstones were exceedingly beautiful both in form and markings, many being purely of a shell-like structure with all the furrows, and resembling a beautiful fossil. The fall of hail was accompanied by vivid flashes of forked lightning and crashing peals of thunder.—I am, Sir, yours, &c. T. W.

"Blackheath, May 30."

To the Editor of the Times.

"SIR,—All who examined the enormous hailstones which fell this afternoon must have been struck with the clearness with which their concentric formation was shown; many, of more than half an inch in diameter, exhibited seven layers. In some cases the layers of ice were alternately transparent and opaque. More than one had for a nucleus an ordinary hailstone, while the rest of its bulk was clear ice. Doubtless this fact, which thousands must have noticed, will tend to remove that long-cherished but evidently erroneous idea that hailstones are simply frozen raindrops, their construction being much more complicated.—Yours, &c.,

"Blackheath, May 29.

H. M. H."

To the Editor of the Meteorological Magazine,

SIR,—As it is interesting to watch the course of thunderstorms, I forward details of that of the 29th. Gloomy morning till 10.30 a.m., then distant T heard in S.E., and about 11 a.m. a few drops of R fell; T at intervals all the morning afterwards, but it cleared up, almost bright sunshine, with very few clouds, about noon. The heavy clouds seemed to pass from S.E. to S.W., and at 1 p.m. still fine here, but very heavy clouds and almost incessant L in the distance from S.W., to N.W. and N.E.; and about 1.15 p.m. the edge of a heavy cloud came over, and sharp R for about 2 minutes; then it quite cleared up again, but at 2.15 p.m. it looked very heavy in the north. It still kept fine here till about 4.30 p.m., when the storm gathered up again from the S. or S.E., and rained more or less till 6.10 p.m., very heavily for about 20 minutes about 5.30 p.m., with heavy crashes of T overhead and vivid L; this was by far the worst time (from 5 to 6), but all this time it looked lighter in the W. than what it was overhead. Although it came from S. and S.E., yet when it went away, it went to the E., and cleared up from the W. R up to 6.15, only .21 in.

There are several places in the road up to my house where the dust was not even licked up, and near Penge there was much less R, for the dust was yesterday evening quite thick in places. I hope we shall soon have some more R, for my garden is all cracks for want of it.

Yours very truly,

C. O. F. CATOR.

Beckenham, Kent, 30th May, 1868.

BECKENHAM (FOX GROVE).—Shower in the morning, another about 2, but at 4.30 the dust was hardly laid, and nearly all the R (.30 in.) fell between 4.45 and 6 p.m. T almost all day, and L until 10.45 p.m. Heaviest R (no H) about 6 p.m., immediately following the only very loud peal of T.

LEICESTER.

STAPLEHURST (LINTON PARK).—Slight **TS** in morning, and very heavy one about 7 p.m., when an inch of **R** with **H** fell in a very short time, flooding the roads very much; total **R**, 1·33 in.

KNAPTOFT HALL [RUGBY].—No storm, and only ·07 of **R**.

LEICESTER.—No storm, and only ·10 of **R**.

COALVILLE.—One of the pinnacles of Christ Church struck and much injured; the N. end destroyed and the roof opened in several places.

LOUGHBOROUGH.—Six beasts were killed by **L** on a farm at Dishley.

LINCOLN.

BOSTON.—Slight **TS** at 11 p.m.; **R** ·08.

GAINSBOROUGH.—**TS** and heavy **R**, ·60.

MIDDLESEX.

HAMPSTEAD (SQUIRE'S MOUNT).—**R** from 1.30 to 2.45 p.m., ·28 in.

LONDON (CHANCERY LANE).—**T**, **L**, and heavy **R** at 2.10 p.m., but only a few small **H** stones.

LONDON (BRYANSTONE STREET).—**L** struck a stack of chimneys, and threw them through the roof.

LONDON (STRATTON GROUND).—House struck.

LONDON (DORSET SQUARE).—**T** and **L** from 0.40 p.m. with little **R**; very loud claps of **T**, with very vivid **L**, from 1.22 p.m. till 2.15 p.m., with heavy **R** and **H**. The amount of **R** that fell during that short time was 0.95 inches. The traffic for some time was stopped through it, the roadways and footpaths being under water. A lamp post was split in two, near Edgware-road. Thermometer during the morning, 75°·2; wind, E.S.E., S.E. S.S.E., and S. The atmosphere continued to be very close all the afternoon; vivid **L** at 11 p.m., with distant **T**. The barometer was falling all the morning. H. E. SEGRAVE.

STAINES.—Slight **TS**; ·21 of **R**.

To the Editor of the Daily Telegraph.

"SIR,—About two o'clock, in the midst of the storm, a terrific clap of thunder seemed to shake the whole of this neighbourhood. On the rain abating I went out and found the stack of chimneys at house No. 11, Mitford-road, had been knocked down with such violence as to scatter the bricks all over the road for a distance of fifty to sixty yards right and left; some of the bricks are to be seen on the roof of the opposite house. The zinc cowls with a mass of brickwork lay in the forecourts of the house and the two adjoining ones. Fortunately there was no one in the front room upstairs at the time, and the window being wide open, the electric fluid, after smashing the mantelpiece and stove, passed out through the open window.—I am, Sir, yours, &c.,

Upper Holloway, May 30.

W. S."

HAMMERSMITH.—Two men knocked down by **L**, one much injured.

LONDON (BRIDGE STREET, BLACKFRIARS).—Man knocked down and stunned by **L**.

LONDON (HOUSE OF LORDS).—The Victoria Tower struck, but no damage done.

KENTISH TOWN (MANSFIELD ROAD).—Between 2 and 3 p.m. the **L** struck and shattered a flagstaff, threw down a coping-stone, and demolished a large window.

HACKNEY (1, CHURCH STREET).—At 2.30 the chimney stack was struck; the L ran down them and shattered the conservatory.

ON THE THAMES, NEAR ROTHERHITHE.—Two men on board the barque Constance were struck by L about two p.m.; one of them, who was clasping an iron bar, was dreadfully injured, being scorched on one side from head to foot. The other was blinded for several hours.

BROMLEY.—Two houses struck.

To the Editor of the Times.

"SIR,—A few details concerning the thunderstorm of this day may be acceptable, especially as an instrument designed last year, and already tested in various ways, has to-day proved its satisfactory action in the most violent rain. I allude to Pastorelli's storm rain-gauge, which shows not only minute by minute, but second by second, the amount and rate of the fall of rain.

"The morning was oppressively close; temperature at noon, 78°; no wind, but vane standing at N.E.; thunder first heard at 0h. 37m. p.m.; first lightning seen at 0h. 43m. p.m., and slight rain at 1h. 3m. p.m.; after 1h. 0m. the lightning was almost incessant in S.E. and S., with prolonged thunder. At 1h. 48m. heavy rain fell, and the following readings were taken from the above-named instrument:—

Time. p.m.	Total fall of rain.	Rate of fall per hour.	Time. p.m.	Total fall of rain.	Rate of fall of rain.
H. m. s.	in.	in.	H. m. s.	in.	in.
1 50 50	0.12	—	2 2 0	0.55	2.3
1 52 0	0.17	2.6	2 3 20	0.60	2.3
1 53 30	0.20	1.2	2 7 10	0.65	0.8
1 54 30	0.25	3.0	2 11 20	0.70	0.7
1 55 40	0.30	2.6	2 14 10	0.75	1.1
1 57 50	0.35	1.4	2 15 0	0.80	3.6
1 58 20	0.40	6.0	2 16 40	0.85	1.8
1 59 40	0.45	2.3	2 20 0	0.90	0.9
2 0 40	0.50	3.0	2 20 10	rain ceased.	

From this we find that the great downpour which occurred here at 1h. 58m. p.m., was at the enormous rate of 6 inches per hour, or 144 inches per day. Hitherto there has been no facile means of noting the rainfall at very short intervals; hence our knowledge of the rate at which rain falls in this and other countries is very limited. The only measurement by myself at all resembling the present was on the 13th of December, 1856, when 0.50 fell in 7½ minutes, being at the rate of 4 inches per hour for that period. I was not then able to measure at short intervals, or the *maximum* rate would doubtless have been greater than to day, since there was no period of 7½ minutes to-day in which the fall exceeded 0.30, or 2½ inches per hour.

I would not have troubled you with these details, but that I have had the satisfaction of seeing many other results of rainfall work applied to practical purposes, and think that this last is not less important (especially in drainage questions) than many of its precursors.

In conclusion, I may add that the storm appeared to come from the S., to pass S.E. of this station, in a S.W. current, moving very slowly against what slight breath of air there was. This view is corroborated by the fact that the rainfall here (0.91) was slightly less than at my future residence (62, Camden-square), 200 yards N.E., where it was 0.93 in. The hail was very slight.

"I am, Sir, your obedient servant,
"136, Camden-road, May 29.

G. J. SYMONS."

NORFOLK.

LYNS (HILLINGTON).—Much sheet L and very distant T.
YARMOUTH.—T.

NOTTINGHAM.

HARWORTH.—Church pinnacle shattered in the morning.

OXFORD.

BANBURY.—Distant T, and only .03 of R.

SALOP.

BRIDGENORTH.—“Morville Church was struck by lightning during the late severe thunderstorm, and sustained considerable damage. The electric fluid first struck the south-west pinnacle of the tower, breaking it in pieces and scattering the fragments of stone in all directions. One piece, weighing 20lb., was hurled the full length of the church, and fell upon the roof at the end of the nave, breaking the tiles. The lightning then flashed upon an iron pipe near the vestry chimney, and passed into the vestry, when it got into the nave of the church. Here it ran along the stone floor of the aisle, turning up in a peculiarly regular manner the cocoa-nut matting with which the aisle was covered, its pathway being marked by a scorched line. Branching off finally towards the north, it appears to have turned over a large piece of the flagstone flooring of the church. The earth beneath the flag was not affected in the slightest degree, nor were the pews in the vicinity, though the books were all found scattered about on the floor.”

SHIFNALL (HAUGHTON HALL).—T S in W. with heavy R.

SOMERSET.

BRIDGEWATER.—T S with heavy R between 5 and 7 a.m. ; at Weston Zoyland, a village 4 miles S.E. of Bridgewater, and on a hillock of red marl, in the midst of an extensive alluvial plain, it was very violent, and a heifer was killed.

STAFFORDSHIRE.

WOLVERHAMPTON.—Violent T S at 8.45 a.m.

SUFFOLK.

CAPEL.—L set fire to a barn and shed belonging to Mr. Allen, in the evening.

BURY ST. EDMUNDS.—A rather severe T S, but only .14 in. of R.

SURREY.

WANDSWORTH.—Horse killed.

STREATHAM.—Several sheep killed.

COBHAM (PYPORTS).—Heavy T S ; .78 of R.

KENNINGTON.—Violent T S, but no H.

EPSOM.—Man knocked down by L.

EWELL.—Two men were standing at the head of a mare in a wagonette, about 10 a.m. ; a flash of L knocked them all down, killed one instantly, and the other lingered only a few days.

SOUTHWARK.—At 0.50 p.m. the top of the steeple of St. Stephen's Church was struck and the tiles stripped off.

EPSOM.—A terrific T S passed over the Downs during the races, accompanied by heavy H. Two curious coincidences are reported :—(1) That the first race run after the storm was won by Mr. T. V. Morgan's “Electricity,” by “Thunderbolt,” ridden by Snowden. (2) That a booth known as “Hit or Miss” was struck, and some of the occupants knocked down.

SUSSEX.

BOGNOR.—L and very distant T.

BRIGHTON.—“The morning was calm and close, but with a cooling east breeze. At half-past 8, however, atmospheric disturbance began, and about fifteen minutes later a dense black cloud came up from the south-west. The effect on the sea was something like that of a tropical tornado, the calm water being lashed

into surf by the high wind that accompanied the cloud. When the wind struck the town it raised an enormous quantity of dust, causing great annoyance to the shopkeepers and tradesmen who had their doors and windows open. At the same time the pall-like cloud covered the sky, and in a surprisingly short space a darkness settled down that necessitated gas or candles in private houses, and prevented one seeing fifty or eighty yards out of doors. About nine o'clock the storm cloud burst in a very peculiar manner. A flash of lightning, a slight rumbling, then a single discharge like that of a great piece of ordnance. The storm afterwards raged for a full hour. In many cases the flash and thunder were almost concurrent, and literally shook houses till the windows and doors rattled. The globular form of the lightning was vividly apparent. In the earliest part of the storm the electric fluid struck Windlesham House, a large boys' school, conducted by Mr. H. C. Malden, on Furze Hill, at the top of Norfolk-road. The building is detached, and has two chimney stacks on the western side. Upon one of these stacks is a lightning conductor; but the fluid struck the other stack a few feet off. It carried away four long and heavy zinc flues from the top of the stack, and tore off the slates in two places on the roof. Descending one of the flues, it tore out a register stove and displaced a mantelpiece in an upper room. It went as far as the drawing-room grate, where it put the fender on one side and and threw the fire-irons out on to the floor. The clerks in the telegraph office at the Brighton Railway were compelled to leave the place. Inspector Carpenter, of the metropolitan police, ventured to enter the office, but was met by a flash of lightning passing from one instrument to another. He was partially stunned and temporarily blinded, and did not recover for a considerable time. Immediately the storm passed northward, and while the detached clouds were still following the same course, a brisk under current of wind came down from the same quarter, and continued till the afternoon. Last evening the weather was again exceedingly sultry."

WARWICK.

Mr. Plant writes to the *Birmingham Daily Post* :—

"By daybreak on Friday it was evident that the air was surcharged with electricity. There was a severe conflict between south-easterly and south westerly currents. Before 7 a.m. thunder was heard in the S.W. Rain commenced falling by 8.15 a.m., and before 9 a.m. a heavy thunderstorm burst immediately over the town. The lightning was frequent and vivid, and some of the peals of thunder followed the flashes almost instantaneously, and with crashing din. The turmoil lasted about three hours, and the rainfall was no less than 4-5ths of an inch. At the beginning of the storm the wind blew from the S.E., veering to W., and terminating E.N.E. There was an extraordinary phenomenon during the deluge of rain. From nine to ten, meteoric stones fell in immense quantities in various parts of the town. The size of these stones varied from about one-eighth of an inch to about three-eighths of an inch in length, and about half those dimensions in thickness. They resembled in shape broken pieces of Rowley ragstone. A similar phenomenon visited Birmingham ten years ago."

BIRMINGHAM—SALTLEY.—The fog signals in a store, also used as a workshop, exploded during the T S, but there seems some doubt as to whether the explosion was produced by L or not.

WORCESTER.

To the Editor of the Meteorological Magazine.

SIR,—As my monthly observations will not be published until Saturday next, I thought you would like to be in possession of the particulars of the storm which happened here on Friday (29th). I have only recorded a very few of such intensity. T was heard at intervals from 3.30 to 6 a.m., when it appeared to be clearing off; at 8.30 it became suddenly dark, and the elements greatly convulsed. A heavy tempestuous storm was ushered in by a flash of L of intense

brightness, immediately followed by a crashing peal of T, which continued at quick intervals, and at its highest pitch for upwards of an hour. At 8.45 a deluging downpour of water commenced, and continued without abatement until 9.30, when it settled down to a heavy storm, which lasted until midday, 1.01 in. of rain being then registered. The sun in a short time after broke through, the remainder of the day being beautifully fine.—I remain, yours truly,

GEORGE DIPPLE.

The Ford House, Bromsgrove, May 30th, 1868.

ORLETON.—T S commenced at 1 a.m. and ended at 10 a.m. T and L bright at 9 a.m. R at times, and some H.

STOURBRIDGE.—Violent T S from 8 to 11 a.m.

YORKS.

DONCASTER.—Violent T S; Mr. Bingley, of the Holmes, struck, but recovered.

KIRBY GRINDALYTH.—At a sheep washing, six were killed by L.

SCARBOROUGH.—T.

WALES.

HAVERFORDWEST.—T and a few drops of R.

RHAYADER.—T L and heavy R from 6.30 to 9 a.m. Total R .70.

SCOTLAND.

DEANSTON.—Distant T. (Probably local, see below.)

FOREIGN.

BRUSSELS, T. PARIS, heavy T S. TOULON, T.

CHAMBERY.—During the storm of Friday (29th) a soldier of the 47th Regiment, stationed at Chambery, was killed by the L while sitting under the branches of a chesnut tree to which he had run for shelter. Five comrades with him were stunned, and received various contusions but not serious ones.

There was neither T, L nor R connected with the storm under notice in Scotland, Ireland, nor even in the N. of England—at Arncliffe, York or North Shields.

WHAT IS FROST?

To the Editor the of Meteorological Magazine.

SIR,—It appears to me very reasonable to note down that a frost has occurred, whenever a radiating thermometer on grass or any other living vegetation indicates by self-registration that the temperature has fallen below 32°.

Damp cloths, wet mats, and many other artificial but good radiators of heat, are neither fair indicators of frost, nor proofs that vegetation has been exposed to a temperature below 32°.

On the 19th of last month, the max. temp. in the shade was 84°.2, and in the sun 100°, but on the morning of 21st, the temp. on grass fell to 28°! for the second time during the month.—Yours obediently,

C. L. PRINCE.

Uckfield, June 5th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—The importance of the question, “Has there been a frost last night?” arises from the effect such frost (if any) would have on vegetation. The thermometer on the grass would be the correct indicator of frost in this sense. As a cultivator of grass, spring corn, potatoes, &c, whose checked growth answers the question at the head of this letter with the thermometer on the grass, and not always with that in the air, I would suggest that the former be adopted as the standard of frost.—Yours faithfully,

P. P. P.

Brynbell, St. Asaph, May 18th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—I do not know if you desire each of your readers to send in his or her vote on the subject of, “What is a frost?” If so, I shall be glad to declare myself in favour of the “ground” observations, against those taken at a height of 4 ft. Although a 4 ft. elevation is, I believe, the “regulation” altitude, yet it is a somewhat arbitrary matter, after all; but if all were agreed to bind themselves to the dicta of the radiation thermometer, the great desideratum of *uniformity* would be attained. Still more: is it not almost absurd to deny the existence of a frost, because the protected instrument reads a few degrees above 32°, when vegetation near the ground is utterly destroyed? (Such was the case last May, in the Isle of Wight). I may here say that a 5 ft. elevation seems more desirable than 4 ft.: it is the stratum in which most of us breathe.

I am rather glad your correspondent has asked the question, “What is shade?” Perhaps it will lead to many observers taking measures to protect their instruments from *reflected* as well as direct heat of the sun, which alone can ensure *perfect* shade in a meteorological point of view.—I remain, yours truly,

E. G. ALDRIDGE.

Newport, I. W., May 18th, 1868.

P.S.—Some years ago (to illustrate the bad result of neglecting to guard against reflection), I remember placing a thermometer not far from a slate-hung wall, when the mercury rose to 90° or 94°. The instrument was “in shade,” popularly speaking, yet it marked many degrees too high, as I believe the *true* temperature was not more than 84°. (The slates were painted stone-colour.)—E. G. A.

To the Editor of the Meteorological Magazine.

SIR,—I must confess I was surprised at seeing the above inquiry in the *Meteorological Magazine*, for I was under the impression science had long ere this decided the matter. At least, such was my idea when the question presented itself to my mind some time ago; and not then knowing from whom to obtain any information upon the subject, I resolved to find out by experiment. At the outset, therefore, I deemed it essential to ascertain practically the proper distance from the soil at which thermometers should be exposed, so as to indicate

the true temperature of the air, as upon *this* I considered the matter to hinge. To that end, I erected a stout pole, of about 7 feet high, on an open lawn, at some distance from any object whatever; this pole I divided off into spaces of 6 inches, and between the hours of 10 and 12 on two or three successive nights, I made several experiments in the following manner:—A terrestrial radiation thermometer was exposed at a distance of 3 inches from the grass, near the foot of the pole, and two standard thermometers were at the same time attached to the pole at 6 and 12 inches from the soil respectively. After the lapse of half-an-hour readings were taken, and the two last-named instruments each raised one space—the lower thermometer always occupying the same position that the higher one had in the preceding experiment. After the lapse of another half-hour, readings were again taken, and so on until the summit of the pole was reached. In this manner, I found that (1) the differences between the readings of either of the two moveable instruments and those of the terrestrial thermometer increased gradually up to about 4 feet from the soil, whilst the differences between the two thermometers themselves decreased. Above that height, the differences in the former instance remained constant, whilst in the latter case there were none at all. Hence it appeared that at a distance of about 4 feet from the soil the temperature of the air was not influenced by terrestrial radiation, and, therefore, at that height the true temperature of the air should be determined. I considered, therefore, that there had been a legitimate frost when a thermometer situated as above so indicated.

Subsequent to the above experiments, I have had no reason whatever to change my views; on the contrary, the various meteorological phenomena which presented themselves to me as I took my daily observations, tended to strengthen them. I am of opinion, then, that at that point, and in that position, at which the most accurate and sensitive thermometer is entirely free from the direct influence of either sun, wind, rain, radiation, or reflection the *true* temperature of the air is to be ascertained. The problem to be solved is not so much *what frost is*, as *how it is produced*, for there are evidently two kinds—viz., that formed by the radiation of heat from the earth's surface, and that produced by the direct influence of the air itself. In the former case, I should consider it a *white* frost, in the latter a *black* one; and it does not follow that although at the time of observation there may be no visible signs of any frost, there has been none, for if the instruments employed be accurate, and have been undisturbed, their readings cannot mislead. Hoping that you will consider this letter worthy of a place in your valuable periodical, and apologizing for its length,

Believe me, yours truly,

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

Dublin, 18th May, 1868.

[A valuable note of independent investigations, proving the wisdom of having the shade thermometers at 4 feet. We thought the difference between a *black* and *white* frost was due to greater humidity of air in the latter case.—ED.]

NEW INSTRUMENTS.

To the Editor of the Meteorological Magazine.

SIR,—Under the head of “New Instruments,” in the *Meteorological Magazine* for this month, you call attention to the necessity of a more perfect shield than that now in use, for the stems of terrestrial radiating thermometers, whereby the cement used to make the etchings thereon perceptible may be preserved and the dew which usually collects may be avoided. These certainly are *desiderata*, as experience has shown me, for I have found that not only does the moisture which invariably collects, render it at times very difficult to take accurate readings, but it also has the effect of raising the cement very quickly, and on two or three occasions I have had to introduce fresh cement myself. These inconveniences might, however, be avoided by having the stem *in vacuo*, for those solar thermometers which are wholly so, are entirely free from the annoyances alluded to.—Yours truly,

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

*Aldborough House Barracks, Dublin,
18th May, 1868.*

[The plan is worthy of trial, but we fear that 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 yet check the sensitiveness of a terrestrial radiation thermometer—still, as we have said, it is worth trying.—Ed]

HOW TO READ MEASURING GLASSES.

To the Editor of the Meteorological Magazine.

SIR,—From all I can learn there appears to be a sad want of uniformity among many observers, with regard to the mode of measuring rain; and would it not be advisable to come, if possible, to some definite understanding on this point; for with those who register daily, the difference, however slight, arising from the want of it, will accumulate in the aggregate to a considerable amount, so much so that with two observers who use the same sort of gauge, but measure without a previous understanding, the difference of rainfall at the year's end may amount to as much as an inch-and-half, or even more. I allude more especially to the small gauges with a graduated measuring glass, such as the 5-inch one issued by Casella.

Those who use this must well know how undefined the surface is in the glass, owing to the *side-suction*, which makes just the difference of .01 between the upper edge and the lower level, or true centre of the surface.

From the test I have made of this particular gauge, I find that the latter is the line intended to be the true level, but it would be well to have the opinion of others on this point, and if we cannot perfectly agree as to which is the right line to go by, at all events agree which to adopt, so that on comparing notes we may feel that we are standing on common ground.

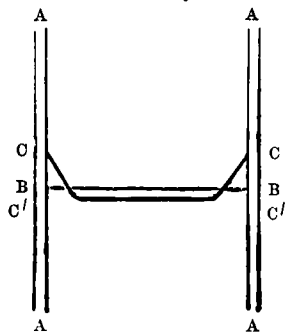
I have communicated with the Rev. C. H. Griffith, who is so well-known as a careful and experienced observer, and without entering here into his reasons, which would take up too much space, I may remark that he evidently inclines towards adopting the lower level, although some arguments may be adduced in favour of the other.

It may be right, while on the subject, to advert to another cause of difference in measuring, and that is the difficulty of holding the glass perpendicular while taking the account, and the slightest deviation (especially in one of small diameter) will of course make a difference in the level. With those whose gauges are three or four feet from the ground, a bit of board placed across the mouth of the gauge to place the glass on, (which can be hung when not in use at the side of the the post, will be found of great service. With those whose gauge is on the ground, a board nailed perfectly true across a couple of uprights, will answer the purpose. A spirit level should be used to test that, and also the surface of the gauge itself.—I remain, yours faithfully,

J. BROOKE.

Haughton Hall, May 4th, 1868.

[We believe that the opticians divide the glasses with mercury, which is, as we all know, repelled by the glass, while water is attracted; they (at least those we have consulted) say that they do not take either the line of contact of the glass and mercury, or the top level of the mercury, but an intermediate point about half-way, or rather nearer the top. The annexed exaggerated diagram shows that the correct practice with water measurement is the same as with mercury, that is to say, neither top nor bottom, but intermediate. Let A A A A be a section of a measuring glass, B B the level of the water uninfluenced by the glass, *i.e.* its true level, the surface will sometimes be found to be curved into c c'. Mr. Brooke takes c as the true level, but we think on consideration he will see that a point between c and c' would more nearly represent B—the true level.



There are two other points in the letter to which we would briefly refer:—(1) The elevation of c above c' is put by Mr. Brooke at 0.01 in., and multiplying that by the number of measurements in a year (assumed as 150), he obtains a possible difference of *an inch and a half, or even more*; but the difference is scarcely so great as 0.01, unless the glass is previously wetted, and therefore the total difference is rather less than $1\frac{1}{2}$ inches, and the *error* less than 0.75—one, however, even then still far too large.

(2) The concluding suggestion in Mr. Brooke's valuable letter is very good. Some years since we had a number of jars divided on both sides, so as to read across the glass, but our impression on trial was unfavourable, and we have not had any more so divided. Mr. Brooke's plan is much better. Col. Ward adopted it some years since.—Ed.]

MAY, 1868.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						TEMPERATURE.						No. of nights below 32°.
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which .01 or more fell.	Max.		Min.					
				Dpth.	Date.		Deg.	Date.	Deg.	Date.				
		inches	inches.	in.										
I.	Camden Town	1.58	—	.82	.93	29	6	87.6	19	35.6	7	0		
II.	Staplehurst (Linton Park) ...	1.92	—	.32	1.33	29	6	87.0	19	37.0	7	0		
III.	Selborne (The Wakes)	1.59	—	.39	.49	23	9	85.0	19	31.8	8	1		
IV.	Hitchen .....	.57	—	1.36	.29	23	5	79.0	19	31.0	6	1	
V.	Banbury .....	.88	—	1.34	.32	22	8	83.0	19	33.0	7	0	
VI.	Bury St. Edmunds (Culford) ..	.56	—	.60	.22	23	5	85.0	19	28.0	6	1		
VII.	Bridport	1.61	—	.42	.30	21	7	81.0	29	34.0	8	0		
VIII.	Barnstaple	1.91	—	.53	.28	10	12	...	...	...	...	...
IX.	Bodmin	2.75	—	.29	.90	28+	15	72.0	18	45.0	2	0		
X.	Cirencester	1.71	—	.57	.70	19	7	66.0	19	47.0	7	0		
XI.	Shifnall	1.52	—	.74	.50	19	9	77.0	19	29.0	7	1		
XII.	Tenbury (Orleton)	2.38	—	.50	.77	19	11	78.0	19	35.3	7	0		
XIII.	Leicester (Wigston) .....	.53	—	1.59	.13	22	9	91.0	19	32.0	6	0	
XIV.	Boston .....	.39	—	1.55	.17	22	8	87.1	19	37.2	7	0	
XV.	Gainsborough	1.19	—	.65	.60	29	8	87.0	19	35.0	6	0		
XVI.	Derby	1.35	—	.81	.14	22	11	83.0	19	37.0	6	0		
XVII.	Manchester .....	.87	—	1.79	.20	29	9	86.0	19	37.0	6	0	
XVIII.	York	1.28	—	.67	.35	29	8	81.5	19	35.5	6	0		
XIX.	Skipton (Arncliffe)	2.63	—	.72	.71	23	15	74.0	20	37.0	6	0		
XX.	North Shields	1.04	—	1.60	.20	9	10	70.0	30	32.0	6	0		
XXI.	Borrowdale (Seathwaite)	6.98	—	2.56	1.33	24	19	...	...	...	...	...
XXII.	Cardiff (Town Hall)	1.79	...	...	.49	27	9	...	...	...	...	...
XXIII.	Haverfordwest	2.35	—	.37	.85	23	8	75.0	18	37.0	1,3,6	0		
XXIV.	Rhayader (Cefnfaes)	2.58	—	.27	.70	29	9	73.0	...	34.0	...	...
XXV.	Llandudno .....	.71	—	1.67	.15	10	9	77.2	19	37.3	6	0	
XXVI.	Dumfries	3.74	+	1.35	.65	18	19	73.5	9	31.0	6	1		
XXVII.	Hawick (Silverbut Hall)	1.74	...	...	.30	23	16	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	2.19	—	.92	.51	23	16	73.0	29	30.0	5	1		
XXIX.	Castle Toward	3.99	...	...	.82	18	16	71.0	17	31.0	4	1	
XXX.	Leven (Nookton)	1.95	—	.05	.33	15	16	70.0	29	30.0	6	1		
XXXI.	Stirling (Deanston)	2.90	+	.25	.37	23	20	68.0	29	26.5	6	2		
XXXII.	Logierait	2.44	...	...	.68	23	17	...	...	...	...	...
XXXIII.	Ballater	1.36	...	...	.33	23	16	71.0	20	27.5	6	1	
XXXIV.	Aberdeen	1.35	...	...	.45	23	19	68.0	29	29.5	6	1	
XXXV.	Inverness (Culloden)	1.14	...	...	.32	24	10	66.0	19	35.7	6	0	
XXXVI.	Fort William	6.22	...	...	1.25	23	23	...	...	...	...	...
XXXVII.	Portree	6.48	+	.83	1.12	28	21	63.5	19	33.0	5	0		
XXXVIII.	Loch Broom	2.26	...	...	.61	23	17	...	...	...	...	...
XXXIX.	Helmsdale	2.58	...	...	.82	21	15	...	...	...	...	...
XL.	Sandwick	1.51	—	.75	.39	23	14	62.0	...	33.0	...	0		
XLI.	Cork	2.35	...	...	.49	18*	15	...	...	...	...	...
XLII.	Waterford	2.61	+	.36	.73	22	17	68.0	31	40.0	5	0		
XLIII.	Killaloe	3.08	—	.10	.58	14	16	70.0	31	33.0	22	0		
XLIV.	Portarlington	1.77	—	1.42	.41	23	19	63.5	17	34.0	4	0		
XLV.	Monkstown	1.10	—	.81	.50	22	12	73.5	29	35.5	6?	0		
XLVI.	Galway .....	...	...	...	...	...	...	...	...	...	...	...
XLVII.	Bunninadden (Doo Castle) ...	3.23	...	...	.43	26	19	65.0	17	28.0	4	2	
XLVIII.	Bawnboy (Owendoon)	2.84	...	...	.43	14	22	72.0	17	33.0	3	0	
XLIX.	Waringtown	2.34	...	...	.35	14	17	72.0	28	33.0	4, 21	0	
L.	Strabane (Leckpatrick)	2.45	...	...	.41	23	17	71.0	20	30.0	4	3	

+ This really fell on 29th, but in accordance with the adopted rule, it having fallen before 9 a.m., is entered to 28th. *And 23rd.

+ 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.

NOTE.—All references to the storm of the 29th are transferred to pages 65 to 72.

ENGLAND.

LINTON PARK.—A warm, dry, sunny month, with less T than usual. Most farming and other crops look well (hay excepted), and all are in a forward state.

SELBORNE.—The month has been hotter than any May I have ever recorded; everything very forward; crops, fruit, flowers, and vegetation in general much earlier than usual, and very productive and luxuriant. 19th the hottest day I ever knew in May.

BANBURY.—Fine warm month; mean temp. $56^{\circ}\cdot6$, being 4° above average.

CULFORD.—An exceedingly dry May, no rain having fallen till the 26th, when we had a slight shower, the total, as shown, was little more than half-an-inch, and fell on five days; mean temp. 56° .

BRIDPORT.—T on 19th.

BODMIN.—Mean temp. $58^{\circ}\cdot5$, being $3^{\circ}\cdot6$ above the average.

CIRENCESTER.—Mean temp. above the average; many cloudless days and nights; the sun's rays oppressive, although light winds prevailed; rather copious rains on the 19th and 23rd proved exceedingly beneficial to the late-sown crops.

HAUGHTON HALL.—A most beautiful May; little rain except with TSS; vegetation unusually forward, but checked towards the end of the month by the cool nights and want of rain. Cornrake first heard on 1st; turtle-doves arrived on 10th; chimney swallows on 30th, but no martens. Lilacs in blossom on 2nd, hawthorn on 15th, dog-rose on 28th; oaks in full leaf on 14th.

ORLETON.—A very brilliant month. Average temp. above that of 1864, and nearly 3° higher than the general average. TL on 8th; a violent TS burst over us at 8.15 p.m. on 19th, brilliant L and loud T for half-an-hour, with about half-an-inch of rain, passing from S.E. to N.W.

WIGSTON.—Mean temp. $58^{\circ}\cdot5$, being about 5° higher than the mean of May for the last 12 years; the rainfall was only about a quarter of the average for the same period.

BOSTON.—The month has been remarkable for its high temp. and dryness. On the 19th the ther. registered $87^{\circ}\cdot1$ in the shade, at 3 p.m., and the black bulb in vacuo in sun, $132^{\circ}\cdot2$. The rainfall was less than in any year since 1848, when it was only .18 in.; the pastures look brown and parched, and there is a great scarcity of water supply in the neighbourhood of this town. The wheat looks exceedingly healthy, and was in ear on the 26th; strawberries were gathered ripe on 28th, and there is every prospect of an early and good harvest.

DERBY.—Evaporation during the month very great; rain much wanted.

MANCHESTER.—Exceedingly dry month; rain much wanted.

ARNcliffe.—Peculiarly genial month; vegetation very forward.

SEATHWAITE.—A fine month, with alternate sunshine and showers. Vegetation generally about three weeks in advance of the average; great promise of excellent hay harvest; only one day on which the rain exceeded 1 in.

WALES.

HAVERFORDWEST.—Fine, beautiful month; warm, but never hot or oppressive, except on 17th and 18th, when the temp. was above 70° and the night temp. not below 54° . Gale on 11th, continuing squally till the 13th, succeeded by dense sea-fogs towards evening and night; R less than average, yet great promise of hay, and crops generally looking well; air sultry and warm towards the end of the month.

CEFNFAES.—Dry month; nights generally cold and frosty; winds high and boisterous, S.E. or N.W., the latter most prevalent.

LLANDUDNO.—A very dry month; from the 4th to the 9th (inclusive) the prevailing wind was E., during the rest of the month it was from the W. or S.W.; very heavy gale on 25th. Cuckoos and swallows very rarely seen or heard, and evidently much fewer than usual; 18th very hot, mean temp. being $64^{\circ}\cdot3$.

SCOTLAND.

DUMFRIES.—Beginning and end of month fine ; second and third weeks showery. TSS on 18th and 19th, very violent, that of the 18th did much damage, the Mansion-house of Murches being destroyed by fire from the L. During the month vegetation made great progress. Hawthorn in flower on the 8th, eleven days earlier than last year, and mean temp. 2°·7 higher. Crops very forward, but oats injured by the grub.

HAWICK.—Cuckoo first heard on 1st ; landrail on 8th. Sharp frost, which killed laburnum blossom, and blackened the stems of potatoes, on the night of the 5th ; T on the 11th, 19th, and 25th ; H on 11th ; much L on 19th. The month on the whole has been genial ; there is a fine appearance of fruit, and the face of the country is beautiful.

AYR.—May is the second driest month of the year here, and the rainfall this May is considerably below the mean of the last twelve years. Vegetation and evaporation are in this month great consumers of water, and this is the first of the summer months, when the rivers here show a decided falling off. Vegetation unusually advanced, and continues very vigorous with forcing weather.

CASTLE TOWARD.—A favourable month for vegetation, having been more free from frosty nights than either last May or that of the year before, but it has failed to repair the damage done by the chilly and withering gale of the 29th of April. Chesnuts, sycamores, larches, peaches, &c., are much blasted ; many of them have lost all their foliage, larches are yet quite brown. T on 18th and 19th ; much R for a week after ; last few days mild, and crops looking well.

DEANSTON.—First week dry, but chilly and very stormy ; young foliage of trees much damaged, and even blown away, and blighted by the salt brought by the wind from the W. and S.W., which was also encrusted on the windows. Hedges and lime trees had not recovered at the close of the month. T and L on 11th and 18th, and distant T on 24th, 25th, and 29th.

LOGIERAIT.—A very fine month ; vegetation making rapid progress ; severe TS on afternoon of 11th ; cornrail heard on 6th.

BALLATER.—Rainfall below the average, the early part of the month being very dry. Sharp frost on 6th, temp. falling to 27°·5. TS with H and R on the evening of the 11th. Cuckoo first heard on 9th ; cornerake on 19th.

ABERDEEN.—The warmest May we have had for at least 12 years, and the driest since 1860 ; temp. 3° above the average, rainfall below it. S., S.W., and W. winds more prevalent than usual, but pressure less. Hoar frost on 6th, injuring blossoms and potatoes ; a little S on the 5th. Vegetation from three weeks to a month in advance of last year, but want of R beginning to be felt severely in some districts, especially for the turnips.

FORT WILLIAM.—A fine day now and then, but the month on the whole wet and unpleasant, without any of the heat we hear of in England. R this month 6·22 in. ; the fall in May for the three preceding years has been 2·01 in., 2·06 in., and 4·43 in. TS on 11th and 18th.

LOCHBROOM.—With the exception of a feeling of cold and wet at the beginning, this is one of the finest months of May that could be imagined. Grass, cereals, and fruits are far in advance of their ordinary state at this date, but a change is surely coming, as the atmosphere is cooling rapidly.

SANDWICK.—Gale 40 miles per hour from 2 p.m. on 1st till 3 a.m. on 2nd, and another of 50 miles from 7 to 10 p.m. on 23rd. May has been finer, warmer, and drier than the mean. Vegetation is weeks in advance of ordinary years. The twilight is now too bright to allow us to see the aurora for a couple of months.

IRELAND.

MONKSTOWN.—82 per cent. of the R of the month fell on the 18th, 22nd, and 23rd. Almost all the fruit trees and crops seem to require R badly ; the wheat plant looks well, but oats are very poor ; the potatoes up to the present time seem in excellent health, and in some places they have been dug in small quantities ; this is much earlier than usual. There is a great scarcity of sparrows, swallows, and other small birds, and on the other hand wasps have already appeared, and are much larger and more vigorous than ordinary.

DOO CASTLE.—Latter end of this month wet, with a continual breeze from the

S.W. The small complement of R which fell in April, the dryness of the first fortnight in May, the continued breeze and absence of sun, have contributed to damage seriously the growth of crops ; at all events in this immediate locality fields of oats have been ploughed up and sown with barley, and in some instances resown with oats ; potatoes, except in rich and favoured spots, not blooming, and grass injured. Frost on 4th, which injured the potatoe stalks ; on the whole this has been a cold and ungenial month.

WARINGSTOWN.—The finest May I ever recollect in every respect ; winds from N.W. to S.W. ; temp. high.

LECKPATRICK.—Fine month for farming operations ; dry until the 18th ; from that date till the 27th 1·89 in. of R fell. Turnip sowing very general during the last week ; great destruction of oat crops by worms ; some oat fields in this neighbourhood were left without a sprout, and have been ploughed up for a turnip crop ; the damage has been confined to the grass lands which had been ploughed up. Latter part of the month has been cold.

APRIL COLD PERIOD.

To the Editor of the Meteorological Magazine.

SIR,—I beg leave to invite attention to the marked interruption which occurred at the usual period in the past month of April, in the regular rise of the temperature.

The mean temperature at Greenwich of the five days from the 9th to the 13th of April, as ascertained by Mr. Glaisher, for 50 years, is $44^{\circ}6$, which is $1^{\circ}2$ colder than the mean of the preceding four days, and $1^{\circ}4$ colder than the mean of the following four days.

At Arbroath, in Scotland, as appears from the last January number of the *Scottish Meteorological Society's Journal*, p. 145, the mean temperature for 22 years of the four days from the 11th to the 14th of April is $42^{\circ}5$, which is $1^{\circ}3$ colder than the four days before, and $2^{\circ}2$ colder than the four days which follow.

Here, the mean temperature (the mean of the max. and min.) of the five days from the 9th to the 13th of last April, was $39^{\circ}5$, which was $10^{\circ}9$ colder than the mean of the preceding four days, and $9^{\circ}1$ colder than that of the four days which followed.

And I learn from the observers at the Kew Observatory that the mean temperature there of the same five days was $39^{\circ}8$, which was $8^{\circ}9$ colder than the mean of the preceding four days, and $9^{\circ}4$ colder than the mean of the four following days.—Your obedient Servant,

D. A. FREEMAN.

Upper Tooting, 19th May, 1868.

UPROOTING OF TREES.

To the Editor of the Meteorological Magazine.

SIR,—I can answer one of your queries as to the blowing down of trees. It is a well-known fact, that all trees throw out their roots towards the point of the compass from which the *prevailing* wind blows. Here, for instance, you will find all the roots of the trees towards the S.W. ; in other parts of England from other points. I have seen the case you sketch hundreds of times. The trees on the W. side of the lane were held firmly by their roots, which run into the field ; those on the other side, on the contrary, having nothing but a bank to hold on by, were easily torn up.—Sincerely yours,

MICHAEL FOSTER WARD.

Bannerdown House, Batheaston, May 22, 1868.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXX.]

JULY, 1868.

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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

* 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. ^hhigher 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 $59^{\circ}\cdot5$; on the 11th it was 44° , the difference, therefore, was $15^{\circ}\cdot5$."—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° , at 19 below 110° , at 27 (*i. e.*, all but two) under 120° , at one $123^{\circ}9$, and at Greenwich 147° . 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.

OWENDOON.—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.

Bartrapps, 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.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXXI.]

AUGUST, 1868.

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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
VOL. III. H

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.

UCKFIELD—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. $81^{\circ}75$, and that of min. $52^{\circ}75$.

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.

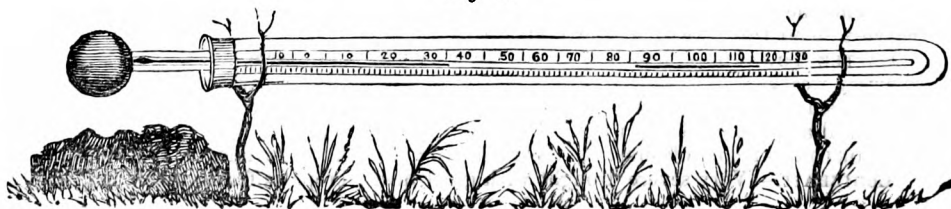
LECKPATRICK.—Hot and dry, all crops have suffered from drought; oats very short; harvest operations commenced at the end of last week. Turnips much injured by worms, and in several instances much damage done by crows, in search of the wire-worm attached to their roots.

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."

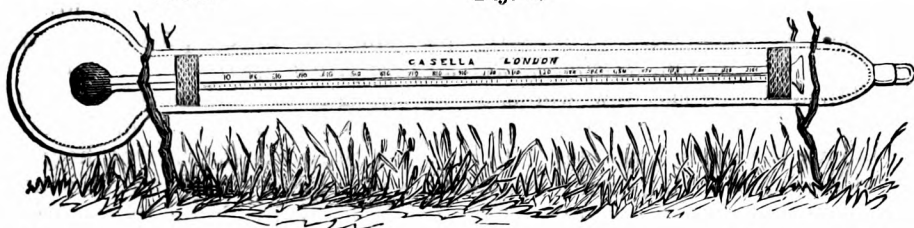
1. **Black Bulb Thermometer.**—A self-registering maximum thermometer, the bulb being formed of black glass. In use from 1835.

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 $0^{\circ}\cdot1$; 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	Monsol	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.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

XXXII.]

SEPTEMBER, 1868.

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METEOROLOGY AT NORWICH.

WE are sorry to be obliged to express our opinion that English meteorologists by no means did themselves or their science credit at Norwich. As will be seen from subsequent pages, there were the usual reports and two or three good papers, but the palm must be awarded to that by Padre Secchi, of Rome, and the discussions were flat in the extreme. We sincerely hope our Devonshire friends will secure some tersely written local papers, and, if they can, raise some disputed point, such as "What is shade?" and secure a discussion similar to that on Storm Warnings at Dundee. Devonshire has hitherto stood well in meteorological matters. The observations of Dr. Huxham, which were commenced in 1727, form a starting point whereof the observers of the present day may well be proud; let them see to it that his *prestige* suffers not at their hands. If the discussions at Norwich were slack, it was not from the absence of observers, for among the list of those present at the meeting we find:—

Adams, Prof., F.R.S.	Cambridge.	Home, D. Milne	Wedderburn.
Barnes, R. H.	London.	Hough, J.	Wrotesley.
Belcher, Admiral Sir E.	,,	Jenyns, Rev. L.	Bath.
Birkbeck, W.	Norwich.	Lowe, E. J., F.R.S. ...	Nottingham.
Birt, W. R., F.R.A.S.	London.	Lund, C.	Bradford.
Blythe, H. E.	Burnham.	Mann, Dr. R. J.	London.
Blythe, Rev. W.	Fincham.	Meldrum, C.	Mauritius.
Brady, A.	London.	Miller, S. H., F.R.A.S.	Wisbech.
Deane, H.	Clapham.	Morgan, T. H.	Hastings.
Denny, H.	Leeds.	Peckover, A.	Wisbech.
Dowson, E. T.	Beccles.	Pengelly, W., F.R.S.	Torquay.
Du Port, Rev. J. M.	Mattishall.	Phillips, Prof., LL.D.	Oxford.
Ellis, A. J., F.R.S.	London.	Secchi, Padre	Rome.
Evans, C.	Norwich.	Smith, D., F.R.A.S.	Birmingham.
Evans, J., F.R.S.	Nash Mills.	Smyth, J., M.I.C.E.I.	Banbridge.
Everett, Prof., D.C.L.	Belfast.	Stewart, B., LL.D.	Kew.
Gillet, Rev. E.	Runham.	Strange, Col., F.R.S.	London.
Glaisher, J., F.R.S.	Greenwich.	Symons, G. J.	,,
Harrison, J. P.	Guildford.	Vivian, E. ...	Torquay.
Hennessey, Prof., F.R.S.	Dublin.		

There is surely no reason why Exeter should not have as goodly a muster, and, by organization and co-operation, set an example to the meteorologists of other cities of the mode of preparing, discussing and supporting meteorology at the British Association meetings in years to come.

The following abstracts are in the order in which the various papers and reports were read :—

REPORT OF THE COMMITTEE ON UNDERGROUND TEMPERATURE.

Professor Everett presented an interim report detailing the various preliminary steps taken by the committee with reference to suitable thermometers and modes of observation. Some few observations had been made in trial borings in the vicinity of Glasgow, and persons aware of deep dry borings were earnestly requested to communicate with any member of the committee.

Herr Sartorius Von Waltershausen, of Göttingen, said that from recent calculations he was inclined to believe the thickness of the earth's crust was fourteen geographical miles. He also ventured to express his conviction that at the time of the first formation of the seas the thickness did not exceed 50 metres (164 feet.)

REPORT OF THE RAINFALL COMMITTEE.

This was read by Mr. G. J. Symons, and its leading features were the following :—

Adopting the same arrangements as in former reports, it was stated that steady progress had been made with the extraction and classification of published and unpublished records, and in the examination of rain gauges. The records of the inclined and tipping funnelled gauges described in the report for 1866, and erected at Rotherham, under the superintendence of Mr. Chrimes, have been discussed with some care. One of the principal results is the determination of the true angles at which rain fell during certain months, and the effect thereof upon the indications of the gauges. The results are that—1. There is no month in the year in which a gauge whose mouth is horizontal collects as much as one which is inclined *and* kept face to wind by a vane. 2. In summer, rain falls nearly vertical the average angle therewith being about 20° ; in spring and autumn about 45° ; and in winter more than 60° . 3. The ratio of the fall on the ground to that at 25 feet above it bears a nearly constant relation to the angle of fall—for instance, in two months, when rain fell at a mean angle of 65° from the vertical, the 25 feet gauge collected 25 per cent. less than that on the ground, and on the other hand, in two months, when the mean angle was 20° , the upper and lower gauges only differed by 5 per cent. 4. The relation of these results to their cause wind was shown by several diagrams to be striking in the extreme. 5. The necessity of all observers keeping the top of their gauges strictly level is brought out very clearly by the tables of results given. By these it is shown that in summer a tilt of even one degree will cause a difference of 0.2 per cent. in the amount collected. It is not unfrequent to find gauges two or three degrees from level, which would give a total error of five per cent. *if* they were always inclined towards the wind; but as the errors are never intentional, it is probable they neutralise one another; but it would be far better for observers to be careful to keep the orifices level, and so to avoid the error altogether. Various proceedings

at stations were recorded; and then an account was given of the new stations established in the central and eastern portions of the English lake district. In the district to which Dr. Miller confined his attention, the fall averages about 100 inches, and at one spot reaches 165 inches; the usual influence of a range of hills or mountains windward of a station is, if the station be close to the hill, to increase the fall, that is to say, ordinarily the maximum fall is on the N.E. slope of a hill, but the normal deposition having been exceeded in consequence of the cooling and condensing influence of the hill, there is so much less vapour in the cloud when it passes onward from the hill. Hence, at say five miles N.E. of a given hill, the fall would be less than if the hill did not exist. This being the case, it might naturally have been thought that the enormous rainfall in the valleys of Wastdale and Borrowdale would leave the districts immediately N.E. thereof with little or no rain. The observations of the last two years have shown that this does not follow.

Professor Phillips and Mr. Symons have both independently been investigating the relation between height above sea level and amount of rainfall, as indicated by both new and old stations in the Cumberland district. Professor Phillips has found in the Scawfell group the maximum fall was at an altitude of 1463 feet. Mr. Symons, by an entirely different method, had determined that the maximum was at an altitude of 1000 to 1500 feet; the two methods have, therefore, led to very similar results.

The relative wetness of different months was examined in much detail, and it was shown that while in dry districts like Norfolk the wettest month is in summer or early autumn, in wet mountainous districts it is in December or January.

The rainfall of several recent years was discussed at some length, and elucidated by large diagrams, from which it appeared that the deficiency noted in the years 1853 to 1859 had ceased, and that notwithstanding the dryness of 1862 to 1864, the period since 1859 has been quite equal to the average, and that the alarm as to forthcoming drought, which was prevalent in 1858, may be dismissed from present consideration.

LUMINOUS METEORS.

Mr. J. Glaisher brought up the report on luminous meteors. It stated that the atlas of star-showers, of which a few charts were last year exhibited to the British Association at Dundee, had been completed, and as it might now be obtained by members at a small cost, it was hoped that observations of shooting-stars would continue to acquire extension and improvement, so that the connection at present shown to exist between shooting-stars and comets would be confirmed by the directions and facilities afforded to observers by their use. In addition to the radiant-points described in the atlas at first observed in the northern hemisphere by Dr. Heis and Mr. Gregg, a similar list of radiant-points of star showers in the southern hemisphere is published by Dr. Heis, from the observations of shooting-stars recorded at

Melbourne between the years 1858 and 1863, by Dr. Neumayer. A complete meteoric survey of the heavens, with a view to determining the most obvious points of radiation, is thus already terminated and brought, at least provisionally, to a satisfactory conclusion. The report stated that although the unfavourable state of the sky prevented observations of the meteoric shower of November, 1867, in this country, yet they were well observed in America on the morning of the 14th of November, and they proved to be nearly as abundant as in the previous year. At Hawkhurst, in Kent, a party of observers watched occasionally until midnight, and afterwards at intervals, until six o'clock a.m. The sky was clear until ten p.m., and the moon so bright that only one or two stars of the first magnitude could be seen. One meteor only was observed. The atmosphere then became foggy, and drift clouds passed across the moon. At 12.15 the fog had increased so much that the moon could scarcely be seen, and the sky continued to become more overcast until 2 a.m. At about two hours five minutes, a large meteor comparable to the moon in brilliancy, shot from between Castor and Pollux in a comparatively clear space to the north, under Ursa major. It left a streak which was perceptible in the space between the clouds. Two or three meteors were observed in gleams among the clouds. At 6 a.m. the clouds became impenetrable, and observations were discontinued. Coming to the meteoric shower of August, 1868, the report stated that at Beeston observatory, Nottingham, the paths of twenty-six meteors were recorded, and some twenty others were counted by Mr. Lowe in the two hours thirty minutes, from 9.30 p.m. until midnight on the evening of the 9th. The meteors were most abundant between 10 and 10.15 p.m., and there were several points of divergence—one in the sword handle of Perseus, and another slightly north of, and above Cassiopœia accounted for most of the meteors. All were blue (mostly intensely blue) or colourless, and nearly all left streaks—were very rapid, and vanished instantaneously. One meteor in the sword-handle of Perseus appeared and disappeared without apparent motion. The August shower of 1868 surpassed that of previous years in accuracy of radiation (having fewer radiants) and in green, yellow and orange meteors, making it less confused in appearance, and conspicuously different from that in 1866. The radiant at ϵ Cassiopœia produced nearly the same proportion of meteors as on the 8th and 12th of August, 1867, The proportion of stars of the first and second magnitude was nearly the same as in 1867, while the rate of frequency in 1868 was nearly double that of 1867, and nearly agreed with that in 1866. Some of the largest meteors of the shower were observed soon after midnight of the 10th. Two meteors seen at Cambridge described curves. Attention has been chiefly confined to determining the radiant point from paths of meteors principally close to Cassiopœia. The point appears to be as nearly as possible R A 2h. 16m., N P D 36° . They always came several at a time, and then a pause. Those that came together were usually in the same part of the heavens.

(To be continued.)

GALE OF AUGUST 22ND.

To the Editor of the Meteorological Magazine.

SIR,—On the evening of the 17th of August the sky presented an extraordinary appearance at sunset. A yellow orange glare spread upwards some 10 or 15 degrees towards the zenith, extending from S.W. to N.W., the sky covered with clouds of intense blackness all round, except where they appeared to lift like a dark pall from that western portion of the horizon. Rain commenced falling at 9 p.m., and towards midnight the wind rose to a gale, which continued with great violence during the night. The next day the weather seemed completely changed from summer to autumn; the two following days were much finer, but cool; the evening of the 21st was chilly, and the same peculiar appearance of the sky at sunset was seen as on the evening preceding the first gale. Towards midnight (Friday) the sky was intensely black, and at 3 a.m. (Saturday) a most terrific gale seemed to strike the town, with a shock like an earthquake. It raged with extraordinary fury for six hours, accompanied by a perfect deluge of rain. From 3.30 a.m. to 9.30 a.m. 2.08 in. fell, in a gauge 1 ft. above the ground, and 150 ft. from sea level. The barometer fell .868 in. from 11 p.m. Friday, to 9 a.m. Saturday.

There was a lull for about one hour; the wind then suddenly veered from S.W., from which point the storm first blew, to W.N.W. and then to N.N.W., raging with unexampled fury, barometer slowly rising, the rain again descending in sheets of water; trees were snapped assunder, and the roads everywhere strewn with large broken branches. The disasters round the coast are very numerous, and it is feared the losses are very great. This storm of wind did not entirely abate under 36 hours. The total rainfall from the commencement of the storm was 2.91 inches, the largest part of which fell during the first six hours.—I am, Sir, yours truly,

EDWARD PICTON PHILLIPS.

High Street, Haverfordwest, August 24th, 1868.

RECORD OF OSLER'S ANEMOMETER.—*Saturday, August 22nd.*—Midnight to 2 a.m., wind S., calm; 2 a.m., wind backing to S.E.; gale coming on, pressure 3lbs. on the square foot, velocity 25 miles an hour; 6 a.m., S.S.E. 7 to 8lbs.=38 to 40 miles, the gusts reaching 12lbs.=50 miles; rain falling in torrents: 9 a.m., S.W., force 6lbs., 35 miles, rain ceased, sunshine; noon, gale increasing, force 7lbs.; 3 p.m., S.W., mean force 9 lbs.=43 miles, with 14lbs.=55 miles in the gusts; 11 p.m., W.S.W., 8 lbs; 2 a.m., Sunday, 23rd, pressure 2lbs., the gale passing off at W. Barometer fallen 5-tenths to 29.4 tenths, sea level. Heavy rainfall, 1 inch in 6 hours, making the rainfall during the past week 2.8 in. and since the 4th of August, 4.2 in.

T. L. MANSELL, M.D.

Guernsey, August 24th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—A heavy gale of wind passed over this station on the 22nd of August, doing considerable damage. It began to blow from the W.S.W. early in the morning. Barometer at 9 p.m., of the 21st stood at 29·872 in., at 9 a.m., of the 22nd 29·271, at 3 p.m. 29·078 in.

HORIZONTAL VELOCITY OF WIND.

From 12.0 to 1 equalled 12·5 miles per hour.

„	1.0	„	2	„	13·6	„	„
„	2.0	„	3	„	14·5	„	„
„	3.0	„	4	„	15·5	„	„
„	4.5	„	5	„	15·0	„	„
„	5.0	„	6	„	14·7	„	„

giving an average of 14·3 miles per hour for the time mentioned. At 7 the wind veered to N.W., and the barometrical pressure increased to 29·140 inches, the velocity of the wind at this hour being 15·8 miles per hour. The gale continued during the night, velocity of the wind at 9 a.m. of the 23rd being 14·8 miles per hour. Great damage done here to trees: many elms blown down and large branches torn from oak and ash trees, the roads being completely strewn with them; the fruit trees also suffered considerably. Many ricks were stripped and their contents scattered.—I am Sir, yours &c.,

CHARLES GRIFFITH, F.M.S.

*Strathfield Turgiss, Winchfield, Hants,
August 24th, 1868.*

JULY IN ITALY.

To the Editor of the Meteorological Magazine.

SIR,—It is of interest to contrast the weather which prevailed in Southern Europe during the early part of this summer with that which we have had here.

The Bullettino Meteorologico di Roma of 31st July contains a statement by the Director of the Observatory at Palermo, under date the 20th July, that constant changes of weather were taking place, and that it might be said that the summer had not then yet commenced.

In the same journal it is stated that a continuous succession of storms had occurred at Rome, commencing in the middle of May and extending to the 10th of July; that during June rain had fallen at Rome on 14 days, to the amount of 3·63 inches; at Tivoli, 16 miles E. of Rome, on 22 days, to the amount of 6·68 inches; and at Velletri, 16 miles S.E. of Rome, on 17 days, to the extraordinary amount of 13·3 inches.—I am, Sir, yours, &c.,

D. A. FREEMAN.

Upper Tooting, 24th August, 1868.

JULY IN FRANCE.

To the Editor of the Meteorological Magazine.

SIR,—I do not know whether you will care to get weather notes from a constant reader and occasional correspondent, residing for a

short time in a somewhat remote corner of France, midway between Rochfort and Biarritz, on the shores of the Atlantic.

As elsewhere, the weather all through July has been dry and hot, with unsteady winds, mostly from the S.W. The highest day temperature has varied from 75° to 94°; the lowest night temperature from 50° to 66°. On the 12th, at 3 p.m., there was a thunderstorm moving in a S.S.E. current. Wind before the storm N.W., shifting and blowing violently, as the storm drew nigh, through N.E., E., S.E., and when the storm had passed, to S.W., and so back to N. again. On the approach of the storm, the barometer rose from 29.98 to 30.00, fell as it passed to 29.98, rose again to 30.04, and when all was quiet once more fell to 29.98. On the 22nd, at 8 p.m., there began to rise a second storm, travelling slowly from the S.E., the wind being also S.E. Suddenly, as the storm approached, the wind sprang into a furious tempest, shifting slowly to S.W. There was but little rain, and the clouds seemed to break and travel both to the S.W. and N.E. of this spot; but at 11 p.m. the wind suddenly sprang up from the N.E., and blew furiously, with deluges of rain, vivid lightning, and terrific crashes of thunder. After the storm, there were light airs from N.E. and E. It is worthy of notice, that beyond the range of the storm, at sea, there was but little wind. On the 25th, 26th, and 27th, there was lightning at night in the distance, the clouds still moving from S. or S.E.

I have carefully recorded these facts about the wind, because I think that if we closely observe the conditions under which we get precipitation, the old loose talk (which, by the bye, Mr. Lowe renews, in a letter to the *Times*,) about excess of N.E. or S.W. winds in dry or wet seasons, is not tenable. Has there been this year any excess of N.E. and E. winds, over the average?—[We thought so. Ed.]—I cannot find it, and I think it is far more rational to betake ourselves to one of two theories to account for wet and dry seasons.

The S.W. wind comes to us, generally, laden with moisture like a saturated sponge, but not a drop falls, unless the hand, in the shape of the N.E. current, is close by to wring it out. Of course the difference of temperature between land and water, and especially in winter and near the sea, counts for something, but in the interior and in summer for zero. This theory is supported by another fact. When do we have heavy and long-continued rains and snows, lasting 12, 24, 36, aye 48 hours (one memorable April)? When are thunder-storms violent and continued? With S.W. and W. winds? No; we only get showers and short storms then. For heavy and continuous rains and memorable thunder-storms the wind must be N.E., E., S.E., and the clouds rising from some point between S.E. and S.W. Why then has there been an absence of rain this summer? Let us lay it to one of two causes. First, the tropical and polar currents may, this year, have been respectively occupying broad bands of country, the one excluding the other, instead of interpenetrating and struggling for the mastery; or, secondly, the S.W. comes to us this year without its

usual charge of moisture. Maury's theory is, that our S.W. winds are the S.E. trades, and if this be so, then we may hold that the amount of moisture which they drink up in the vast wastes of the southern oceans, varies in different years, from some as yet unknown cause, or that the load has been discharged almost wholly in the equatorial calms, or at any rate before arriving in our latitudes. Finally, as these two theories contain no contradictions, may we not hold them as *both* having influence and acting together? and this probably will be found to be the truth. It would be, therefore, highly interesting to have meteorological notes from the southern hemisphere.

What I object to is, the idea that the tropical current brings us *of necessity* rain *per se*. Whether the wind be polar or tropical, in a dry season, the weather is dry and the finest and hottest days are when we have gentle airs from the W. and S.W. The old country rhyme comes more near to the truth :—

“ When the wind's in the north,
The frost comes forth ;
When the wind's in the south,
It's in the rain's mouth ;
When the wind's in the west,
It is in the best ;
When the wind's in the east,
It's neither fit for man nor beast.”

Yours truly, T. L. LEWINGTON.

Royant, Charente Inférieure.

SOLAR RADIATION TEMPERATURES.

To the Editor of the Meteorological Magazine.

SIR,—Thanks to your note on “Solar Radiation Temperatures” in the last number of your magazine, and Mr. Stow's valuable letter on the same subject; the discrepancies between reading in the sun at different stations during the late hot weather, which perplexed so many of your readers, are satisfactorily explained; and, if Mr. Stow's concluding suggestions were generally adopted, might easily be avoided for the future.

But the whole subject of the proper position for thermometers, both in the sun and shade, is one which calls for immediate attention and settlement, if the observations now being so assiduously made throughout England are to have any comparative value.

When two Government Observatories give results differing on an average by nearly 50°, as shown by your correspondent, Mr. Taylor, it is not to be wondered at if the general public, who are not acquainted with the causes of such discrepancies, should place little confidence in meteorological observations, at any rate as regards the readings in the sun.

And even as regards shade temperatures, though in this department there is something more like an approach to uniformity, there is still great room for improvement. To take one instance from your own Table of Temperatures for July of this year, I see that your corre-

spondent at Cirencester, in Gloucestershire, makes the max. temp. for that month 75° , and the min. 59° . Now at nearly every other station in England the max. temp. is reported as above 90° , the lowest, with the exception of a few places in the extreme W. and N., being 88° . On the other hand, the min. at all other stations, with the exception of one in Cornwall, was below 50° , and in one instance below 40° . So that while all other stations show a range of from 40° to 50° , the range at Cirencester would appear to have been only 16° . I have no doubt that upon enquiry the true explanation of this apparent anomaly would be found in the fact that your correspondent at Cirencester places his thermometer in some artificial shade, probably the hall or passage of a house, where their indications, however valuable in themselves, are of course worthless for the purpose of comparison with the readings of instruments placed in the open air.

This is an extreme case. But even among those who use the thermometer-stands which have lately come into use, there is far from that uniformity which is desirable. It is evident that in many of these stands the thermometers read too high, owing to insufficient provision against the transmission of direct solar heat through the roof or back of the stand. In others, owing to the stand being too small, there is not a sufficient margin of shade, yet if these points were attended to, if all thermometer-stands were made with a double roof or back, with an interval between, [if filled in with some non-conducting material like saw-dust, so much the better], and if a sufficient margin of shade were allowed, which might be secured by all stands being made of a certain prescribed size and form, the readings of good instruments in such a stand would be unimpeachable, and that great desideratum—a uniform standard of comparison, would be secured.—I am, Sir, yours,
G. T. RYVES.

Nuthall, Nottingham, August 26th, 1868.

[Mr. Ryves' letter is much to the point. We have been favoured with another note from Mr. Stow which we hope to give next month having no room this. Our readers may rest assured none more earnestly desire uniformity than ourselves, but much care and numerous trials should always precede meteorological legislation. We do not think the question of the best pattern and mode of using solar radiation thermometers could be in better hands than Mr. Stow's.

Concerning Cirencester we plead guilty at once; we strongly suspect our correspondent has returned the maximum at 9 a.m., and the minimum at the same hour, in lieu of the monthly extremes, but whether this or Mr. Ryves' explanation is the true one, the readings are clearly incorrect.

Lastly, with respect to thermometer stands and boxes, we intend in our next to commence a series of articles (with engravings) descriptive of the most generally used forms, as introductory to an account of a series of experiments which our indefatigable ally, Rev. C. H. Griffith, intends commencing as to the results obtained in stands of different patterns.—Ed.]

HIGH TEMPERATURES, JULY 13TH TO 23RD.

THERE was at one time, but we believe there is no longer, some danger of meteorologists splitting into two schools, one bent upon taking the "mean" of everything, the other declaring "means" of no use, and that individual and synchronous observations were alone valuable. As is usually the case, there was *some* truth on each side, and *in media tutissimus*. For the investigation of storms and exceptional phenomena, individual observations, such as the following table contains, are alone of use. The map is self-explanatory, and the principal deductions from it and the table seem to be—

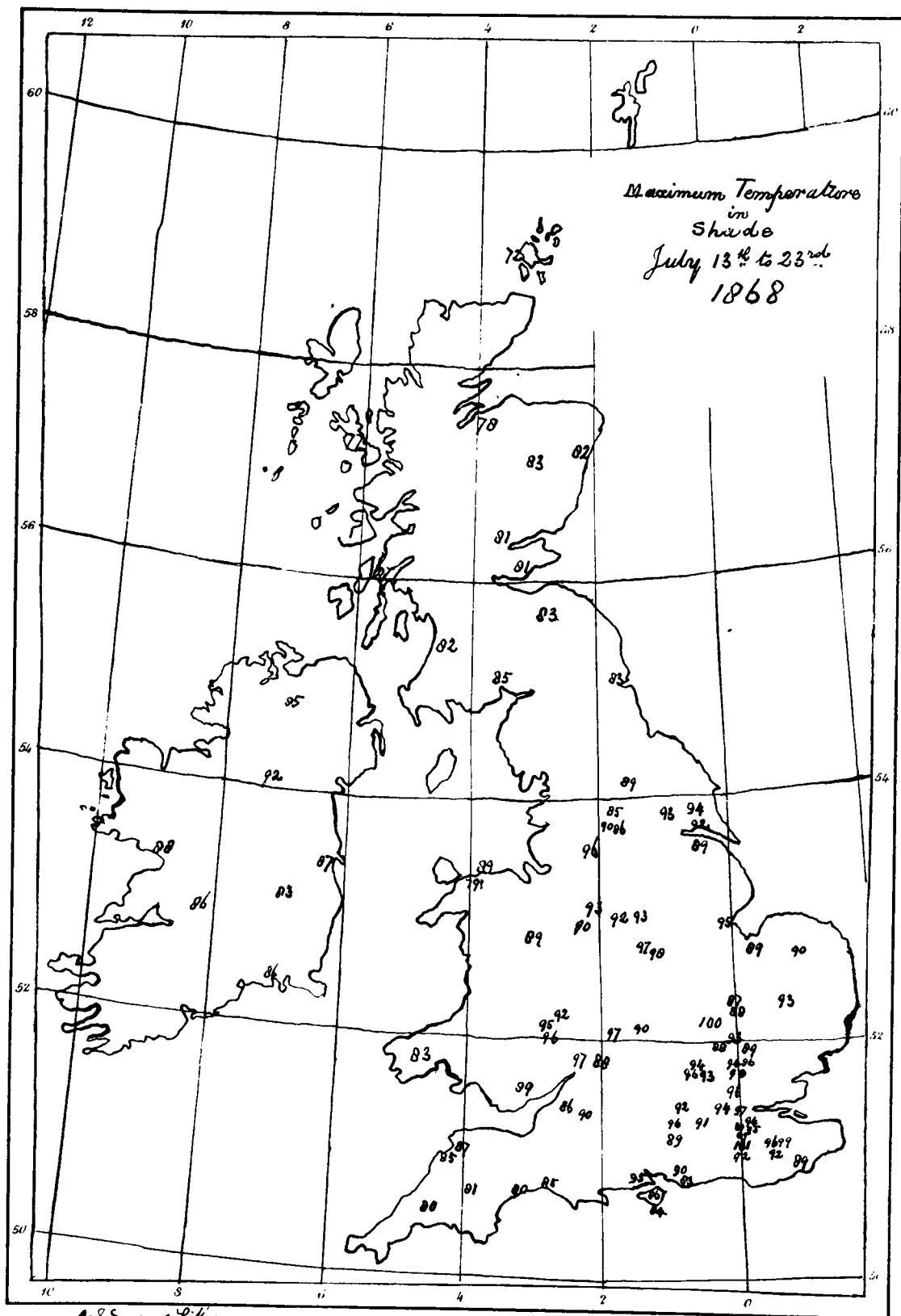
- I. That small differences of locality and in the position of the thermometers, cause greater variation in the temperature recorded than 100 miles of geographical position; compare, for example, the counties of Kent and York.
- II. That the highest temperatures are widely distributed; 95° or upwards, being recorded in most of the inland counties.
- III. That the date of the hottest day seems to have travelled eastward in a rather remarkable manner, being 13th in the W. of Ireland and N.W. of Scotland, 14th in the middle of Ireland and at one or two stations in Scotland and Wales; 15th on E. of Ireland, generally throughout Scotland and Wales, and at stations in Cornwall and Devon. The next hot day was the 21st, in the counties of Middlesex, Oxford, Cambridge and Stafford; the 22nd was hotter still at all other stations, except Worthing and Ventnor, where the maximum (such as it was) occurred on 23rd.
- IV. The lesson this table teaches is, "*Get ALL the thermometers tested, and mount them uniformly.*"

STATION.	OBSERVER.	MAXIMUM		Height above Sea.	THERMOMETER.	STAND AND REMARKS.
		TEMP.	DATE.			
MIDDLESEX—Camden Square	G. J. Symons, Esq.	93.3	21	115	Ver. Greenwich	"Glaisher" over grass.
Winchmore Hill	T. Paulin, Esq.	90.0	21	350 ?		
SURREY—Cobham (Pyports)	G. Dines, Esq.	91.4	...	66	Ver. Kew.	"Glaisher" on grass.
Wimbledon Camp	F. Pastorelli, Esq.	96.2	22	...		"Welsh" on lawn.
Sunningdale (Lynnwood)	Admiral Sir F. W. Grey	94.0	22	265		Shaded by trees and walls.
Upper Footing	D. A. Freeman, Esq.	93.0	22	...		"Glaisher" stand.
Clapham	H. Ruddle, Esq.	94.0	22	...		In garden, well protected from sun.
KENT—Hythe	H. B. Mackeson, Esq.	91.5	22	...	Not a standard.	Modified "Glaisher."
Cranbrook (Hartley)	G. Pile, Jun., Esq.	92.0	21, 22	352	Ver. Greenwich	Box stand, double, with venetian sides
Tunbridge Wells	Rev. F. W. Stow	92.4	22	403	Ver.	
Tunbridge	Dr. Fielding	100.5	22	71		
Staplehurst (Linton Park)	Mr. J. Robson	96.0	15, 22	296		
" (East Sutton)	Mr. Skinner	99.0	...	387		
Sevenoaks	Rev. J. B. Murdoch, ...	88.5	...	...
Bromley	Rev. A. Rawson	89.0	...	250	Ver. Greenwich	"Glaisher" over grass.
Greenwich Observatory	J. Glaisher, Esq. F.R.S.	96.6	22	159	"	Small do., do., near a path; exposed.
Beckenham (Parkside)	C. O. F. Cator, Esq.	95.0	22	157	"	"Glaisher" in large garden, several trees.
" (Fox Grove)	P. Bicknell, Esq.	93.8	22	142	"	Double roofed "Glaisher" over grass.
SUSSEX—Hastings (Ore)	T. H. Morgan, Esq.	89.0	22	360		

STATION.	OBSERVER.	MAXIMUM		Height above Sea.	THERMOMETER.	STAND AND REMARKS.
		TEMP.	DATE.			
SUSSEX—Worthing	W. J. Harris, Esq.	83·0	23	17	Ver. Greenwich	Modified "Stevenson" over grass.
HAMPSHIRE—Isle of Wight (Ventnor)	Dr. Martin	84·0	23	150	" "	Penthouse, approved by Mr. Glaisher.
Isle of Wight (Newport)	Mr. E. G. Aldridge	86·4	22	53	Standard.	In a well ventilated hut.
Lymington (Wainsford)	H. Fawcett, Esq.	94·5	22	82	Ver. Kew.	Modified "Lawson."
Havant (Leigh Park)	W. H. Stone, Esq. M.P.	90·0	22	110	" "	"Glaisher" on grass.
Alton (Selborne)	T. Bell, Esq.	89·0	22	400	" "	Hangs facing N.N.E.
Strathfield Turgiss	Rev. C. H. Griffith	95·9	22	209	" "	Modified "Lawson."
BREKSHIRE—Maidenhead	W. Lessell, Esq.	92·0	...	90 ?	" "	
Wantage	E. C. Davey, Esq.	84·0	21	185	Ver. Greenwich	Against a garden wall facing N.
HERRS—Berkhamstead	W. Squire, Esq.	93·7	22	361	" "	"Glaisher" stand in garden.
Hitchin	W. Lucas, Esq.	88·0	22	238	" "	On N. wall, 5 ft. above ground.
OXFORD—Banbury	T. Beesley, Esq.	90·0	21	350	" "	{ In W. angle of a window facing N., 16 ft. above ground.
CAMBRIDGE—Cambridge (Emmanuel Col.)	J. G. Wood, Esq.	86·5	21	...	Six's.	N. side of house.
Cambridge (Beech House)	J. Nutter, Esq.	88·0	22	40	Ver. Greenwich	"Glaisher," very open position.
Abington Pigotts [Royston]	G. Pigott, Esq.	99·9	21	130	" "	In very shady part of garden.
ESSEX—Epping	H. Doubleday, Esq.	96·0	22	360	" "	"Glaisher" stand.
Harlow (Moor Hall)	Mr. Huntley	94·0	22	189	Ver. Kew.	"Stevenson" on grass.
Dunmow (High Roding)	Rev. E. Maxwell	89·0	...	252	Ver. Greenwich	On lattice, 3 in. from wall facing N.
Saffron Walden (Audley End)	Mr. Bryan	92·6	21	140	" "	"Lawson."
SUFFOLK—Bury (Culford)	Mr. P. Grieve	93·0	22	84 ?	Ver. Kew.	{ On a board fastened by wooden blocks to N. side of a stable wall.
NORFOLK—Dereham (Mattishall)	Rev. J. M. Du Port ..	90·1	22	165	" "	Under a thatched eave facing N.
Lynn (Hillingham)	Rev. H. Ffolkes	89·0	22	93	" "	Well shaded.
Dorset—Bridport	A. Stephens, Esq.	85·0	...	80	Ver. Kew.	On a boarded stand, shaded by trees.
DEVON—Dartmoor	Mr. Watts	81·0	...	1400	" "	"Glaisher," 5 ft. above flower bed.
Sidmouth (Belgrave)	Dr. Mackenzie	80·2	15	26	Ver. Kew.	Double boarded stand.
Bideford (Northam)	Rev. I. H. Gossett	84·5	14	173	" "	Treble boarded stand.
Barnstaple	T. Mackrell, Esq.	87·4	15	31	Ver. Greenwich	{ In double frame penthouse, open to N., 5 ft. above ground.
CORNWALL—Bodmin	Captain Liddell, R.N.	79·5	15	325	" "	"Lawson," venetian in front.
SOMERSET—Bath (Paragon)	Dr. Barter	89·8	22	113	Ver. Kew.	
GLOUCESTER—Bristol (Frenchay)	F. F. Tuckett, Esq.	86·0	15	...	" "	
Newent (Boyce Court)	General Drummond ..	88·0	...	133	Ver. Kew.	
HEREFORD—Ross	H. Southall, Esq.	97·0	22	200 ?	" "	
Hereford (Richmond Place)	E. J. Isbell, Esq.	96·1	22	200	Ver. Kew.	
Leominster (West Lodge)	E. P. Southall, Esq.	94·6	22	229	" "	
SHROPSHIRE—Shifnal (Haughton Hall) ..	Rev. J. Brooke	90·0	22	353	Ver. Greenwich	
Oswestry (Hengoed)	Rev. A. R. Lloyd	89·0	21	471	" "	
STAFFORD—Stone (Barlastone)	W. Scott, Esq.	92·5	21	530	" "	
WORCESTER—Evesham (Lansdowne)	R. Burlingham, Esq.	97·3	22	120	Ver. Greenwich	

HIGH TEMPERATURES, JULY 13TH TO 23RD—(continued.)

STATION.	OBSERVER.	MAXIMUM		THERMOMETER.	STAND AND REMARKS.
		TEMP.	DATE.		
WORCESTER—Tenbury (Orleton)	T. H. Davis, Esq.	92·2	22	Ver. Greenwich	“Glaisher,” not very good position.
LEICESTER—Wigston	T. Burgess, Esq.	93·0	15, 22		
Lancaster (Belmont Villas)	H. Billson, Esq.	96·7	22		
LINCOLN—Boston	Dr. A. M. Adam	94·5	22		
Ulceby (Killingholme)	Rev. J. Byron	89·0	...	60	Louvre box, painted white, over grass. “Lawson” stand. “Glaisher” stand. “Glaisher” stand. { On two stout posts, facing N., a good thick shade above. “Welsh” on open lawn.
NOTTINGHAM—Nottingham (Nuthall)	Rev. G. T. Ryves	93·0	22	...	
DERBY—Derby	J. Davis, Esq.	92·0	22	180	
LANCASHIRE—Manchester (Old Trafford)	G. V. Vernon, Esq.	95·5	15	106	
YORKSHIRE—Huddersfield (Fartown)	Captain Clichester	86·0	22	...	
Huddersfield (Nortonthorpe)	A. M. Box, Esq.	90·0	22	475	
Hallifax (Willow Hall)	L. J. Crossley, Esq.	85·0	22	630	
Ripon	Rev. F. W. Stow	88·7	15	110	
Hull (Beverley Road)	J. Smith, Jun., Esq.	91·8	22	11	
Holme on Spalding Moor	G. Dunn, Esq.	93·3	22	30	
Beverley	T. Dyson, Esq.	94·0	“Glaisher’s.”
NORTHUMBERLAND—N Shields (Kosella-pl.)	R. Spence, Esq.	83·3	22	124	
WALES—Cardiff (Penttyrch)	F. G. Evans, Esq.	89·0	15	100	
Haverfordwest	E. P. Phillips, Esq.	83·1	14	85	
Llandudno	Dr. Nicol	88·6	15	99	
Llanfairfechan	T. Paulin, Esq.	79·0	15	...	
DUMFRIES—Dumfries (March Hill Cottage)	Mr. T. Hogg	84·5	15	70	
ROXBURGH—Galashiels (Wooplaw)	J. Murray, Esq.	83·0	15	880	
AYR—Auchendrane	E. Cathcart, Esq.	82·0	15	96	
FIFE—Leven (Nookton)	W. McG. Miller, Esq.	81·0	15	80	
PERTH—Deanston (Stirling)	J. Finlay, Esq.	81·3	15	130	Double louvre boarded box.
ABERDEEN—Ballater	J. W. Paterson, Esq.	83·0	14, 15	656	
Aberdeen (Grammar School)	Rev. A. Beverley	82·1	21	96	
INVERNESS—Culloden	A. Forbes, Esq.	78·1	15	104	
Portree	Mr. J. Grant	77·2	13	60	
ORKNEY—Sandwick	Rev. Dr. Clouston	71·6	15	78	
IRELAND—Waterford	Mr. R. J. Greer	86·0	14	60	
Killaloe	Rev. C. Mayne	86·0	14	123	
Portarlington	Dr. Hanlon	83·0	14	236	
Monkstown	A. Pim, Esq.	87·0	15	100	
Galway	Professor Curtis	88·0	13	25	“Glaisher’s.”
Bawnboy (Owendoon)	G. H. L'Estrange, Esq. ..	92·0	14	218	
Strabane (Leekpatrick)	Rev. C. Maxwell	85·0	14	260	



E. J. Symons Litho.

THUNDERSTORM OF JULY 11TH AND 12TH.

To the Editor of the Meteorological Magazine.

SIR,—In compliance with the wish expressed in your August number, that persons in the districts of the old ironworks in Surrey or Sussex should send reports of any accidents by lightning during the thunderstorms of July 11th and 12th, I write to inform you that three oak trees were struck by lightning in an area of about a square mile, between the Parish Church of Ewhurst and the sand hills north of it. There is scarcely a farm house in the neighbourhood without an iron fireback, and tradition says these were cast in the parish sometime in the 16th and 17th centuries from iron derived from the sandstone of our hills. I am also told that a farm-house was set on fire at Loxwood on the borders of Sussex. There are several features in the thunderstorm which I think are worth recording,

1. The storm came up from the north-east, precisely the opposite direction to other thunderstorms that have occurred at Ewhurst in the twelve years that I have resided there. Thunderstorms usually come up from the S.W. and go round to the N. or N.E., by Hosham and Guildford or Aldershot avoiding our hills.

2. The flashes, as mentioned by Mr. Ingram at Steyning, were often of immense length with numerous forks, and mostly horizontal and very high in the sky, so that no thunder was heard to accompany them.

3. I also distinctly noticed a diffused roseate hue in the N.E. up to about 25°; it is not mentioned by anyone except an observer at Guildford. It suggested to my mind the probability that the flashes which produced it were very high in the air, the tints having an auroral character similar to the colours in a Gassiot tube.

4. Two oak trees were struck—or at least the bark stripped off their projecting roots—without the trees being themselves touched. One of the trees was within a quarter-of-a-mile of my house, the other at Lyne Park, in the parish of Capel.—I am, Sir, yours truly,

J. PARK HARRISON.

Ewhurst, Surrey, August 26th, 1868.

The amount of rainfall in the two days was—11th, 1.36 in., 12th, 0.91 in., total, 2.27 in. On the hills it was about 3 in.

RADIATION THERMOMETER AT SOUTHAMPTON.

To the Editor of the Meteorological Magazine.

SIR,—In reply to Mr. Taylor's question, I have to say that the solar thermometer at the Ordnance Survey Office, Southampton, is not in vacuo, and is elevated (perhaps 12 or 18 inches) above the ground. The Greenwich instrument, on the contrary, has a vacuum jacket, and is placed on the grass.—I remain, truly yours,

E. G. ALDRIDGE.

Alma House, Newport, I. W., August 18th, 1868.

AUGUST, 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.	ENGLAND.	Camden Town	2.28	+ .64	.53	17	10	88.2	5	46.0	26	0
II.		Staplehurst (Linton Park) ...	2.30	— .41	.48	11	12	90.0	5	45.0	25*	0
		Selborne (The Wakes).....	3.89	+ .71	1.17	17	13	82.5	4	44.0	2	0
III.		Hitchen	4.81	+ 2.46	2.22	19	16	81.0	5	46.0	25†	0
		Banbury	3.64	+ 1.51	.95	18	13	87.0	4	45.0	1	0
IV.		Bury St. Edmunds (Culford) ..	1.98	— .46	.66	6	8	88.0	5	42.0	25	0
V.		Bridport	4.61	+ 2.02	1.20	17	13	82.0	4, 5	42.5	26	...
		Barnstaple	4.68	+ .49	1.47	18	16	85.0	4	44.5	2	0
		Bodmin	4.03	+ .17	.71	21	21	74.0	5	49.0	1	0
VI.		Cirencester .....	...	...	...	...	...	...	...	...	...	...
		Shifnall (Haughton Hall) ...	3.78	+ .91	1.34	18	14	86.0	3, 4	46.0	24	0
		Tenbury (Orleton)	4.60	+ 1.72	.91	18	20	89.6	4	42.0	1	0
VII.		Leicester (Wigston) .....	...	...	...	...	...	...	...	...	...	...
		Boston	3.29	+ 1.00	.93	18	11	88.0	5	48.0	28	0
		Gainsborough .....	...	...	...	...	...	...	...	...	...	...
		Derby	3.14	+ .54	.44	22	16	89.0	4	46.0	26	0
VIII.		Manchester .....	...	...	...	...	...	...	...	...	...	...
IX.		York	2.56	— .15	.62	22	11	85.0	5	46.0	25	0
		Skipton (Arncliffe) ...	6.52	+ .58	1.05	25	20	80.0	6	48.0	31	0
X.	North Shields	1.88	— .97	.54	22	12	77.8	1	45.0	31	0	
	Borrowdale (Seathwaite) .....	...	...	...	...	...	...	...	...	...	...
XI.	WALES.	Cardiff (Town Hall).....	6.46	...	1.40	18	9	...	...	...	...	...
		Haverfordwest	3.48	— 1.40	1.50	21	10	83.6	3	45.0	28	0
		Rhayader (Cefnfaes).....	4.38	— .28	1.30	6	14	84.0	...	43.0	...	...
		Llandudno	1.73	— 2.09	.46	22	14	93.0	4	50.5	25	0
XII.		Dumfries	4.73	+ .85	1.21	13	21	88.0	4	43.5	31	0
	Hawick (Silverbut Hall) ...	4.19	...	1.67	22	15	...	...	...	...	...
XIV.	Ayr (Auchendrane House) ...	6.16	+ 2.19	1.66	13	23	85.0	4	44.0	9	0	
XV.	Castle Toward	6.69	+ .39	1.28	11	23	82.0	2	39.0	27	0	
XVI.	Leven (Nookton)	3.92	+ .93	1.10	22	13	81.0	2	45.0	...	0	
	Stirling (Deanston)	6.46	+ 1.84	1.72	13	22	84.0	4	42.0	31	0	
	Logierait	4.81	...	1.23	11	15	...	...	...	...	...
XVII.	SCOTLAND.	Ballater	5.88	...	2.25	13	14	84.0	2	38.0	31	0
		Aberdeen	6.94	...	2.45	11	13	80.7	2	44.0	31	0
XVIII.		Inverness (Culloden)	6.62	...	2.22	14	13	81.1	4	46.4	20	0
		Fort William	10.90	...	1.40	11	22	...	...	...	...	...
		Portree .....	...	...	...	...	...	...	...	...	...	...
	Loch Broom	8.26	...	1.95	11	18	...	...	...	...	...
XIX.	Helmsdale	4.70	...	1.50	14	12	...	...	...	...	...
	Sandwick	5.32	+ 1.61	1.28	11	20	68.5	3	43.1	11	0	
XX.	Cork	5.92	...	3.07	12	13	...	...	...	...	...
	Waterford	6.39	+ 2.44	1.54	12	15	80.0	3	48.0	29	0	
	Killaloe	5.80	+ .87	1.58	12	22	82.5	3, 4	39.0	29	0	
XXI.	Portarlinton	4.09	— .41	1.23	13	21	80.0	2	41.0	20	0	
	Monkstown	4.50	+ 1.29	1.37	12	15	...	...	...	...	0	
XXII.	IRELAND.	Galway	3.93	...	1.38	21	19	82.0	2	38.0	27	0
		Bunninadden (Doo Castle) ...	3.80	...	1.20	21	20	78.0	2	34.0	20	0
XXIII.		Bawnboy (Owendoon)	4.84	...	1.25	21	21	85.0	2	39.0	19	0
		Waringstown	4.45	...	1.16	13	17	88.0	4	38.0	19	0
	Strabane (Leckpatrick)	5.14	...	1.65	13	20	84.0	3	36.0	20	0	

* And 26th. † And 27th.

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

METEOROLOGICAL NOTES ON THE MONTH.

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

ENGLAND.

LINTON PARK.—First week hot and dry, latter part of month dry and fine; winds various. The month on the whole may be regarded as an average one for August, the early ripening of the corn being due to the preceding hot and dry months. The TS on the morning of the 11th was sharp and very near, there being two storms about an hour apart. The wind was very high on the 22nd, and until midday on the 23rd, doing much damage to the hops and fruit.

SELBORNE.—Wind on 22nd and 23rd did immense damage to the hops; one farmer estimates his loss at £800. L on 9th and 15th.

BANBURY.—High wind on 22nd.

CULFORD.—The rain we have had has greatly improved the face of the country, although the pastures have not yet got their wonted colour, and more rain is anxiously looked for. Young potatoes are fast forming from the tubers produced early in the spring, and if the autumn prove favorable, these will be of more value than the early formed ones. T on 11th.

BRIDPORT.—Very heavy S.W. gale sprang up at 1 a.m. on 22nd, continuing the greater part of the day; the sea very rough; 1.20 in. of R fell on 17th, chiefly in the night.

BARNSTAPLE.—22nd, storm began at noon; several wrecks in Barnstaple Bay.

HAUGHTON HALL.—Heat most oppressive till the 6th, when we had T and heavy R, but as hot as before, when it cleared off; on the 11th R in earnest, and was most acceptable, the harvest being well secured in beautiful condition, and wheat quite an average crop, if not more. On 20th, the swedes sown two months since began to vegetate in spite of the baking, but too late to do any good; potatoes a very poor crop and all "ackerspit" as it is called here—that is, growing again from the tubers first formed; mangold have grown and borne the heat better than any other root crop. Two sulphur butterflies seen on 2nd, painted lady butterfly on 10th; leaves falling like autumn on 7th; wasps still scarce; mushrooms very plentiful on 21st; damsons and apples plentiful; after the 18th the pastures, before brown as stubble, became green as if by magic.

ORLETON.—The first five days intensely hot and dry; the grass land burnt up; harvest nearly finished; heavy R with some T on 6th, followed by a lower temp. and damp atmosphere, with frequent R, which in eight or ten days produced a magical change in the grass land; the last three days again fine and hot; mean temp. of month about 2° above the average. TS on 11th and 18th. Violent wind after 9 a.m. 22nd.

DERBY.—The rain has been above the average, but it will require much more to make up for the past drought, though the effect of what has fallen is marvellous.

YORK.—TS on 11th at 10.30 a.m., and on 15th from 3.40 to 4 p.m.

SHIELDS.—Much cloud. Two TSS on 5th, two on 6th, T on 15th.

WALES.

HAVERFORDWEST.—The first week the intense heat continued, the 3rd being the hottest day of summer; from the 6th to the end of the month the weather very broken and stormy, especially on the 17th and 22nd, on which day it blew a fearful gale, with torrents of rain. Harvest all got in and in splendid order, the earliest known for many years.

CEFNFAES.—A pleasant month, the rain most beneficial; a very heavy R for 20 minutes about 3 p.m. on 6th. [1.30 in. entered on that day; did it all fall in that time?—ED.]

LLANDUDNO.—4th, warmest day of the season; at about 1 p.m. dry bulb 91° and wet 71°. On 22nd wet and stormy after 3 p.m.

SCOTLAND.

DUMFRIES.—Beginning of month very hot, the remainder showery with strong winds. T on 7th, 11th, and 15th. Country very brown at the beginning, but fresh and green towards the end; harvest mostly secured before the end of the month.

SILVERBUT HALL.—The first five days sultry, fine change with TS on 6th; T and L on 14th and 15th, fine lunar rainbows on the 9th and 17th. This month on the whole has been good for the country, the crops in general have turned out well, except the potatoes, which are fingering.

AUCHENDRANE.—This August has been warm and wet, and consequently a bad harvest month; the soil at 3, 12, and 22 in. depth was 2° above the mean August temp. for soil for the last three years; the mean height of gauge in river still remains low 2 standard being 9; the sky much overcast, especially at night; wind moderate except on 22nd.

CASTLE TOWARD.—The month began hot and dry for a few days, then a week of fine mild showers, the temp. falling 4° or 5° every day till the 11th, when 1·28 in. of R fell in 24 hours.; R with T from 1 to 6 p.m. on 15th, on which day the harvest began, but the weather has been rather wet for securing the crops.

DEANSTON.—The fine, warm, dry weather ceased on the 4th, after which time dull and rainy. Only 146 hours of sunshine, while there were in June 300, and July 291 hours; in four days, 11th to 14th, 3·73 in. of R fell. Grain crops all cut but not all carried, young tubers growing from the potatoes.

BALLATER.—A large meteor at 9 o'clock on 10th. A very gratifying change of weather from the dryness of the previous three months; a great improvement in the grass and green crops.

ABERDEEN.—Fogs on 11th to 16th, after which a little potatoe blight. R much above the average, but, from having principally fallen on three days, the month may be considered a dry one. Harvest has been begun and very nearly finished (in good condition) in the course of the month, a thing almost, if not altogether, unprecedented in this quarter; the R has saved the turnips; grass is recovering with great rapidity; vegetation is as active as if it were spring. T on 5th, 7th, 11th, and 19th; TS on 6th and 22nd.

ROSSE PARSONAGE.—Very fine weather occasionally in the early part of the month, but very wet and coarse in the latter part. TS on 9th; nearly half the R fell on four days; the total fall is nearly double the average falls of the corresponding month in the three preceding years.

LOCH BROOM.—The month began with beautiful weather, but by the time the corn began to be ripe the R appeared, and though now much is cut not a sheaf is yet bound; the month has, on the whole, been an unpropitious one to the farmer as July was to the grazier.

SANDWICK.—August has been much wetter than the mean, and rather warmer; the crops are good and they are now being cut down earlier than usual.

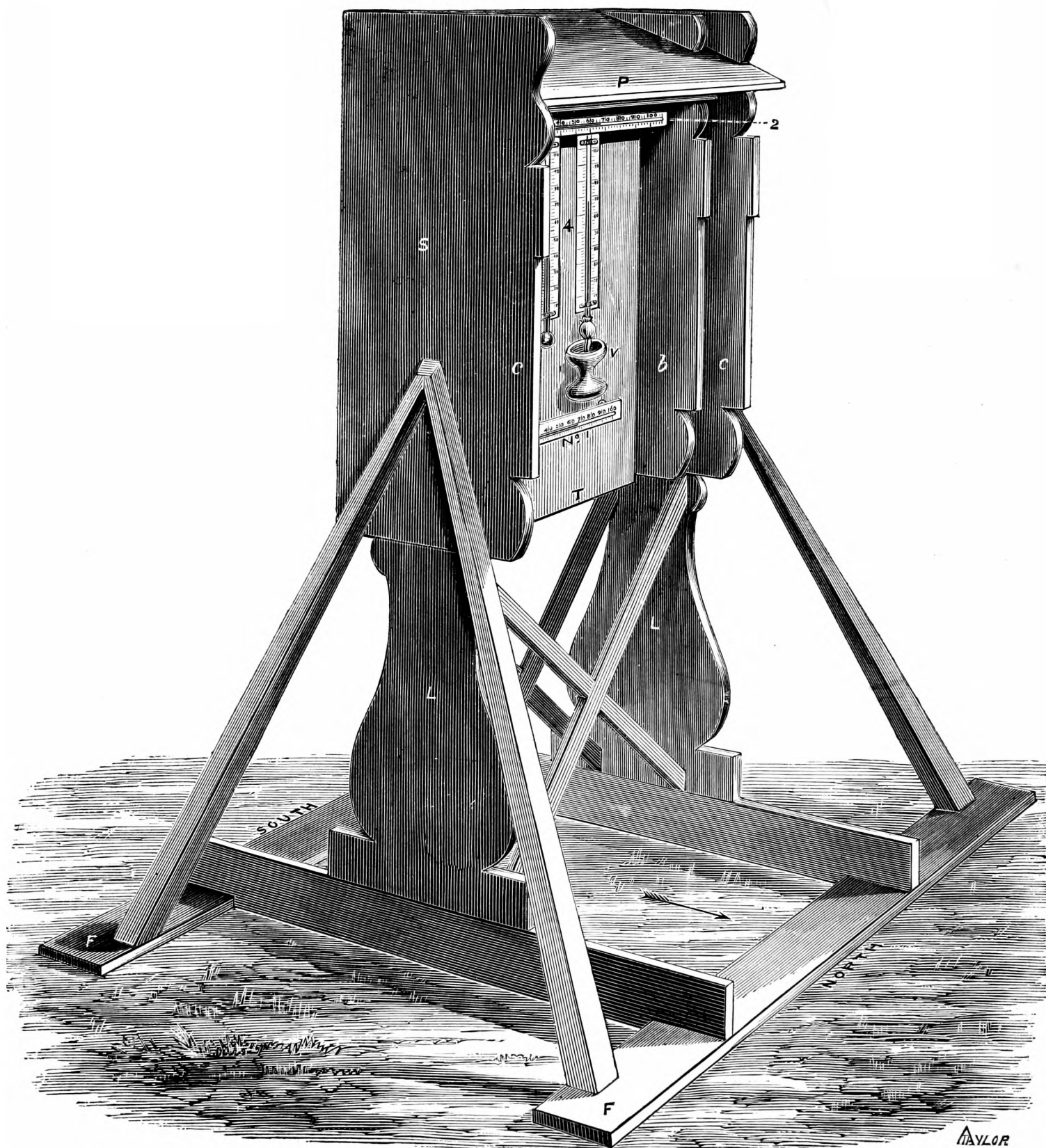
IRELAND.

DOO CASTLE.—Remarkably fine month with a fair supply of R evenly distributed over it. Harvest fully three weeks earlier than usual; hay and oats harvested without the slightest drawback from unsettled weather. Temp. high at the beginning, but lowering towards the end.

OWENDON.—This month has been most favorable in every respect. TS on 8th and 10th, T on 7th and 16th.

WARINGSTOWN.—R commenced on the 5th, but not in sufficient quantity to do any good till the 10th; the spring of grass very rapid after that date. Harvest all in haggard [? stack] and thatched at least six weeks earlier than usual.

LECKPATRICK.—The long drought came to an end on the 5th; cutting oats commenced at that time. The latter part of the month was unfavourable for gathering the harvest. This was the wettest August since 1862; more rainfall than during the previous three months.



LAWSON'S THERMOMETER STAND.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXXIII.]

OCTOBER, 1868.

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THERMOMETER STANDS AND SHADE TEMPERATURE.

OUR readers will recognize in the above a subject by no means novel to these pages, and upon which it is of vital moment that uniformity should prevail. The absurd position of many thermometers in the present day is but the perpetuation of the anarchy which Lawson vividly sketched in his scarce, privately printed, work on "The Arrangement of an Observatory for Practical Astronomy and Meteorology."

"I had often been led to doubt the accuracy of comparative observations between thermometers that were placed at a distance from each other, and particularly when the circumstances of their exact position as to height from the ground, or distance from the wall, or other localities were unknown. On conversing with my meteorological friends as to the indications of their thermometers, and the situations they respectively occupied with regard to shade, &c., I found that the variations or differences between my thermometers and theirs were often much greater than the circumstances of the day or weather seemed to warrant; I was, therefore, led to enquire whether the temperatures of the shady places, *or places so called*, on which the instruments had been fixed were at all in unison with each other, and I found that scarcely any observations had been made with thermometers placed under exactly similar circumstances, and without which unity no deductions can be drawn with any claim to accuracy. Some thermometers faced the north, some the north-east, some the north-west, &c., &c. Some were from three to five feet from the ground, some ten to twenty; some were embowered, some placed in a box, some sheltered by a high house or wall, some by a low wall, or by palings, some touching a wall, and others distant from it; some were in a angle of a high building (cool as a cellar), some exposed to the sun's rays either morning or evening."

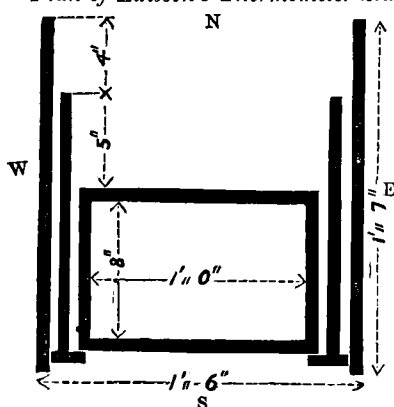
In order to realize the fact that matters are *now*, in many cases, as bad as they were in 1843, it is only necessary for our readers to refer to our last number, or, better still, for them to follow Mr. Lawson's example, and converse with their meteorological friends as to the position of their thermometers. We shall be much surprised if the slightest examination does not convince *all*, how imperatively necessary it is that the subject should receive thorough and accurate examination.

We think a moment's reflection on the almost infinite variety of houses and grounds belonging to the numerous observers, in this and other countries, will demonstrate indisputably that a thermometer stand must be used; if, however, any persons are of a different opinion we shall be happy to record their views.

Assuming, in the interim, that a thermometer stand is accepted as

indispensable, our difficulties have only commenced, for the varieties of stands are almost as numerous as the stands themselves, though they are mostly resolvable into modifications of Glaisher's, Lawson's, and Welsh's, and of their comparative advantages or frequency of adoption absolutely nothing is known. We have devoted considerable care to the investigation of the original designs and the successive modifications they have subsequently undergone, and believe that in this and subsequent articles we shall do greater justice to the various stands than their designers have done, *e.g.*, Mr. Lawson's stand has been lithographed once, in his own book, and engraved twice, *viz.*, in the *Quarterly Journal of Meteorology* and in *Orr's Circle of the Sciences*, and all three represent it incorrectly, the last two reproducing the inconsistencies of the original lithograph.

Plan of Lawson's Thermometer Stand.



The stand, as designed about 1840, by Mr. Lawson, is accurately represented in the accompanying engraving and plan. The whole of the wood-work was to be $\frac{1}{2}$ -inch, deal painted white, the extreme height six feet three inches, the space between the double sides three-quarters of an inch; other dimensions can be taken from the drawings. The flat boards FF may be weighted or pegged to secure firmness, the legs LL are merely prolongations of the sides s c and c, the duplicate sides are kept apart by small blocks of wood, through

which the screws pass, P is a sloping double roof to throw off the rain, No. 1 is the maximum thermometer, No. 2 the minimum, Nos. 3 and 4 the dry and wet bulb. It will readily be seen that the projection of the sides is such that it will be very rare for the sun's rays to reach the bulbs, even by reflection.

Reference was made last month to a series of experiments on various forms of thermometer stands which will shortly be commenced; it can hardly be necessary to state that their object is the determination of the best form of stand for general adoption, and the influence of the various patterns on the results recorded. Now, therefore, is the time for any suggestions on the subject to be brought forward; obviously we can neither undertake that every plan shall be described at length, nor engraved, nor constructed for trial against others, but we do guarantee careful and impartial consideration of all. Need we, in conclusion, point out to those who may favour us with designs, that accurate drawings or photographs are preferable to pages of descriptive matter, and that, if practicable, they should also state the cost.

METEOROLOGY AT NORWICH.

(Continued from page 124.)

Padre Secchi read the following interesting paper "On some Meteorological Results obtained in the Observatory at Rome":—

Meteorology is a local as well as a general science, but some of its problems cannot be resolved until each single station has already thoroughly fixed what belongs to its own climate. Under this condition only shall we be able to institute a comparison between different places for discovering what is the relation which exists between the meteorological variations in different countries, and whether there are changes which are strictly periodical or not. When we compare in meteorology what is going on in different countries, we find a relation of two kinds, one of opposition, the other of similarity. The cases of opposition are not very rare, and in this year while summer was hot and dry in higher latitudes of Europe, it was wet and rainy in Rome, contrary to the ordinary rule. These opposite results are probably due to the same origin, that is to a different limit which has been reached by the aerial currents in this year in comparison with other years. But to establish this fact we have not yet sufficient grounds, and further researches are necessary. I thought, therefore, that the comparison would be easier in the department of similarity, and I proposed to myself the investigation as to whether certain storms which are said to be periodical at the same time of the year are really so. As these storms are generally accompanied by a great variation of temperature, I took this element as the basis of discussion. I had therefore reduced the temperature observations made at our observatory during the last forty years, in order to obtain the mean temperature of each day, free, if possible, from every accidental irregularity, and as these observations have been made with great care by diligent observers, I think the result will be perfectly trustworthy. The result has been calculated for the hour of noon from the year 1828 to 1867. Particular tables give the partial results for each five years. Simple inspection of the curve drawn after the figures of the table shews that even after so long a period of years, no regular curve is obtained, but only an irregular polygon. Now the question arises, is there any probability that by increasing the number of years we may arrive at a perfectly smooth and regular curve? Certainly if these variations are due only to chance they will disappear by increasing the number of years, because these changes being now in anticipation and now in *retard*, they will compensate one another, but if there are physical causes acting periodically, we shall never be able to eliminate them. Besides, if they are only local and accidental variations, they will be peculiar to one place only, but not to a large country. We have, therefore, a double means for discovering their real origin. The length of time is, unfortunately not at our disposal, since before the last forty years the observations were made with much less care than now, and they are not available for comparison with the present ones. But we can compensate for this want of long period of obser-

vations in another way. The best plan is that introduced by Mr. Bloxam, that is to combine the numbers so that each day would result from the mean of the five nearest days, so that the mean of 1, 2, 3, 4, 5, January, may be regarded as the result for the 3rd; 2, 3, 4, 5, 6, as the result for the 4th, and so on. By doing so we eliminate the accidental changes which proceed from irregular causes to the extent of five days, which may be admitted as a usual period during which meteorological causes may extend their action. Now the result is, that even after this operation no regular curve is obtained. Therefore we are induced to conclude that some of these most remarkable inflexions are not accidental, but connected with some periodical influence. To see how far this conclusion was supported by facts observed at other stations, a comparison was made between Rome and those meteorological stations of Europe, for which we have a similar calculation. Similar tables were formed for the following series of stations:—

Rome.....	40	years	1828	...	1867
Bologna (Italy)	45	„	1814	...	1858
Vienna (Austria).....	90	„	1775	...	1864
Prague	40	„	1800	...	1839
Paris	41	„	1806	...	1848
Brussels	30	„	1833	...	1862
Berlin	110	„	—	...	—
Greenwich ...	45	„	1814	...	1858

The series of curves is exhibited in a plate, and shows that even after centuries of observations no smooth and regular line can be obtained. Comparing together these curves, we find a full evidence that there are some periodical causes acting very strongly, because at certain periods of the year the inflexions of the curves are common almost to all the stations. One of the most remarkable of these inflexions is that of April 10th, when both in Rome and Bologna there is a *fall* of one degree in the mean temperature, but which in reality represents a fall of seven degrees. This variation can be traced up to Greenwich, with a little anticipation of a few days, which is of the same character as that which we usually find in the propagation of storms. Another very distinct fall is that of July 26th, which is very strong in Italy, and is visible with the same anticipation in the west of Europe. It is, however, to be observed that the mid-land stations of Vienna, Prague, and Berlin seem to be less affected. A very strong elevation of temperature is to be observed all through Europe on the 1st of May, while a great depression takes place after the 10th. This depression, however, although very strong in the northern parts of Europe, is scarcely sensible in Italy. The 10th of January, 30th of June, 28th of September, and 13th of December, are also remarkable periods for diminution of temperature, as July 15th, August 5th, and November 30th are days of sensible elevation. No doubt the real origin of these variations is the position of the sun and the distribution of its heat on the earth, considered not only according to the celestial declination of that luminary, but chiefly in

relation to the portions of the earth's surface to which its rays are perpendicular. So, for instance, I have noticed that when the sun passes vertically from the broad ocean, over the continent of Africa, in the latitude of Guinea, we have always a strong change of temperature in Southern Europe. These strong variations of temperature take place always in consequence of great storms, and I have no doubt that the periods which are observed in these will be found to correspond with the positions of the sun vertically to certain portions of the earth's surface of a particular character. However, I think that we must also take into consideration the successive propagation of aerial waves, which introduces a considerable variation of the days in which this change becomes sensible in any particular place. And here I am naturally brought to say something about the propagation of the principal storms throughout Europe, especially between England and Italy. After the institution of the telegraphic international correspondence through Europe, I began to follow the track of the great storms which reach the Roman sea-coast. Attention paid to the telegraphic meteorological despatches, to the state of the barometer, and to magnetical instruments, persuaded me that we felt in Rome several of the greater storms which had appeared in England and Scotland, and that they reached us about two days after. A more accurate study of the track of the storms through France and Switzerland confirmed this induction. Now I arrived at the general rule that the barometer at Nairn in Scotland is the best indicator of future state of the weather in Rome for two days after, and I always keep that station as a most interesting landmark for a storm menacing Rome. The time employed by a storm to make this voyage is commonly two days, of which time a great part is traversing the Alps, this chain of mountains diminishing its speed, and often dividing a large storm into two or more partial storms. The late Professor Matteucci confirmed this result, and I am so sure of it that I suggested to that statesman to obtain a constant careful indication from Nairn or any station near it, in order to foresee the storms of the Mediterranean. I said that an advertisement of the approaching storm was also obtained through magnetical instruments. This is indeed a most important fact, and which, about ten years ago, gave me the key for understanding the very strange changes exhibited, especially by the horizontal force magnet. After much labour I finally came to the conclusion that a very great storm affected the magnetical instruments more or less, and that the magnetical disturbance anticipated in Rome, commonly by one day, the arrival of the storm. There had been a good deal of opposition in England against this conclusion, because no similar correspondence has been found to take place there. But 10 years constant observation, and a practical rule which has been already formed in our observatory for this purpose, persuade me that the fact is real, and if not general, we might look for an explanation, but must not deny it where it has been carefully observed. In France M. Marie Davy has verified my conclusion and accepted it. It is for us a constant fact that, when in Rome a fine, steady, and

beautiful season is going on for several days the daily variations of the magnetical instruments are perfectly regular, but no sooner does a storm appear, or a storm is approaching, than a great irregularity takes place in the magnetical curves. This was supposed formerly to come from variations of temperature in the instruments, but this cause was excluded by the fact that the temperature of the observatory-room is kept almost perfectly constant. The origin, however, of these changes must not be sought very far. Everybody knows that electricity is powerfully developed in storms, and to such a degree that it affects common magnets readily in many cases. During some storms I have seen magnetical instruments become complete fools. These electrical currents have been found to circulate in telegraphic wires, and they propagate themselves to a great distance through the earth, and they must affect magnetical instruments even if they are far from the centre of electrical disturbance. This theory is so natural that I wonder it should have found any opposition. The anticipation of the storm by the currents is also very easy to be understood, since the velocity of earth currents is enormously greater than that of aerial currents. From the time of this anticipation it appears that the earth currents get in motion when the storm reaches the Continent from the Atlantic Ocean. It seems that electricity developed in the storm cannot be uniformly dispersed and distributed on the main continent as on the sea, so that we have in this manner definite currents determined in the earth according to the difference of electrical conductibility of the ground. This, perhaps, is the reason why this influence is not so evident in England which is surrounded by the sea, where the weather is so changeable, and the island is the very first landing-place of the storms. Whatever may be the reason of this difference (if it really exists), I cannot hesitate to admit a fact which I see so frequently reproduced in my observing-place. We must, however, remark, that when I say that the storm is accompanied by magnetical disturbance, it does not imply that every perturbation is invariably followed in course by a storm. The storm may pass at some distance and without having aerial rain or lightning, we may have only a cloudy appearance, which announces the not very distant storm, which is very often found from newspaper information to have taken place. There are also other perturbations which are not always connected with storms: notably some are due chiefly to the aurora borealis in distant northern countries. But these also, as far as I believe, will be easily connected with meteorological changes. I do not intend with this to state that all the magnetical variations in the globe have a meteorological origin; this would be too much. Certainly a particular solar action might be contemplated, although it may yet appear doubtful whether its influence is direct or only indirect. The members of this section are well aware, I think, that we prosecute the study of solar physics, especially in relation to magnetical purposes, and that to this effect a drawing is made in our observatory every fine day of the sun's image and spots. We have already ten years of these observations. From these it appeared that the minimum of

Meteorological Society of Mauritius had in 1853 adopted measures for tabulating the meteorological observations recorded in the log-books of the numerous vessels frequenting the harbour of Port Louis, and that a large mass of data had been chronologically arranged. The society, in short, during the last sixteen years, has been keeping a daily meteorological journal of the Indian Ocean; and it is from this journal, which contains the fullest possible details regarding the direction and force of the wind, the pressure and temperature of the air, the state of the weather with regard to cloud, fog, rain, lightning, &c., and the condition of the sea, that the materials for the charts are mainly derived. As the journal has been carried on without interruption since the 1st of January, 1853, and is being still continued, the character of the weather over the navigated parts of the Indian Ocean on any one day may be at once ascertained by turning up the date. Up to the present time above 215,000 days' observations, that is, observations of twenty-four hours each, have been tabulated in all, and a separate collection has been made of details relating to the gales and hurricanes which have taken place during the same period. Since 1858 the number of observations has considerably increased, and for several years there is a daily average of from seventy to eighty days' observations, or, in other words, of seventy to eighty vessels, on board of which observations were taken daily in different parts of the ocean. It is now fourteen years since, impressed with the importance of synoptic weather charts, as a means of investigating the conditions and laws under which meteorological changes are produced, I attempted to bring out a series of such charts in monthly parts. The observations for March, 1853, with several charts, were published in 1856, and daily charts for other months of the same year were prepared. For various reasons, of which paucity of data was one, the average daily number of observations being only thirty, the further prosecution of the work was abandoned. Subsequently, several hundreds of synoptic charts were constructed for periods for which the observations were more numerous, and it is now proposed to issue the charts for 1861. The average daily number of days' observations for that year, recorded in the Mauritius registers, is seventy, and as I have been favoured by the meteorological committee of the Royal Society with a portion of the observations collected for the same period, under the late Admiral FitzRoy, and been kindly promised the rest, the total daily average, including the observations taken at the Indian and other observatories, will fall little short of 100. In order to refer the observations to absolute time, the meridian of 60° E. is taken to represent noon, and the necessary corrections are applied to the local times at all stations, east or west, of that meridian. As the registers give the winds and weather at short intervals, and generally mention the times of change, the charts are easily made synchronous in these respects. When, however, vessels are at a considerable distance from the meridian of 60°, and are going at the rate of from seven to ten knots an hour, corrections have to be applied to

their positions as given at noon. The direction of the wind, after correction for magnetic variation, is indicated on the charts by arrows flying with the wind, the vessels' position being at the arrow head. It being desirable that the charts should be as simple as possible, the Beaufort notation and scale for weather and force of wind have been adopted, and the currents and state of sea are denoted by symbols. In ordinary weather the barometer and thermometer are generally observed on board ships only at noon, and hence the isobaric and isothermal curves do not represent the pressure and temperature at the same moment of absolute time, but at local noon of each station. During times of great disturbance, when the barometer is falling rapidly, hourly or more frequent observations are taken at sea, and therefore the observations can be reduced to absolute time. But the area of disturbance, and consequently the differences in time being small, it is seldom that corrections are necessary. Great care is taken that the charts shall faithfully represent the facts, for the object is to ascertain truth at whatever sacrifice of preconceived notions. If, for example, nine vessels at moderate distances from each other should all have the wind from the same quarter, but a tenth vessel should have it from the opposite quarter, the latter is not rejected, but entered with the others, although there is a strong probability that an error has crept into her log-book. The observations are so numerous that occasional exceptions do not affect the general evidence. As specimens of the charts, I beg leave to lay before the section those for the 16th January and the 12th February, 1861. The former contains eighty-four arrows, representing an equal number of stations at which observations were taken on that day. The most prominent feature of this chart is a storm to the south-eastward of Cape Colony, consisting of two great currents of air, the one from the southward and the other from the northward, with a low barometer between them. It is one of those extra-tropical gales which point from westward to eastward, beyond the polar borders of the trade wind, and affect the barometer at Mauritius. The chart for the 12th February shows the winds, weather, &c., at ninety-six stations. It will be seen that between the north-west monsoon and the south-east trade wind two revolving storms are raging, accompanied by a low barometer, torrents of rain, and a very high sea. A glance at the storm farthest east shows the wind moving more or less round a central axis, for it happens that vessels are on all sides of it. The other, in which Mauritius is involved, is as rotatory as its companion, but the circuit is not completely seen from want of more vessels on its northern side. An inspection of the charts which precede and follow this one will show that these storms existed and travelled together for several days. Both charts show a strong tendency in the wind to move tangentially to the isobars, but it is only a tendency, the arrows being generally inclined to the isobars. Now, the Mauritius observations, together with those of the Meteorological Department of the Board of Trade, are alone sufficient for constructing daily charts (like those presented), for a period of ten

years. I venture to think that a series of such charts would be of no small value in further elucidating various subjects of theoretical and practical importance—as the sources and development of atmospheric electricity, the relations of vapour and heat, the connection between the isobars and the direction of the wind, the origin, progress, and forms of storms, the limits, direction and force of the trades and monsoons with regard to season, and other subjects which will readily suggest themselves. As a method of investigating weather phenomena, and of discovering the laws which regulate atmospheric changes, there can, I think, be little doubt, that synoptic or synchronous charts, such as those exhibited, are much more important than mean or average charts, in which periodicities and various deviations and disturbances are entirely concealed. I would go further, and say that a series of synoptic charts for a particular ocean would be of more service to the practical navigator than average charts—that, for example, a synoptic wind-chart showing the actually observed directions and force of the wind at many stations on a single day, of average or normal weather, would be a better guide to the seaman than a chart showing the average directions of the wind for a period of three months. But however that may be, and without at all undervaluing the method of averages, I think it may be said, that it is to the system of mapping the daily weather over extensive areas that Meteorology is likely to owe its chief progress for some time to come. Who can doubt that, if we had charts, showing the directions of the wind, the isobars, &c., over the North Atlantic, the continent of Europe, and the British Islands, at a certain hour on each day, during the last twelve months, we should be in a position to solve partly or wholly questions of the utmost importance to science and navigation. I have no doubt that this will be done sooner or later—indeed it is being already done by France—and that valuable results will be obtained.

The learned Professor also read a paper on “Storm Warnings in the Mauritius.” The author went into the subject in much detail, but the result of the investigations which he had set on foot, with a view to ascertain the relation which existed between the weather as observed at Port Louis in the Mauritius, and as it existed at the same moment of time all over the Indian Ocean, had established very satisfactorily the fact that no gale of any magnitude could occur at a distance of from 1500 to 2000 miles without it being known at the Mauritius.

A Member called attention to the advantages the southern position of Ceylon offers for issuing storm warnings to the Indian coast.

Dr. Mann read a paper “On the resemblance and contrasts of the climates of the Mauritius and Natal,” and another entitled “Abstract of Meteorological Observations made at Pietermaritzburg, Natal.”

Dr. J. H. Gladstone, F.R.S., read a paper by his brother, G. Gladstone, giving a brief account of the results of a few observations of the atmospheric lines of the solar spectrum in high latitudes.

SOLAR RADIATION TEMPERATURES.

To the Editor of the Meteorological Magazine.

SIR,—I have only just read Mr. Stow's letter in the August number of the *Meteorological Magazine* upon "Solar Radiation Temperatures," and referred to in the number just received. I cannot say, however, that it appears to me the great discrepancies existing between observers are as yet satisfactorily accounted for. Take, for instance, the extraordinary difference between the Ordnance Survey readings at Southampton and those of the Greenwich Observatory, given by Mr. R. Taylor. It is suggested, indeed, that the reason lies in the fact that the Southampton thermometer is placed 18 in. above the grass, and is not protected by a vacuum jacket, whilst the Greenwich instrument is placed upon the grass, and is in vacuo; but my own quite independent observations, within three miles of Southampton, and with the thermometer under similar conditions with Mr. Glaisher's, with the exception of its not being in vacuo, (which *on the grass* Mr. Stow tells us is not an important difference, the wind not perceptibly affecting it), would scarcely seem to bear out the theory.

The difference is still immense between readings on the grass here and readings on the grass at Greenwich, and it is still a mystery to me what can be the reason.

I append a comparative table of the Ordnance Survey, Mr. Glaisher's, and my own readings for June, and only add that the thermometer used by me is one of Negretti and Zambra's dull black spherical bulbs, the stem not blackened further than the bulb itself, and thoroughly exposed to the S.E., on a grass sloping bank always kept short mown.

Your readers will all no doubt look forward with interest to further communications on this subject, and if uniformity can be obtained in the method of making all meteorological observations, as well as for solar radiation temperatures, it will be a great thing gained.

	Greenwich.	Ordnance S.	Shirley Warren.
June 19	149·0	101·2	104·0
" 20	165·3	101·4	103·0
" 21	128·0	87·0	100·0
" 22	110·0	87·1	90·0
" 23	149·1	81·6	92·0
" 24	135·0	83·4	100·0
" 25	127·0	85·5	92·0
" 26	145·0	90·1	115·0
" 27	157·5	100·2	115·0

I am, Sir, yours truly,

R. C. HANKINSON.

Shirley Warren, Southampton, September 18th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—Through the courteous kindness of Mr. Glaisher, I am able to answer the question put by myself in your journal of July last, viz., "What is the cause of a difference of so many as forty degrees of solar temperature between Holloway and the Greenwich Observatory?"

Mr. Glaisher having read my note, was so good as to offer to compare

my thermometer with the instruments used at the Royal Observatory.

From the tenor of the correspondence on this subject that you have inserted subsequently, I was afraid that my thermometer was at fault. It was therefore with much satisfaction that I received a note from Mr. Glaisher, saying, "your thermometer is good; it reads very nearly identical with our thermometers when placed side by side." I had always, rightly it is thus shown, considered the name of Casella, as maker, a sufficient guarantee of accuracy. It was obvious, then, that the cause of the discrepancy must be some external local condition, and the result of my observations has been to confirm one of your conclusions, as stated in the August number of the Magazine, p. 114.

On the 11th inst., the day that I fetched away my thermometer from the Observatory at Greenwich, the sky was perfectly clear, and the sun had great power (the solar thermometer read 137° .) Looking down, however, from the high ground on which the Observatory is placed, one could see spread over the town, and away northward, a layer of smoke, dense enough to intercept a considerable portion of the sun's heat. Although this veil of smoke would become gradually thinner and lighter as it extended to my neighbourhood, there would doubtless still be enough of it to screen us from some of the sun's heat.

The Royal Observatory is 159 feet, and my garden 94 feet above mean sea level. The distance from my house to the densest part of the buildings between here and Greenwich, is three miles, from that point to the Royal Observatory is four and a half miles—sufficient conditions of elevation and distance to account for the greater clearness of the atmosphere over the Observatory, and consequently to give higher readings of solar radiation thermometers. Omitting then the minuter points of difference as to the construction of the instruments, I conclude that local influence of smoke is in this instance the main cause of the wide difference observed, while it shows also how thin a film suffices to make a screen. It is possible that the excess in the readings of the Greenwich thermometers over those of other stations, in the open country at high levels, may be accounted for by the proximity of wooden sheds, which I think would reflect some heat to the ground on which the thermometers are placed.

My conclusion is borne out by the result of your own experiments—your readings being a few degrees higher than mine, while they are also considerably below those at the Royal Observatory. Your garden in Camden Square has nearly the same relative bearings as my own, looking towards Greenwich, while it is about half a mile further from the centre of London.—I remain, Sir, yours, &c.,

W. B. KESTEVEN.

Holloway, September 16th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—To prevent misapprehension, I must remind your readers that in my former letter I referred only to solar thermometers *in vacuo*, which read always 15° to 30° higher than the ordinary black bulb;

this results necessarily from their construction. The temperature indicated by a black bulb *in vacuo* consists of two parts—the temperature of the outer jacket, which is communicated to the bulb, plus the direct effect of the sun's rays on the bulb; the latter is rapidly received, because the sun's heat rays can pass through glass, but slowly parted with, because the heat so received cannot be radiated back through the glass. The temperature of the bulb, therefore, rises till it is so far above that of the glass jacket that the cooling effect of the latter equals the heating power of the sun's rays. The ordinary black bulb, on the contrary, loses heat, both by direct radiation and by contact with the surrounding air, and must therefore always indicate a lower temperature; such instruments are valuable for showing approximately the heat received by vegetation, but cannot be used for accurate *comparative* observations.

It will be easily seen from what I had said, that if the intensity of the sun's rays be the same, the indications of black bulbs *in vacuo* will vary according to the temperature of the outer jacket. Position, therefore, must make a considerable difference, and wind, by cooling the jacket, must, to a certain extent affect the instrument. Experiments show the effect of wind to be small on a solar *in vacuo* sheltered by being placed among grass, and (contrary to my previous belief) still smaller on one hung freely in the air at four feet, because the temperature of the glass jacket never, even in calm weather, rises much above that of the air; it is greatest when the instrument is placed on hot surfaces, such as black boards, which is a serious objection to their adoption, which I formerly was disposed to advocate.

We have three sources of discrepancy:—(1) difference in instruments; (2) difference in position; (3) difference in clearness of air. The first, though immense, between thermometers *in vacuo* and ordinary black bulbs, will seldom exceed 10° between well-made thermometers *in vacuo*. I have, indeed, in one instance found it 14°, but I think I was wrong in supposing this difference would be much greater in June than in March. As I have shown, this source of difference can be got rid of by extending the lamp-black to the stem. The second, causes extreme differences of 15° or 20° between thermometers *in vacuo* placed on grass and those hung in air, and of 8° or 10° between those placed on green grass and those which rest on a pretty thick bed of dry and withered grass. I hope next month to give an account of my investigations on the subject of position, which have been carried on this month. The third undoubtedly influences instruments in London and other large towns to a considerable extent; your observations at Camden Town, with instruments agreeing with mine, gave in the past summer readings often 10° lower, though Camden Town is very far from the heart of London, and how much more the sun is obscured in the city, I leave it to your readers to guess or discover.

I am, Sir, your obedient servant,

F. W. STOW.

Tunbridge Wells, Sept. 30, 1868.

SEPTEMBER, 1868.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of nights below 32°.	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours		Days on which ≥ 1 or more fell.	Max.		Min.			
				Dpth	Date.		Deg.	Date.	Deg.	Date.		
		inches.	inches.	in.								
I.	Camden Town	1.74	— .52	.33	26	10	91.0	7	43.0	11	0	
II.	Staplehurst (Linton Park) ...	2.70	+ .48	.60	28	10	92.0	7	43.0	9	0	
III.	Selborne (The Wakes).....	4.49	+ 2.05	.98	19	11	81.5	7	36.5	11	0	
IV.	Hitchen	2.77	+ .91	.71	30	10	79.0	7	43.0	10*	0	
V.	Banbury	3.05	+ .68	.83	25	10	81.0	7	36.5	24	0	
VI.	Bury St. Edmunds (Culford) ..	1.74	+ .13	.42	19	10	87.0	7	39.0	10	0	
VII.	Bridport	3.39	+ 1.07	.80	19	12	84.5	6	42.0	14†	...	
VIII.	Barnstaple	3.71	— .05	1.52	19	11	87.0	8	44.0	24	0	
IX.	Bodmin	6.44	+ 2.77	1.96	17	13	79.0	7	46.0	15	0	
X.	Cirencester	2.89	+ .03	.75	30	8	...	...	...	...	...
XI.	Shifnal (Haughton Hall) ...	2.62	+ .67	1.15	25	10	76.0	7	40.0	24	0	
XII.	Tenbury (Orleton)	2.99	+ .31	1.00	25	10	86.2	7	37.5	24	0	
XIII.	Leicester (Wigston)	2.61	+ .40	.66	26	8	89.0	6, 7	38.0	24	..	
XIV.	Boston	2.22	+ .65	.80	19	9	87.5	7	43.5	25	0	
XV.	Gainsborough .....	...	...	...	...	...	...	...	...	...	...
XVI.	Derby	1.72	— .62	.80	25	10	85.0	6, 7	44.0	17	0	
XVII.	Manchester .....	...	...	...	...	...	...	...	...	...	...
XVIII.	York	3.24	+ .91	1.05	25	15	83.0	6	41.5	9	0	
XIX.	Skipton (Arncliffe) ...	4.28	— .68	1.17	27	12	77.0	8	40.0	25	0	
XX.	North Shields	3.58	+ 1.88	.92	25	18	81.6	7	45.0	16	0	
XXI.	Borrowdale (Seathwaite)	5.77	— 7.44	1.43	28	13	...	...	...	...	...
XXII.	Cardiff (Town Hall) .....	...	...	...	...	...	...	...	...	...	...
XXIII.	Haverfordwest	4.04	+ .33	1.00	19	9	78.8	6	41.0	13	0	
XXIV.	Rhayader (Cefnfaes).....	3.86	+ .02	.73	25	11	83.0	...	40.0	...	...
XXV.	Llandudno	1.77	— .57	.79	25	7	87.5	6	43.5	13	0	
XXVI.	Dumfries	2.67	— .06	.95	29	13	78.5	6	37.0	13	0	
XXVII.	Hawick (Silverbut Hall) ...	4.06	...	.68	25	14	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	1.70	— 2.03	.48	29	13	78.0	6	30.0	13‡	2	
XXIX.	Castle Toward	2.35	— 2.27	.80	30	13	73.0	6	33.0	14	0	
XXX.	Leven (Nookton)	3.04	+ .56	1.07	19	14	78.0	6	40.0	9	0	
XXXI.	Stirling (Deanston)	2.64	— .51	.86	29	15	79.5	6	32.0	13	0	
XXXII.	Logierait	3.03	...	.75	29	13	...	...	...	...	...
XXXIII.	Ballater	6.30	...	2.20	19	17	79.0	6	31.5	14	1	
XXXIV.	Aberdeen	3.87	...	1.07	19	15	78.2	6	40.7	13	0	
XXXV.	Inverness (Culloden)	3.55	...	.97	29	12	75.0	6	39.8	13	0
XXXVI.	Fort William	2.11	...	.58	28	12	...	...	...	...	...
XXXVII.	Portree	4.44	— 6.33	1.23	29	14	73.0	6	34.2	15	...	
XXXVIII.	Loch Broom	2.07	...	1.10	29	14	...	...	...	...	...
XXXIX.	Helmsdale	3.27	...	1.20	29	12	...	...	...	...	...
XL.	Sandwick	1.41	— 2.25	.33	27	13	67.5	6	41.4	12	0	
XLI.	Cork	5.98	...	1.14	19	15	...	...	...	...	...
XLII.	Waterford	6.90	+ 3.77	1.70	29	17	73.0	5	48.0	28	0	
XLIII.	Killaloe	2.98	— 1.18	.62	25	18	78.5	5	39.0	28	0	
XLIV.	Portarlinton	2.89	— .39	.51	21	18	76.5	6	38.0	14	0	
XLV.	Monkstown	3.16	+ 1.17	.93	25	11	...	...	...	...	0
XLVI.	Galway	2.41	...	.43	10	13	74.0	8	34.0	30	0
XLVII.	Bunninadden (Doo Castle) ...	2.85	...	1.00	29	9	66.0	2	32.0	...	0	
XLVIII.	Bawnboy (Owendoon)	2.23	...	.48	11	16	83.0	6	38.0	30	0
XLIX.	Waringstown	1.68	...	.29	28	14	82.0	6	37.0	13	0
L.	Strabane (Leckpatrick)	1.64	...	.33	10	13	79.0	6	34.0	9, 25	0

* And 12th, 23rd & 24th. † And 24th. ‡ 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 Hair; S for Snow.

ENGLAND.

LINTON PARK.—The early part of the month exceedingly dry, only '11 in. of R falling between the 22nd of August and 18th September; a little T on 18th and 27th; fog on 24th; the first seven days very hot; prevailing winds S., S.W., and N.E.

SELBORNE.—The storm on the 18th was accompanied by a kind of whirlwind, which occasioned much damage to the orchard house glass, and, at Worldham, tore up a tree of considerable size by the roots. Max. temp. $81^{\circ}5$ on 7th, and only $64^{\circ}0$ on 8th; T and L at 6 p.m. on 18th with heavy R and violent wind; TS from 3 to 5 a.m. on 27th, with H, heavy R, and violent wind from the S.W.; dense fogs on mornings of 20th, 21st, and 22nd.

BANBURY.—L on 26th; TS on 30th.

CULFORD.—The rains which we have recently had are causing the pastures to assume their vernal hue which they have not previously done this summer. The late sown turnips are now growing vigorously, and promise to be very useful, and even early potatoes, planted after the R we had on the 6th of August, have now every appearance of producing a useful crop. T on 27th and 30th.

BRIDFORD.—The first fortnight very fine, hot, and dry, the second fortnight wet and stormy. Gale sprung up on 25th from S.W., increasing to a very heavy gale on the 27th and continuing; till morning of 27th, a very heavy sea on. Heavy TS in the early morning of 26th, with vivid L and heavy R; L on 18th, 25th, 29th, and 30th.

BODMIN.—The rainfall since the 16th, $6\cdot42$ in. has been unprecedented.

CIRENCESTER.—The latter rains, although so much less than in August, have produced greater effects on vegetation, doubtless occasioned by the lessened influence of the sun. T on 26th.

HAUGHTON HALL, SHIFNALL.—The second growth of potatoe tubers larger than those first formed, and likely to be a good crop, frost permitting; barley stubble quite green, from the sprouting of the shed grain; damsons, an average crop; acorns, most abundant. Temp. very high at commencement of month, difference of 20° between it on 7th and 8th.

ORLETON.—The first seven days were hotter than ever before registered in this month; on the 7th the ther. stood at $86\cdot2$ in the shade, but at 9 p.m. wind from N. suddenly set in with a cloudy sky, and by the next day the temp. had fallen 20° ; no R till the 17th; remainder of month stormy, with heavy showers and rather cold; T on 19th and 29th, L on 29th and 30th. TS at 4 p.m. 29th.

BOSTON.—Very hot and sultry up to the 7th, temp. moderate during the rest of the month; TSS, with heavy rains, on 26th and 27th; gale from E. on 25th, and another from S.W. on 27th.

DERBY.—September commenced with intense heat, and beautiful weather continued to the middle of the month, when copious showers began to fall continuing to do so to the end of the month. The temp. has been (here) $2^{\circ}5$ above the mean of the past seven years, and, as a mark of the past season, Indian corn has ripened for the first time in upwards of 20 years during which I have grown it.

YORK.—TS at 4 p.m. 20th, and at the same hour on 30th.

ARNcliffe.—An unusual amount of E. wind.

NORTH SHIELDS.—Aurora on 15th and 18th, fog on 19th, L on 7th; TS on 20th and 26th.

WALES.

HAVERFORDWEST.—The month commenced with fine warm weather, and up to the 11th summer heat continued, the wind then veered round to the E. with a great reduction in temperature; a very wet, and at times stormy, period from the 20th to the end of the month.

RHAYADER, CEFNFAES.—A fine, warm, and genial month; harvest fine; acorns, haws, hips, and all berries very large and abundant.

SCOTLAND.

DUMFRIES.—The first half of the month fine, the latter half showery, but on the whole a remarkably fine month. Grass fields as green as in spring. Mean temp. exactly the same as September of last year.

SILVERBUT HALL.—Sharp frost on night of the 8th. A month of fine weather; pastures looking green and beautiful; cereals all secured in fine order; potatoes excellent in quality, and keeping almost clear of disease; Swedish turnips suffering from mildew, but a very fair average crop. T and L, accompanied by heavy R, on the 27th, 29th and 30th.

AUCHENDRANE.—The river and springs are still very low; the gale on the 12th was not severe here; 25th and 29th boisterous; the destructive gales of the 20th and 27th were not felt here.

CASTLE TOWARD.—A pleasant month; pasture abundant; turnips getting mildewed; vegetables plentiful; flower garden quite gay.

NOOKTON.—Heavy R on night of 19th; gale and heavy R on night of 20th.

DEANSTON.—Dry till the 20th; frost during the nights of 9th, 13th and 14th. TS with heavy R at 4.30 p.m. on 27th, and again at 11.30 a.m. on 29th.

BALLATER.—The latter part of the month very wet, and total rainfall much above the average for September. No frosts to speak of, and vegetation up to 7th of October uninjured and remarkably vigorous for the season.

ABERDEEN.—T and L on 7th, 28th and 29th. Auroræ on 5th, 6th, 11th, 12th, and 24th. Fog on 20th, 21st and 22nd. A month of dull, damp, gloomy weather; hours of R more in number than in any month since March, 1867. Rainfall, bar., and temp. all above the mean. Winds from N.W., N., N.E. and S.E., much above the average frequency.

ROSSE PARSONAGE.—Upon the whole a fine month; T and L on the night of the 5th. E. winds during the latter part of the month, but no great storm, though it was high on the 19th; S on the hills on the 25th.

PORTREE.—The finest September on record; the best harvest weather for 20 years; all the crops are chiefly in stack in good condition. The potatoes are very much diseased, fully two-thirds of the crop are quite rotten and unfit for use.

LOCH BROOM.—This has been a most beautiful month, equally beneficial to the farmer and the grazier.

SANDWICK.—Lunar rainbows on the 25th and 30th; auroræ on 9th, 15th, 19th (flashing high), 21st, 22nd, 25th and 26th. The month has been drier and colder than the mean. It has been fine harvest weather, and a good crop is all nearly secured, much earlier than usual.

IRELAND.

DOO CASTLE.—Delightful weather up to the last week, when there were some very wet and stormy days. The harvesting of all crops a complete success; fodder far more plentiful in the country than was at first anticipated, the prices of cattle in consequence "looking up." Potatoe digging just commenced in this locality; the crops excellent.

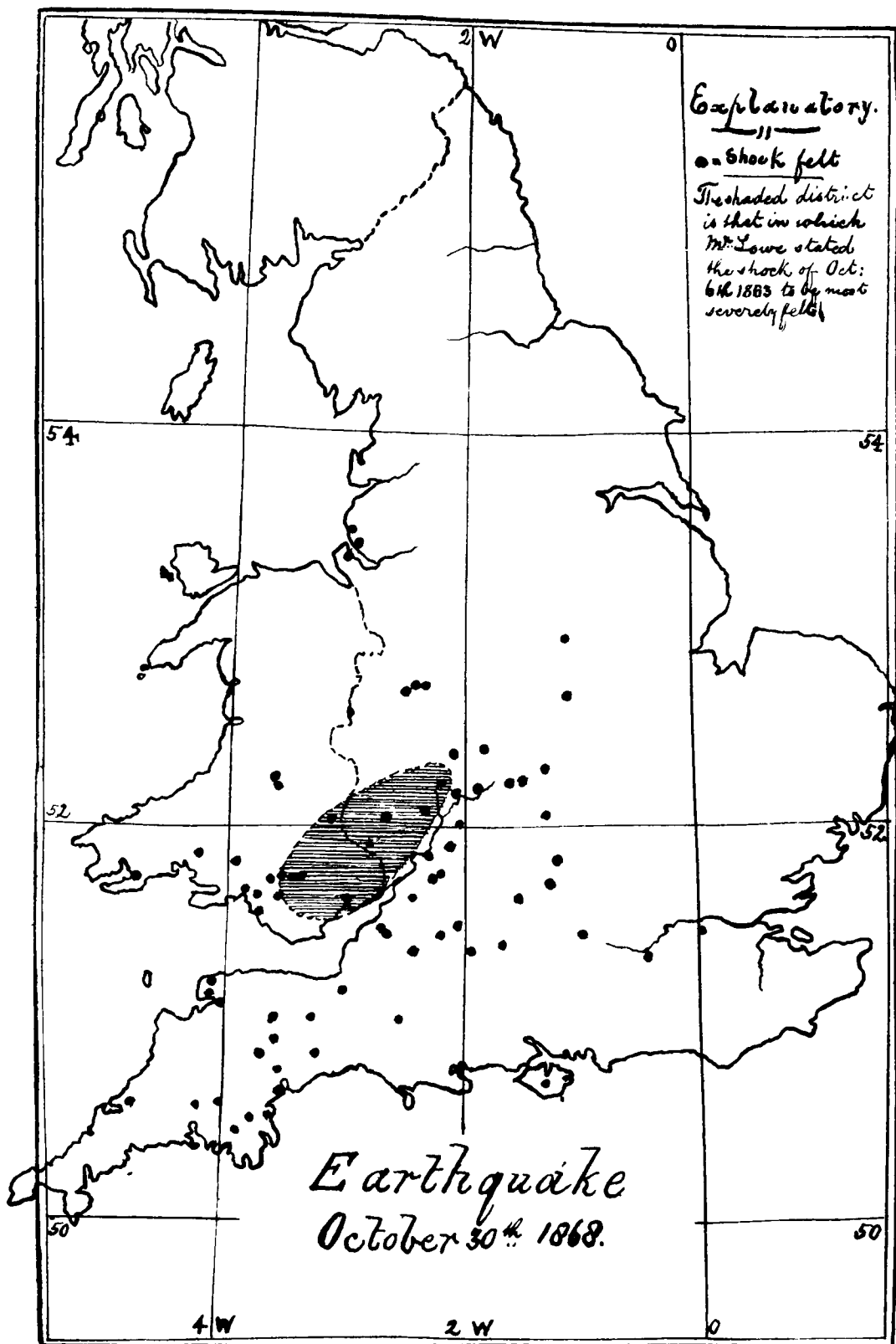
OWENDOON.—T on 30th.

WARINGSTOWN.—Fine, dry, and seasonable; first week very warm, after which cold N. and E. winds set in for a fortnight, another mild week at the close of the month.

LECKPATRICK.—A fine month; although the ther. in air 4 ft. above the ground never fell to 32°, there was frost on the grass on six nights, the minimum being 29°; so low a reading in this month is unprecedented.

TO OUR READERS AND CORRESPONDENTS.

Owing to the space occupied by the reports of the British Association Meeting, several very valuable communications are unavoidably postponed to our next.



A. J. Symonds, Litho:

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXXIV.]

NOVEMBER, 1868.

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

EARTHQUAKE OF OCTOBER 30TH.

IF anyone wanted evidence of the prevailing ignorance as to correct time—we do not mean time true to seconds or tenths of a second, but correct to a minute—he would be abundantly supplied by the last earthquake, which we believe really occurred at 10.35 p.m., but which is reported to have been felt at all sorts of times within half an hour thereof. We put the subject prominently forward, because we think many observers are not so careful as they should be to have some one clock or watch about the correctness of which there should be no doubt. Let us give just one instance of the necessity of so doing, and an instance which will bring us back to our subject. Earthquake shocks travel at the rate of about 14 miles per minute, therefore as the shock was felt at Pembroke and Blackheath (210 miles apart), and at Liverpool and Torquay (200 miles apart), it is abundantly clear that if the times had been taken with any approach to correctness, we should have known considerably more about the shock than we now do. For instance, if it was a surface shock travelling S to N., it should have been a quarter of an hour earlier at Torquay than at Liverpool, and of course the time should get gradually later at intervening stations, instead of which it is irregular in the extreme. The theory has been propounded that these last earthquakes have their origin not in the ordinary subterranean regions of volcanic fires, but much nearer the surface, in the explosion of large accumulations of gas in the coal measures. If this were the case, the time would have varied considerably, in circles, having the site of explosion for their common centre; but, as we have before stated, the recorded times are so discordant as to be of very little use. If we could have relied upon their being within three or four minutes of correct, we might have done something in the matter.

The accompanying map shows all the places at which we are at present aware of its being felt, and it will be noticed that their grouping agrees very well with that which prevailed in October, 1863.

We believe the recent shock to have been, at all but one or two places in Monmouthshire, slighter than that in 1863, in fact, so far as we have heard, one clock only has been stopped, viz., at Worcester.

To the Editor of the Meteorological Magazine.

SIR,—It may interest you to know that a violent shock of earthquake was felt at the Hendre House, two miles from Newcastle and

seven from Monmouth, on Friday night, October 30th, at 10.30 p.m. ; three chairs were upset in the dining room, and the shock was altogether more violent than the one in 1863.—Yours truly,

H. E. SEGRAVE.

November 2nd.

To the Editor of the Meteorological Magazine.

SIR,—A distinct shock of earthquake was experienced in many parts of this city at 10.25 p.m. Friday, October 30th. At the time, I was writing in my dining room ; the street was quiet, the house also, most of the inmates having retired to bed. The sensation was as if a heavy piece of furniture had fallen down, and was accompanied by considerable vibration and a loud rumbling noise ; the shock lasted about three seconds. Although I had never experienced the shock of an earthquake, it occurred to me at once what it was, and on the following morning I was confirmed by many friends, some of whom had been in countries where they are more frequent.—Yours, &c.,

C. S. BARTER, M.D.

Bath, November 3rd.

To the Editor of the Meteorological Magazine.

SIR,—An earthquake having visited this neighbourhood during the past night, I hasten to inform you of the occurrence, though I have no doubt you will be inundated with communications on the subject, as it is highly improbable that such a visitation should have been exclusively confined to this locality. The first shock was felt at half-past ten last night, the second at about three o'clock this morning. The undulatory movement appeared to me to proceed from S.E. to N.W. in one regular wave.

The vibration in the first case was sufficiently violent to considerably alarm many of those who felt its effects, as proof of which I must tell you that a little daughter of mine jumped out of bed, under the impression that the house was about to fall, and could with difficulty be persuaded to again retire to rest ; some small cottages situated about a quarter of a mile from here were so shaken that the poor people who inhabited them sat up the greater part of the night.

In a gentleman's house at Chippenham, some crockery, I am told, fell off a shelf through the violence of the oscillation.

No reports, however, of any serious consequences arising from the shock have reached me, and no noise, as accompanying it, is spoken of by anyone. As far as the instruments in my possession are concerned, I was unable to detect any disturbance whatever. The barometer remained steady at the reading taken at 9 p.m., viz., 29.86, as corrected for temperature only. The lowest registered by my thermometers was, in air 47°, on grass 44°. Wind light from west ; rainfall nil ; sky tolerably clear ; humidity, as shown by hygrometer, 93. The temperature never sank between 9 p.m. and 9 a.m.

I am, Sir, yours truly,

F. BONNYCASTLE GRITTON.

*West Tytherton, Chippenham, Wilts,
31st October, 1868.*

THERMOMETER STANDS.

(Continued from page 138.)

THE stand which we have next to describe is that known as "Glaisher's" from the inventor's name, and "Greenwich" from the place where it was first used in 1841. This stand has been so long in use, so generally employed in England, and so many different modifications are called by the owners "proper Greenwich stands," that we have prevailed upon Mr. Glaisher to favour us with the following detailed description :

DESCRIPTION OF THERMOMETER STAND BY JAMES GLAISHER, Esq.,
F.R.S., F.R.A.S., PRES. MET. SOC., &c.

"The objects of the stand are, to sufficiently protect the thermometers from radiation, reflection, and conduction of heat, and from rain, and to expose the bulbs of all the thermometers, so that the air passes freely to them from all directions at all times. It consists of an upright post firmly fixed in the ground, carrying a revolving frame. This frame is made of $1\frac{1}{4}$ in. deal, planed down to about an inch, and consists of a horizontal board (through which the vertical post passes), of a vertical board, connected with one edge of the horizontal board and projecting upwards, and of two inclined boards, one of which is connected at the top of the vertical board, and the other at the other edge of the horizontal board, and the other inclined board is parallel to the first inclined board, being separated by blocks about 3 inches in thickness. The latter inclined board is covered with zinc ; to the top of it is hinged a penthouse, or projecting roof, (A) of sufficient width to prevent rain falling on the bulbs of the thermometers when the wind is blowing towards the face of the stand. In addition, there is a narrow piece of half-inch deal (c) fixed to the edge of the horizontal board, near to the lower part of the inclined board, projecting downwards four inches, to prevent the rays from the rising or setting sun falling upon the thermometers. The frame is always turned with its inclined part to the sun, and the air passes freely through the frame, so that heat which is conducted through the outer inclined board meets with a current of air passing between it and the second inclined board ; and the heat which may pass through the second inclined board meets with a much larger volume of air passing between it and the horizontal and vertical boards.

"The stand is to be planted as far from walls or buildings as possible.

"The dry and wet bulb thermometers (D) are attached to the vertical board (B) and near its centre, so that their bulbs are three or four inches below the horizontal board, and four feet above the soil.

"There are two narrow pieces of thin wood affixed to the face of the vertical board on either side, at a distance from each other of less than the length of the thermometers, the one pair for the maximum thermometer, with its bulb 4 feet above the soil, and the opposite pair for the minimum thermometer, with its bulb 4 feet above the soil, the maximum and minimum thermometers being a little inclined, so that the bulb of the minimum thermometer (E) is lower than the other end of the ther-

rometer, and that of the maximum (F) a little higher than the other end of its tube.

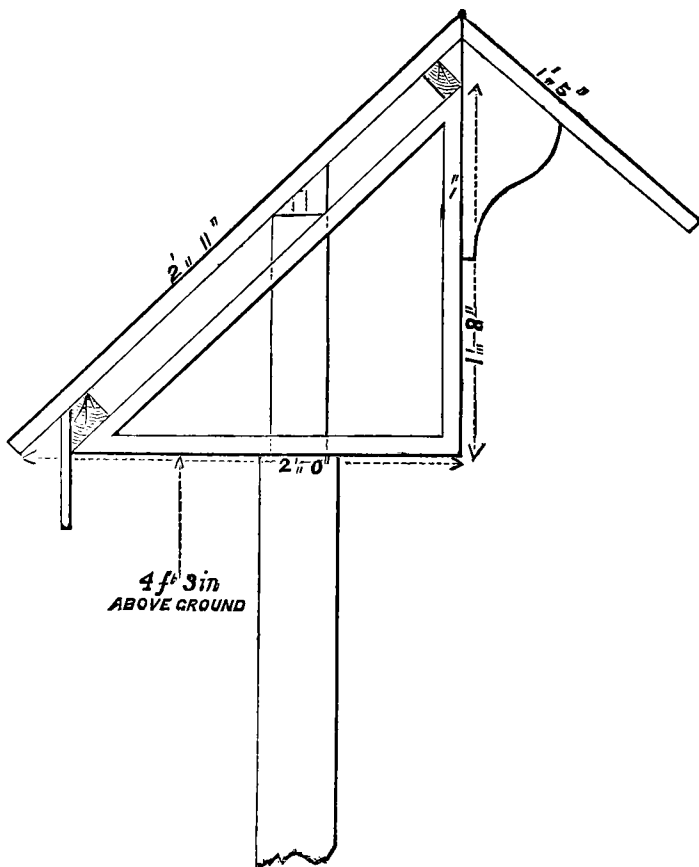
"The size of the frame is dependent upon the number of instruments it has to carry, and upon their lengths: if the stand is to carry the dry and wet thermometers, and the maximum and minimum thermometers only, its length should be the sum of the lengths of these two thermometers, together with the width of the dry and wet bulb thermometers, with a little space between them, as well as at the ends of the maximum and minimum thermometers.

"If the maximum and minimum thermometers be one foot each in length, and the space occupied by the dry and wet bulb be four inches, then the length of the horizontal board should be three feet or very nearly; the height of the vertical board about one and a half feet, and the breadth of the horizontal board 18 or 20 inches.

"The space above the thermometers on the vertical face is available for observations by Daniell's hygrometer, or Regnault's hygrometer, or ozone observations, or any other experiments.

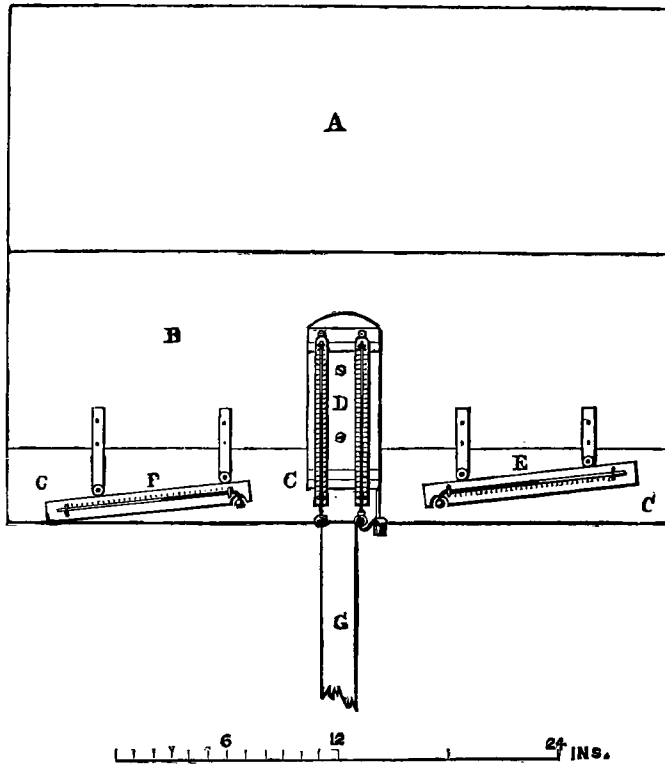
"Should more extended series of observations be contemplated, then a stand equal to that of the Greenwich stand would be necessary."

Fig. 1. Glaisher's Stand.—Side View.



The exact lateral dimensions of the Greenwich stand are marked on fig. 1, and whatever the breadth of the stand, they would remain the same. At Greenwich the breadth is 4 ft. 10 in. In fig. 2 we have shown the breadth as 3 ft., and the arrangement above recommended for ordinary observers.

Fig. 2. Glaisher's Stand.—Front View.



REVIEWS.

THE pressure on our space for several months past has prevented any notice of many important publications, and the accumulated number is now such that extreme brevity must characterize our notices.

Report of the Meteorological Committee of the Royal Society for the year ending December 31st, 1857. 8vo, 75 pages, 6 plates.

Report of an Inquiry into the connection between Strong Winds and Barometrical Differences. Presented to the Committee of the Meteorological Office by R. H. SCOTT, Director. 8vo, 49 pages, 2 plates.

On the 30th of April, 1865, Admiral FitzRoy's career of useful toil ceased, and for some months subsequently his system was most energetically continued by T. H. Babington, Esq., the late Admiral's scientific assistant; on the 15th of December, 1866, a committee of the Royal Society were appointed to superintend the office. Their first report

bears date December 31st, 1867, and has been waiting for notice some few months. When the composition of the committee was first announced, considerable dissatisfaction was felt by many meteorologists, and some very personal criticisms were published. We, however, were no party thereto, preferring, and believing it more proper, especially considering the very high repute of all the members, to wait until they had had a trial. The record of the first year's work is now before us, and we do not see (excepting perhaps one or two of their appointments) how it would have been possible to fulfil the designs of the Royal Society more ably than they have done.

The Royal Society suggested three leading topics—Ocean Meteorology, Storm Signals and Land Meteorology. As regarded the meteorological observations at sea, they, by their representative on the previous enquiry committee,* recommended that a mode of grouping returns on cards should be tried; this was done to the extent of filling up several hundred, but did not prove so advantageous as was expected, and was therefore abandoned in favour of a modification of Admiral FitzRoy's old data books, and as four out of the ten persons employed in the office are stated to be engaged in the "Reduction of Logs," we may hope that no long period will elapse before some really serviceable publications are issued. Storm signals have always been disliked, and, if we may so say, snubbed by the Royal Society, and their meteorological committee endeavoured to do the same. But however much poor FitzRoy may have been chaffed, and however much he may have damaged the cause by the constant prediction of "N.W. to N. and E.," in spite of all, the unscientific British public believed in storm signals, nearly every nation in Europe copied the system, the British Association for once opposed the Royal Society, and now—well the present state of affairs is best indicated by the following letter and telegram:—

"WEATHER SIGNALS.

"TO THE EDITOR OF THE TIMES.

"Sir,—I am instructed by the committee of this office to communicate to you the subjoined extract from a letter just received from Herr von Freeden, director of the Nord-Deutsche Seewarte at Hamburg, which may be of interest to some of your readers:—

"The fact that on Friday, October 23, we received intelligence of the hurricane which reached us on the Sunday, has induced the harbour authorities to request that the Seewarte would act on the message sent by you, and allow the FitzRoy drum signal to be hoisted both here and at Cuxhaven. Hitherto I have only been able to give publicity to your telegrams by posting them at the Bourse and sending them to the newspaper *Börsenhalle*, but henceforward they will be communicated to the public officially."

"Accordingly the drum signal will be hoisted at Hamburg and Cuxhaven, and will have the same significance there as it has at a British station.

"I am to state that telegraphic intelligence of storms has been sent to Hamburg since the beginning of February last, and that Herr von Freeden has kept a continuous check on the accuracy of the information sent from London ever since that date.—I have the honour to be, Sir, your obedient servant,

"ROBERT H. SCOTT, Director.

"Meteorological Office, 2, Parliament Street, November 3rd."

"CALCUTTA, October 20th.

"The Meteorological Department has organized the system of storm-signals, to be exhibited at several prominent places in this city."

* *Meteorological Magazine* Vol. I., p. 67-69.

The distinguishing feature of the new management is the investigation of the land meteorology of the British Isles. This takes the lion's share of the £11,000 expended in 1867, and the description of the instruments forms the main portion of the report now before us. The details are so clearly given, the plates so explicit, the skill evinced in the arrangement of the instruments so great, and the price of the report so low, that we will not enter into any description, but recommend our readers to get copies for themselves. There is one point upon which we hope the next report will be explicit, namely, the position in which these splendid instruments have been placed. We look forward also with much interest to a statement of the mode of tabulating and publishing the very voluminous records which these instruments will supply.

The second work above mentioned contains a discussion of the observations (as published daily in the *Times*) from the coast stations, with reference to the probable accuracy of prediction, to be obtained by the method of barometric gradients, a term suggested by Mr. Thomas Stevenson, C.E., in the *Journal of the Scottish Meteorological Society*, for January, 1868, and popularly explained in *Good Words*, June, 1868. We need not tell meteorologists that the term, though new, only implies attention to a modification of a rule which has been accepted by almost all the writers on the subject, which forms the basis of Buys Ballot's *Aëroclinoscope* and of his storm signals, nay more, which had, singularly enough, been the subject of a pamphlet by one of Mr. Scott's subordinates, published only a short time before.

The law is very tersely expressed by Mr. Scott in the following words :—

“ If any morning there be a difference between the barometrical readings at any two stations, such as Groningen and Maestricht, a wind will blow on that day in the neighbourhood of the line joining those stations, which will be inclined to that line at an angle of 90° or thereabouts, and will have the station where the reading is lowest on its left hand side.”

The paper gives the results in about 1000 cases, and the rule is shown to hold good as to *direction* 94 times in 100, and as to *direction and force* about 3 times in 5.

Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, in the year 1865, under the superintendence of the Rev.

ROBERT MAIN, M.A., Radcliffe Observer. 8vo, 66 pages.

ALTHOUGH much smaller than the Greenwich volume, the Oxford observations have always an air of freshness which is very pleasant. In the present volume we note the record of temperatures on the top of the lofty tower of the observatory (105 feet) every day in the year, and a table epitomizing ten years ozone observations, from which Mr. Main deduces the following results :—

1. The greatest quantity of ozone generally occurs in the spring, and the least quantity in October and November.
2. The absolutely greatest quantity occurs in May.

3. There is in every month less ozone in the evening than in the morning.

Considering the great interest now taken in the position of thermometers, &c., we should be glad in the next volume to see rather more copious details of the positions of the various instruments, with engravings in elucidation. But we hope nothing will be left out in order to make room, for there is nothing in the volume that can be spared.

Results of the Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, 1866.—(Extracted from the Greenwich Observations, 1866). Quarto, 364 pages and 1 plate.

In addition to the usual copious magnetical and meteorological details, the present volume contains a description of a new and very simple mode of recording the velocity of the wind, which has been mounted by Mr. Browning, the description being elucidated by a plate. It may be convenient to state a few of the principal magnetical and meteorological results for 1866 :—

MAGNETISM	Mean Declination.....	20° 27' 47"
"	" Dip	68° 1' 16"
BAROMETER	Mean (at 159 ft.).....	29·714 in.
"	Max. "	30·506 "
"	Min. "	28·450 "
TEMPERATURE	Max. (July 13th).....	87·2 degrees.
"	Min. (January 13th)	23·7 "
"	Mean	49·8 "
HUMIDITY	"	82
CLOUD	"	7·1
RAIN	No. of Days	173
"	Total Depth.....	30·72 in.

A very full list of luminous meteors in the celebrated November shower closes the volume.

Meteorological Report for 1867, edited by the REV. R. F. WHEELER, M.A. [From the Natural History Transactions of Northumberland and Durham.] 8vo, 32 pages, and several large folding tables.

THE most complete, most interesting, and, in all respects, the best local meteorological report we have seen. The editor will soon have to abandon his large folding tables, as they are yearly getting larger, better, and more unwieldy, and for them he will have to substitute consecutive tabular pages. We rejoice at the ample details of meteorology, crops, fruits, natural history, &c., and at the energy and ability of the editor being backed by such a capital corps of observers.

Meteorological Tables, &c., 1867, by C. BARHAM, Esq., M.D. [From the Journal of the Royal Institution of Cornwall.] 8vo, 11 pages. THE banks of the Tyne and the Land's End have not perhaps much in common, yet the next work on our list contains the returns from

the south-west of Cornwall, from Truro, Helstone, St. Sennen Land's End, Penzance, Bodmin, &c., carefully edited by Dr. Barham. These local abstracts require only nurture and perseverance to render great services to meteorology and natural history; in the latter branch the Cornishmen must look to their laurels in more senses than one.

Third Annual Report on the Sanitary Condition of Merthyr Tydfil, being for the year 1867, by the Medical Officer, T. J. DYKE, Esq., F.R.C.S., &c.—White & Sons, Merthyr. 8vo, 23 pages.

THE record of marvellous progress which we have previously noted in this town continues, and the death rate, which in 1852 was thirty in a thousand, in 1867 was under 21. The town is, as readers of *British Rainfall* are well aware, in a district of heavy rainfall—50 or 60 in. per year; this, with a dense population, no drains, and no means of obtaining, or rather retaining, pure water, led to the usual results. The mortality was 30, the average age at death was 17, and the town was altogether as uncomfortable as it was unhealthy; now all that is changed. The rain, instead of soaking and soddening the ground, runs into 34 miles of sewers, and purges them thoroughly, while that which falls on the hills is intercepted, stored, cleansed, and supplied plenteously throughout the houses of rich and poor alike; the water is even softer than in 1866, for it averages only 3 degrees of hardness.

THE SUMMERS OF 1865 AND 1868.

To the Editor of the Meteorological Magazine.

SIR,—Notwithstanding the reported heat of the past summer, an examination of the registers of former years reveals the fact that the average temperature of the five summer months of May, June, July, August and September, has this season been only a trifle over that of 1865 for the like period, as will be seen by the following figures, which denote the average max. thermometer in the shade for the day, and the usual min. for night, thus :—

		1865.	
		Average max.	Average min.
May	.....	70·9	46·2
June	.....	76·7	48·5
July	.....	77·1	51·5
August	.....	73·3	50·5
September	.....	78·0	53·1
Average for 5 months ...		75·2	50·0
		1868.	
May	.....	70·5	45·6
June	.....	74·2	49·0
July	.....	81·4	55·5
August	.....	74·7	53·7
September	...	74·8	51·1
Average for 5 months ...		75·1	51·0

From the above it will be seen that the average day temperature in 1865 was a trifle higher than it has been the past season, but has been more than compensated by the greater heat of the night; but the whole difference is much less than might be expected, when we remember the hot weather in July, and in fact the advantages the present season has had over 1865 was in consequence of the high temperature of that month and the small rainfall of the season—only 8·06 inches falling in 1868, against 12·88 in 1865, and the still greater disadvantage that year presented, of the hottest and driest weather being at the end of it, the September of that year being, in my opinion, a more remarkable month than any in 1868, and one which much increased the average temperature of the period given, so that by the end of that month the growth of trees and other things of a permanent character were as far advanced towards maturity as they were the past season at the same time, and notwithstanding the great rainfall of that year, (exceeding that of 1860 in this district), I would regard it as a more favourable season in many respects than the one we are now passing through.

J. ROBSON.

Linton Park, Staplehurst, October 31st, 1868.

SHADE TEMPERATURE.

To the Editor of the Meteorological Magazine.

SIR,—As you have invited discussion on the question of shade temperature, and the desirability of adopting among observers some uniform plan of thermometer stand, I venture to offer a few remarks thereon.

Shade temperature of the air, I take it, is that which is indicated by a thermometer wholly protected from the sun's rays, and from radiation by surrounding walls, &c. ⁽¹⁾

It seems to me that the thermometer stands generally in use are open to the objection that they become more or less heated *en masse* by the direct rays of the sun during the day, and cool down rapidly by radiation during the night. I have noted a fall of two degrees occurring in a thermometer moved two or three inches in advance of the board of one of these stands, on which it had been suspended in contact, while the temperature remained unaltered in another thermometer left in contact with the board. ⁽²⁾ I find, also, that not using a stand, I register a lower temperature by day, and higher by night, than is registered by my neighbours using ordinary stands. This difference amounted to from one to five degrees during the day and from three to six degrees during the night, within the last eight days. ⁽¹⁾ My thermometers (made by Casella) are suspended on an iron railing, at the distance of ten inches before a window, about ten feet from the ground, facing north-west, and screened effectually from the west by a range of coach-house and stable buildings, extending at a right angle from the wall in which is the window referred to, so that not a ray of sunshine reaches it all the year round. The bulbs of the thermometers

are freely exposed to the air, and I cannot but regard them as favourably placed for registering the actual temperature of the air. I concur in your observations upon the almost infinite variety of houses and grounds, and although retaining a preference for my own arrangements, and mistrusting the ordinary thermometer stands, I can see the importance of uniformity upon the form of thermometer stand, and shall be ready to submit to the dictum of the learned in these matters when they shall be agreed thereon.—I remain, yours, &c.,

W. B. KESTEVEN.

Holloway, November, 1868.

[Mr. Kesteven has done such good service by calling attention to irregularities in solar radiation temperature records, that we gladly allow him to break a lance against thermometer stands. On their behalf, however, we submit two or three notes, which will be most readily recognized by small figures we have ventured to insert in his letter.

(¹) Walls, especially thick ones, are marvellous storehouses of temperature—by day far colder than the surrounding air, and at night correspondingly warmer.

(²) The thermometers had no right to be in contact with the board. (See p. 155)

We are very glad that Mr. Kesteven recognizes the improbability of any other observer having a similar position for his thermometers, and welcome most heartily so able a convert to uniformity.—ED.]

REGISTRATION OF RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—Is the moisture produced by heavy dews (which I often find in my rain gauge) to be recorded as part of the “rainfall?” I have often been puzzled about this, and I should be glad to know what is considered the proper practice by those who have had the greatest experience in these matters. This morning, at 9 o'clock, I measured 0.07 in., resulting from the frosty dew of last night, the minimum temperature at 4 feet having been 34°·7, the wet and dry bulbs reading alike, 45°·7, and every object being completely saturated with the dew and fog.

As the addition to the rainfall proper, of even the small amounts produced as above, must make some considerable difference in a year's observations, and as uniformity of practice is so especially desirable, I shall be very much obliged if you will publish this letter.

Yours obediently,

BOSCAWEN T. GRIFFITH.

Trevalyn Hall, Wrexham, October 12th, 1868.

[Dew is certainly to be included in the total amount, since so far as measurement is concerned, rain includes Rain, Snow, Hail, Fog, Dew, in fact all collectable moisture whatever be its form. The above quantity being less than 0.01 inch, should be returned to the gauge, and left to augment the next measurement.—ED.]

SOLAR RADIATION TEMPERATURES.

To the Editor of the Meteorological Magazine.

SIR,—I have registered the reading of a black bulb thermometer *in vacuo*, and an ordinary exposed black bulb (both by Negretti and Zambra, and tested at Greenwich), for the last two years and more, and although most of your readers are aware of the difference, it is evident from the correspondence in your last two numbers that some are not. Both instruments were placed on forked sticks, two inches above short mown grass, and during the two years from July 1st, 1866, to June 30th, 1868, the results were as follow.

Excess of black bulb *in vacuo*, was—

From 1° to 5° on ...	19 days.
Over 5° and under 10° on	57 "
" 10° " 15° "	110 "
" 15° " 20° "	156 "
" 20° " 30° "	361 "
" 30° " 40° "	27 "
Exceeded 40° on ..	1 "

Least difference, 1°, November 30th, 1867, foggy and calm.

Greatest, 44°, August 1st, 1866, bright sun, and heavy gale blowing.

Average difference for two years, 19°·22.—Yours truly,

THOS. WARING.

Waringstown, Co. Down, November 2nd, 1868.

METEOROLOGY AT NORWICH.

(Concluded from page 146.)

THE METEOR SHOWER OF AUGUST, 1868.

Mr. Glaisher read the following paper by Mr. G. Forbes:—

Having been requested to write an account of what I saw during the late August meteor shower, I shall attempt to state as shortly as possible the appearance at Cambridge on the nights of the 10th, 11th and 12th of August. The meteors were in general small, and those trains which appeared to vanish instantaneously were probably optical delusions. No meteors were observed to burst. Attention was chiefly directed to determining the numbers and the radiant point. Being unprovided with a suitable chart, I was only able to lay down the directions of the meteors about Cassiopœia. Though such observations were limited in number, yet they were the most trustworthy ones, in that the lines of flight had to be produced but a short distance. I should have considered the numbers hardly sufficient but for the remarkable agreement between the position of the radiant thus determined on the 10th of August and that determined on the same day last year. The diagram shows the direction of eight, which alone were suitable for my purpose. The point marked A is probably, as nearly as can be determined from them, the radiant point. Its position is R A 2h. 16m. N P D 31°. B is the point discovered last year. Its position is R A 2h. 43m. N P D 29° 30'. On the night common to the 11th and 12th of August, the meteors were far more erratic. Not more than five or six came from about the radiant point of the previous evening. They seemed to come from the point marked A1. On the

evening of the 10th the directions were much more generally from the radiant point than last year; for though so few were charted, many more were seen to pass in directions through the same radiant. On neither night did I see any meteors coming from the radiant in Pisces which I determined last year. As to numbers, the best idea of them will be obtained from the table, in which all those appearing to come from about the radiant are collected into one column, while the erratic ones are placed in another. From this it appears that the hourly average on the evening of the 10th was 20, which, compared with the average of 25 last year, shows that the shower has not yet ceased decreasing since the maximum in 1863. The night of the 11th gave seventeen conformable meteors in the hour; but on this night, owing to the clouds in the early part of the evening, and the brilliancy of the moon in the latter part, I was only able to observe for one hour. The colour of the meteors was almost uniformly white, but on the evening of the 10th, at six minutes past eleven, an erratic one passing Cassiopœia was green and red, scintillating like Sirius, and equal to a third magnitude star. In the case of a meteor leaving a train, the nucleus was generally noticed to pass beyond the end of the train. This appearance struck me even more forcibly in the great November shower of 1866. In such a case the nucleus disappeared suddenly without previous diminution of brilliancy. This, if it was no optical delusion, is important when considered in connection with the prevailing theory of the illumination of these bodies. On the 10th the paths of two meteors were curved. The first appeared before I had begun noting them down. The second, marked A in the diagram, described the curve shown there. The only other one I ever saw describe a curve of this sort was on the 21st of October, 1866, at eleven o'clock, when the curve marked B was described round B Aurigæ. The meteor A appeared at 12h. 11m. 38s. The trains were generally broken in the middle, just as in last year's shower. I then thought the haziness of the sky was the cause, but this year the 10th of August was one of the clearest nights I ever saw. The most curious appearances in the late shower were—1st, the description of the curves; 2nd, the passing of the nucleus beyond the end of the train (this is perhaps an optical delusion); 3rd, the undiminished brilliancy of the nucleus before its sudden extinction; 4th, the fact that the density of the shower still continues to decrease each year; and 5th, the apparent change in the position of the radiant point on successive nights. This, however, is possibly an error arising from an insufficient number of observations; but it was suspected by Dr. Twining in America many years ago. In fact, he found the radiant point on ten successive nights in the great August shower of 1863, and so far from agreeing, these points on being joined in order, formed a regular curve. I have now mentioned everything worthy of notice which I saw during the late shower; and I hope that, when combined with other observations in different places, these remarks may not be altogether useless.

OCTOBER, 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° on grass
		Total Fall.	Difference 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	2.54	— .05	.59	25	13	66.2	12	27.8	19	6	
II.	Staplehurst (Linton Park) ...	2.07	— 1.03	.60	3	11	66.0	12	27.0	19	6	
III.	Selborne (The Wakes).....	3.41	— .80	.68	6	13	64.0	24*	27.5	17	6	
IV.	Hitchin	2.89	+ .34	.61	3	14	58.0	6, 15	30.0	18||	2	
V.	Banbury	2.36	— .07	.53	3	13	60.0	10†	25.0	19	6	
VI.	Bury St. Edmunds (Culford) ..	2.62	— .09	.53	3	11	62.0	6	26.0	19	4	
VII.	Bridport	3.32	— .71	.65	6	17	69.0	12	27.0	20	5	
VIII.	Barnstable	5.59	+ 1.47	1.07	7	22	66.0	13	33.5	20	0	
IX.	Bodmin	6.01	+ .69	.90	24	22	63.0	11	36.0	18	0	
X.	Cirencester	2.64	— .85	.60	26	12	...	...	...	...	...
XI.	Shifnall (Haughton Hall) ...	1.50	— .74	.25	3	17	58.0	10†	25.0	20	3	
XII.	Tenbury (Orleton)	2.24	— .99	.66	6	19	63.0	10	26.3	18	5	
XIII.	Leicester (Wigston) .....	...	...	...	...	...	...	...	...	...	...
XIV.	Boston	3.22	+ 1.10	1.36	3	16	62.2	12	31.0	19	2	
XV.	Gainsborough .....	...	...	...	...	...	...	...	...	...	...
XVI.	Derby .....	...	...	...	...	...	...	...	...	...	...
XVII.	Manchester	4.50	+ .69	.68	6	24	64.0	10	30.0	2	4	
XVIII.	York	2.92	+ .40	.76	3	15	58.0	10	29.0	18	2	
XIX.	Skipton (Arnccliffe) ...	7.53	+ .87	1.20	31	19	60.0	1	34.0	19	0	
XX.	North Shields	2.08	— 1.20	.67	2	12	59.5	31	31.0	19	1	
XXI.	Borrowdale (Seathwaite).....	...	...	...	...	...	...	...	...	...	...
XXII.	Cardiff (Town Hall).....	4.36	...	.83	16	16	...	...	...	...	...
XXIII.	Haverfordwest	5.50	+ .31	1.07	28	15	61.0	12	28.0	18	1	
XXIV.	Rhayader (Cefnfaes).....	3.95	— 1.65	1.01	28	22	83.0	...	28.0	...	3	
XXV.	Llandudno	2.56	— 1.40	.56	28	21	64.1	10	34.6	19	0	
XXVI.	Dumfries	3.53	— 1.39	.49	24	22	62.0	10	28.0	19	2	
XXVII.	Hawick (Silverbut Hall) ...	2.13	...	.36	28	16	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	5.86	+ .91	1.01	28	22	61.0	11	26.0	20	4	
XXIX.	Castle Toward	5.37	— .38	1.02	24	25	61.0	11	27.0	18	19	
XXX.	Leven (Nookton)	1.89	— 1.86	.40	24	14	58.0	5	28.0	20	4	
XXXI.	Stirling (Deanston)	4.83	— .08	.50	16	21	59.3	9	24.0	20	12	
XXXII.	Logierait	2.77	...	1.15	25	18	...	...	...	...	...
XXXIII.	Ballater	1.80	...	.66	24	13	58.3	31	24.0	20	9
XXXIV.	Aberdeen	1.96	...	.67	24	13	60.0	10	28.2	19	14
XXXV.	Inverness (Culloden)	1.90	...	.39	19	12	56.6	31	33.2	20	0
XXXVI.	Fort William	11.37	...	1.63	31	27	...	...	...	...	...
XXXVII.	Portree	14.20	+ 3.42	1.92	14	28	58.2	10	33.8	18	0	
XXXVIII.	Loch Broom	8.52	...	1.06	16	28	...	...	...	...	...
XXXIX.	Helmsdale	3.44	...	.57	24	17	...	...	...	...	...
XL.	Sandwick	5.34	+ .42	.58	15	24	57.0	6	34.4	20	0	
XLI.	Cork	2.87	...	.78	5	18	...	...	...	...	...
XLII.	Waterford	3.72	— .68	.74	23	25	61.0	12	34.0	19	0	
XLIII.	Killaloe	6.20	+ 1.13	1.20	23	24	59.5	11	30.0	19	1	
XLIV.	Portlannington	2.08	— 3.05	.44	24	24	63.5	11	31.0	18	1	
XLV.	Monkstown	1.00	— 2.92	.30	23	11	...	...	...	...	...
XLVI.	Galway	6.16	...	1.18	23	26	63.0	3	32.0	17¶	0	
XLVII.	Bunninadden (Doo Castle) ...	4.11	...	.53	23	24	57.0	10	28.0	2	5
XLVIII.	Bawnboy (Owendoon)	4.38	...	.65	5	27	63.0	11	31.0	4**	3
XLIX.	Waringstown	2.13	...	.35	5	19	64.0	11	31.0	18††	3
L.	Strabane (Leckpatrick)	3.31	...	.35	23	25	61.0	9§	27.0	19	11

* And 25th. † And 13th. ‡ And 24th & 31st. § And 10th & 11th. || And 19th.

¶ And 20th. ** And 16th & 17th. †† And 19th & 20th.

+ 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.—Dahlias in good condition till the 5th of November.

LINTON PARK.—Frosts on six days; those on the 19th and 20th unusually severe for the time of year; L on the evenings of the 21st and 22nd; high winds on the 3rd and 24th, but on the whole it may be considered a fine month.

SELBORNE.—Several trees (apple, dogwood and others) with second blossom; very high wind on 24th; two trees blown down in my grounds.

BANBURY.—Gale on 24th, trees blown down; H on 21st.

CULFORD.—High wind on 24th; mean temp., 46°·5; the weather during the whole month has been fine for the time of the year.

BRIDPORT.—A wet month, with the exception of the 2nd week, which was fine.

CIRENCESTER.—Dahlias killed between 18th and 20th. A large meteor seen at midnight of the 8th. A great crop of acorns, and fine Spanish chesnuts.

HAUGHTON HALL.—A slight shock of earthquake felt about 10.50 p.m., on 30th; the sensation was as if a door had been shut heavily below stairs, but no other noise; it lasted about two seconds; it was felt generally in this neighbourhood; the temp. had been high. Great and sudden changes of temp. during the month, with frequent R, but no weight of it, the greatest fall in one day being only 25 in. The potatoes left in the ground, instead of being lifted at the usual time, have done well; the second crop of tubers doubtful as to keeping, the skins being hardly fast. The rhododendrons flowered a second time, the blossom appearing from the centre of the former one, then in seed. Many ferns, too, especially Filix-mas, that had withered from heat, sprouted again, as in the spring.—[ERRATUM. Last month Ackerspit should have been Ackerspritt.]

MANCHESTER.—This has been the first month since March with a rainfall above the average; H on 17th, 26th, 29th, and with thunder on 23rd.

ARNCLIFFE.—Unusually wet month; gale from W. on 30th.

NORTH SHIELDS.—H with T on 16th.

WALES.

HAVERFORDWEST.—The month commenced fine and calm, with white frosts in the mornings; from 6th to 10th very wet; another wet period, alternating with cold uncertain weather, set in on the 15th, and continued with increasing wetness and stormy weather, till the end of the month.

CEFNFAES.—A sensible shock of earthquake was felt on the night of Friday, the 30th, about 11 o'clock, accompanied by a rushing noise, as of a steam engine going past at full speed; its direction appeared E. and W., and was felt at many places in this neighbourhood. The month has been generally wet, with stormy winds chiefly from the S.W.; violent gale on the 24th; snow on the 18th.

LLANDUDNO.—H, snow, T, and forked L on the 19th.

SCOTLAND.

DUMFRIES.—A few fine days at the beginning; the rest of the month broken weather, with occasional frosts; snow on 17th and 19th; H on 18th, 21st, and 29th; the end of the month very stormy; mean temp. 1°·5 below the corresponding month. Rainfall also below the average of last five years.

HAWICK.—A mild month; T and L on 16th; fine aurora on the night of the 19th; and beautiful rainbow on the morning of the 25th. Potatoes are not keeping well in this neighbourhood.

AUCHENDRANE.—The rainfall is above the average; the winds have been principally equatorial, and the weather stormy and, towards the end of the month, boisterous.

CASTLE TOWARD.—The first half of the month mild, the latter stormy, cold, and wet, with frosts almost every night after the 12th. Bedding-out plants are

still unhurt, although 27°·0 was registered on the 18th: the frosts being always followed by R may account for it. Many of the laurestinus are already in full flower.

DEANSTON.—Although there has been a good deal of R there has also been a fair allowance of sunshine, 115 hours against 119 in September; some sharp frosts, and on the 19th a slight fall of snow and a heavy fall on the hills; T on 6th and 15th; aurora on 19th.

LOGIERAIT.—A very wet month: auroræ on several nights; keen frost on the 19th.

BALLATER.—Aurora on 19th; both rainfall and temp. below the average; Locknager covered with S on the 1st of October, the first time this season, the nearer ranges white on morning of the 20th. The potatoe crop a fair one, with no trace of disease, and secured in good condition.

ABERDEEN.—L on the evenings of the 13th, 15th, 18th, and 23rd; auroræ on 7th, 15th to 23rd, 25th and 26th. A fine month but rather cold, the mean temp. (45°) being 1°·3 below the average; winds generally light, S.W., W., and N.W. more frequent than usual.

FORT WILLIAM.—S on the hills on the 6th, low on the hills on 15th, and all covered with it on the 18th; ice nearly half-an-inch thick on the 19th. Very wet month.

PORTREE.—The month has been very wet, cold, stormy, very squally throughout, with coating of S on the hills and several heavy H showers. Much of the corn is still unstacked in the latest part of the island, and the potatoes unlifted. Only two dry days during the month.

LOCHBROOM.—On the whole this has turned out one of the wildest and stormiest Octobers of recent years; 28 rainy days in the month, and not one fine one since the 11th; fortunately, except potatoe lifting, little of harvest work was undone on its "enter," and owing to its surly conduct, many potatoes are still exposed to its inclemency.

SANDWICK.—Heavy gales on the 6th and 16th; auroræ on 9th, 10th, and 19th to 23rd, very fine on 21st; solar halo on 5th; lunar rainbow on 25th; the month has been wetter and colder than the mean; TS on morning of 26th. A shower of large H at 10 a.m. on 27th was the most remarkable incident in the month; many of the hailstones were the largest I ever saw, six of them weighing half an ounce, or two scruples each, half an hour after the shower, being twice the weight of those which broke 40 panes of glass in the Manse in 1843; but from this shower coming more obliquely, and on the N. and W. sides, only 20 panes were broken. There was smaller H mixed with it; most of the hailstones were round like marbles, but some were pear-shaped.

I R E L A N D.

MONKSTOWN.—A very severe gale on the 24th.

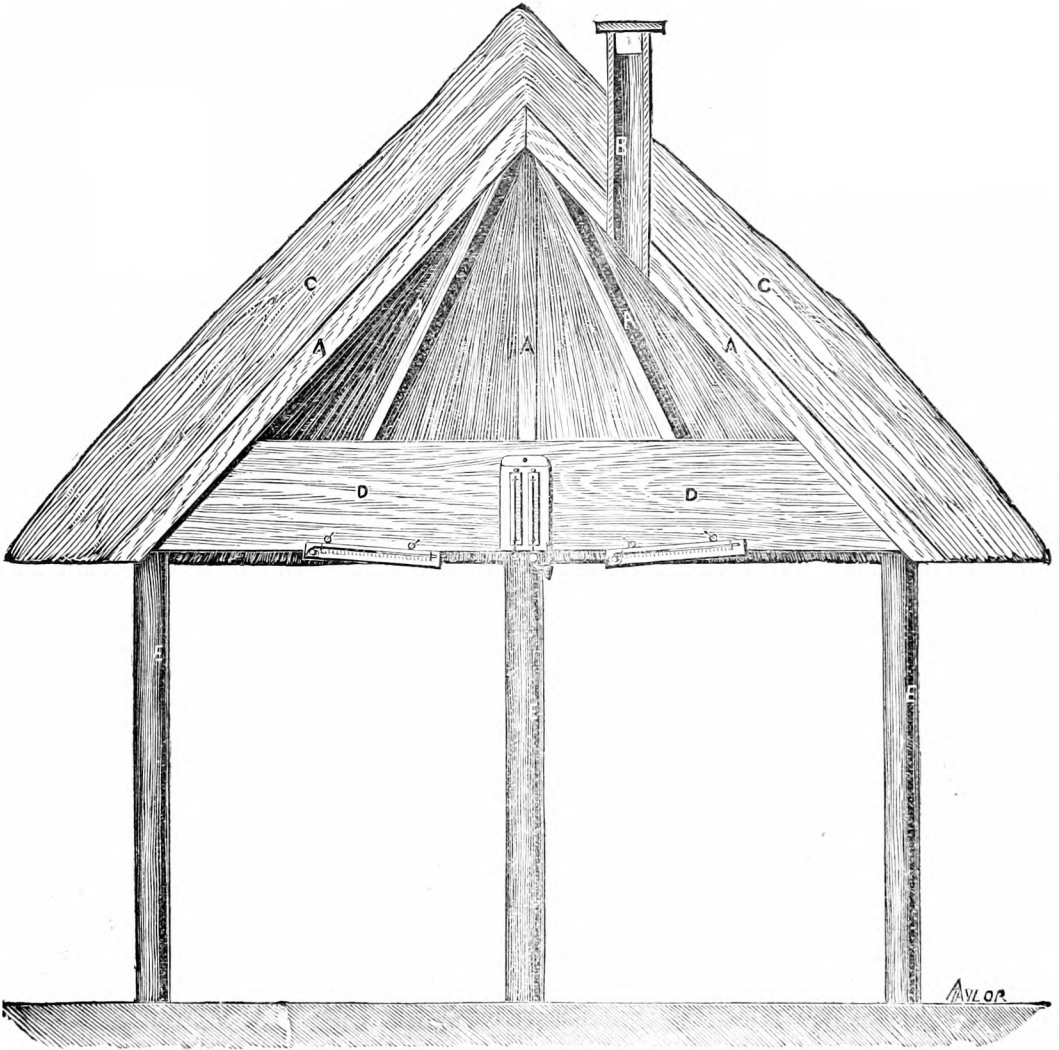
DOO CASTLE.—Wet month; R on almost every day, accompanied by strong winds; gales on the nights of 5th and 24th, still further establishing "periodic gale about the 25th, &c." Potatoe digging progressed, despite of the inclemency of the weather and its unsuitableness for this kind of work. S on the mountains on 17th.

OWENDOON.—First S on mountains on 17th; great aurora on 19th; high gale on 24th; temp. in shade, 57° on 31st.—[Total rainfall in September should have been 3·05.]

WARINGSTOWN.—An extremely fine and enjoyable month; several heavy gales towards the end; potatoe crop very good.

LECKPATRICK.—Very cold month; temp. lower than ever recorded here (for this month); frost on grass on 16 nights; rainfall for the year to the end of this month only 29·63 in.; during the same period in 1867 there fell 41·47 in.; great scarcity of water hitherto; some wells still unsupplied with water; latter part of the month stormy; short gale on 24th.

MARTIN'S THERMOMETER STAND.



A A A A Rafters.

B Chimney.

C C Thatch.

D D Thermometer Board.

E E E Posts.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XXXV.]

DECEMBER, 1868.

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THERMOMETER STANDS.

SINCE last month we have been favoured with several communications on the above subject, some of which we append to this article. Wishing, however, to complete as soon as may be our description of all the leading varieties, we proceed to notice

MARTIN'S STAND.

We do not intend to pledge ourselves that Dr. Martin was the first to adopt the following form of stand, but we think so, and know of no description prior to that which he gave in *The Undercliff*, published in 1849. In the preface to that excellent work he describes with praiseworthy detail the quality and position of all his instruments. He writes :—

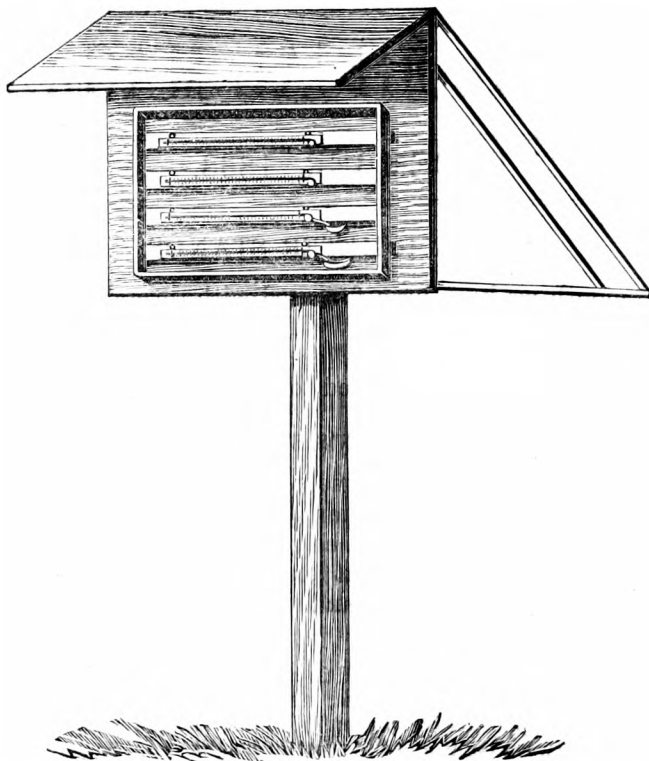
“The thermometers have been placed in a little observatory built expressly in a most exposed, and, for such a purpose, unobjectionable situation. It consists of a thatched roof, supported on wooden uprights, partly resting against a wall, the whole being between eight and nine feet in height.

“At a distance of about six feet from the ground small deal boards are fixed transversely, so as to give each pair of thermometers its proper aspect ; and the roof is ventilated by a zinc chimney for the purpose of preventing any accumulation of heated air from affecting the instruments, which are hung upon the deal boards just mentioned, each pair being placed opposite a cardinal point of the compass. There is no building or high ground within a considerable distance, and the whole has been so contrived that the northern pair of thermometers, from which the results given have been derived, can by no accident be affected by radiation or reflection.”

When Dr. Martin planned this little observatory, even when ten years later he wrote this description of it, meteorological uniformity had no existence, and this open-sided summer-house with a chimney was a capital scheme. In the Strathfield Turgiss experiments (to the account of which these descriptive articles are an indispensable prefix,) we have reproduced Dr. Martin's stand, with only one exception. The height of 4 ft. above grass has been so universally adopted, that it would be most unwise to think of substituting any other height. Therefore, our Dr. Martin's stand carries the thermometers at 4 ft. above the grass instead of at 6 ft., as he had them.

In other respects, as will be seen from the drawing, it exactly resembles his.

JAMES'S STAND.



This is a copy of Glaisher's, of which we gave engravings and description last month, except that Col. Sir Henry James, R.E., F.R.S., recommends that the thermometers should be attached to a frame in front of the stand, as represented in the annexed sketch, instead of being hung below it, as advised by Mr. Glaisher. The relative advantages of the two methods are on trial. Our readers will notice that four registering thermometers, two dry and two wet, are represented, and that Mason's hygrometer is not shown on Col. James's frame, he recommends that "The hygrometric observations should *be taken from the spirit thermometers.*" The italics are Col. James's, and we reproduce the paragraph from his, in many respects excellent, "*Instructions for taking Meteorological Observations, with Tables,*" which was published in 1860. The general excellence of the work gives additional weight to this bad advice, and we can only express our astonishment at his issuing such an "instruction" in 1860, and warn our readers by no means to follow it. Extreme accuracy and sensibility are indispensable for correct hygrometrical observations, and neither for accuracy nor sensibility are spirit thermometers to be compared with mercurial ones,

To the Editor of the Meteorological Magazine.

SIR,—As I had some share in starting the discussion of this subject in your columns, will you allow me to say that the thermometer stand described by Mr. Glaisher in your magazine for this month appears to me to be quite unexceptionable.

My only doubt is whether the plan of a *revolving* stand would be found to work well in the case of the generality of amateur observers.

In an observatory, where there would be competent assistants always at hand to make the required adjustments, there would of course be no difficulty about the matter. But I imagine that there are many amateurs, who are in the habit of making regular and careful observations of the readings of their self-registering thermometers once in the course of the twenty-four hours, who could not undertake to attend to the management of a stand requiring adjustment several times a day, according to the position of the sun.

I would therefore suggest, as an alternative plan, some modification of the Glaisher stand, such as would shelter the thermometers from the influence of the morning and evening sun, assuming the vertical board on which the thermometers are suspended to be always facing due north. This might be effected by the addition of wings projecting from the two ends of the vertical board, without interfering with the general structure of the frame, which would still be admirably calculated to guard the instruments from all danger of direct solar heat during the midday hours, when the sun's power is greatest. Perhaps your correspondent, the Rev. C. H. Griffith, whom you mention as occupied with a series of experiments in connection with this question, might be induced to make a trial of such a modified stand as I have described, with special reference to determining the differences, if any, between the readings of thermometers in such a stationary stand, and those of similar instruments in a revolving frame of the pattern described by Mr. Glaisher.—I am, Sir, yours truly,

G. T. RYVES.

Nuthall, Nottingham, November 24th, 1868.

To the Editor of the Meteorological Magazine.

SIR,—I am glad you have taken up the subject of thermometer stands, for it is one that greatly needs attention.

Will you allow me to say that the Greenwich stand, excellent as it is in other respects, appears to me not sufficiently to guard the thermometers against *heat reflected from the ground*. On an ordinary summer's day, and with the stand placed as it should be on grass, this is of no great consequence, but when long-continued drought has made the grass-plot, as it did everywhere last summer, as bare and brown as a turnpike road, your thermometer might as well be opposite a sunny wall, as four feet above the sunny ground, with nothing to intercept the reflected heat. It seems presumptuous to question the Greenwich observations, but I cannot help thinking that some of the very high maxima recorded there, are partly due to this cause. For several years

I kept my thermometers on a stand made after the Greenwich model, on a breezy lawn some 320 feet above the Thames, with light feathery trees (laburnum, acacia, &c.,) so happily placed that while they kept the grass in shade they allowed the freest circulation of air. Always during that time in hot dry weather, I found, on comparing my weekly maxima with those at Greenwich, as given in the Registrar-General's Report, that if the maximum fell on a bright sunny day, the Greenwich temperature was several degrees above mine, while if the sun was less powerful, they were much more nearly together. I should hardly, however, venture to criticise Mr. Glaisher's arrangements on the strength of my own observations, were it not that the case is so much strengthened by the record at Kew, where (as you will no doubt tell us shortly) the thermometers are enclosed in a cubical box with double sides of louver-board, which, while it admits a free current of air in all directions, guards against all possibility of influence from reflected heat. Thus taking the maxima for the months of July, August and September last, we find the following very great difference:—

	Greenwich.	Kew.
July 22nd	96°·6	90°·2
August 5th	90°·5	85°·4
September 7th	92°·1	86°·4

which can hardly be due altogether to difference of locality, but must, I think, be partly owing to the cause I have named.

The evil would be, to a great extent, obviated by a horizontal board, 15 inches wide, and as long as the stand is wide, suspended at a distance of a foot below the lower edge of the board B by two strips of wood or metal attached to the ends of the horizontal board. This would sufficiently intercept the heat reflected from below, while it would not interfere with the free access of air to the thermometers.

When you have sufficiently ventilated the subject of thermometer stands, I hope you will take up the various methods in use of calculating daily mean temperatures.—I am, Sir, your obedient servant,

B. W. SMITH.

Hampstead, N. W., November 21st, 1868.

To the Editor of the Meteorological Magazine.

SIR,—I am glad to see Mr. Kesteven's letter, and your invitation to meteorologists to offer their opinions on the best method for registering the true shade temperature.

I believe this is a most difficult question, and that much remains to be done to arrive at a just uniformity in recording the maximum shade temperature.

I quite agree with Mr. Kesteven in what he says of the greater heat shown inside the thermometer stands, and in some instances I have observed a difference of *seven degrees* between a thermometer inside the stand (not in contact with the board) and one in some shade outside, the heat having apparently accumulated inside the stand as within an oven,

I am not prepared with any plan to supersede the present stands, though I have no doubt that they would be greatly improved by being covered with a thick straw thatch, and having both sides and bottom open. May we not hope that Mr. Glaisher himself will again turn his attention to this important subject, and suggest some improved thermometer stand that may be universally adopted?—Yours, &c.,

JAMES LIDDELL, Com. R.N.

Bodmin, November 21st, 1868.

MONTHLY CHRONICLE.—NOVEMBER.

On 3rd, about 3.20 p.m., a very bright meteor was seen, during strong sunshine, from Chipping Norton, Birmingham, Rugby, Northampton, and other places; from the bearings given it would seem to have disappeared above the town of Banbury.

On 5th, the transit of Mercury was very well seen, the sky being for November remarkably favourable.

	First contact.				Last contact.		
	h.	m.	sec.		h.	m.	sec.
Leyton	21	0	12.38	...	21	3	5.70
Steyning	20	59	15	...	21	1	45

On 8th, snow 0.1 in. deep in London in the early morning, and near Birmingham three or four inches deep. Very heavy in Switzerland; the *Courrier de l'Isère* states that more than 8000 sheep were buried in snow.

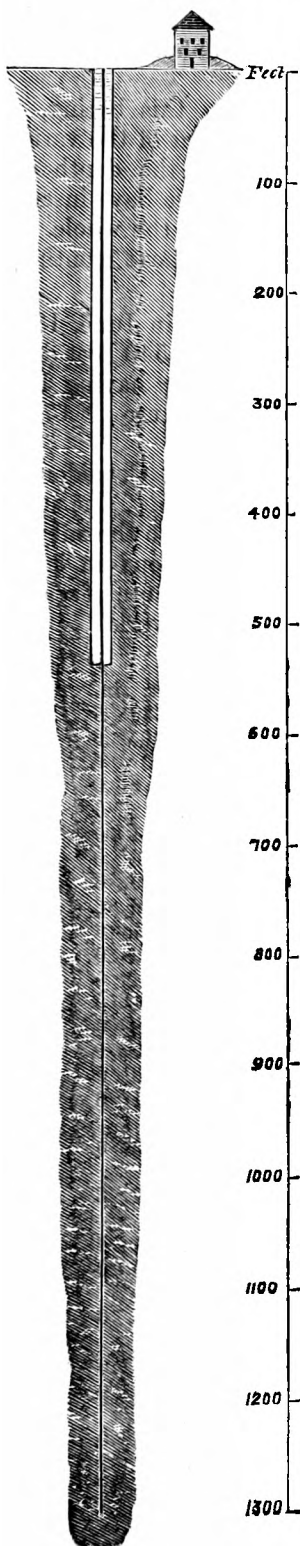
On 9th, three specimens of the parrot crossbill (*Loxia pityopsittacus*) were seen on the Malvern Hills—said to be a sign of a hard winter.

On the 13th, the barometer rose to 30.65, reduced to sea level. The following paragraph appeared in the *Express*, and was copied into several papers:—

“STATE OF THE BAROMETER.

“We feel it is a duty to direct the serious attention of mining proprietors and managers of mines to the extraordinary height of the barometer, which marked 30.65 this forenoon. The greatest caution should be observed during the next few days, for the result of any sudden fall of the barometer would be that the gas, now kept back by the very great weight of the atmosphere, would rush into the workings to the imminent peril of careless miners. The terrible accidents at the Oaks and Talk-o'-the-Hill Collieries in 1866 happened after a sudden fall of the barometer. On the 10th of December the mercury stood at 30.40; on the 11th there was a fall of nearly one inch, and that fall continued till the 13th. During that interval the explosions at the above-named collieries took place. Nearly all serious casualties from fire-damp have occurred when great depression of the barometer has been observed. At such times there is considerable difficulty in obtaining proper ventilation, and as a rule a more than ordinary amount of air should be sent down into the mines. The managers, especially in very gaseous pits, should take care that this precaution is attended to, the neglect of which, under the circumstances indicated, is almost criminal.”

On the night of the 13-14th, a very much grander display of meteors occurred than the public had been led to expect; they were mostly large, and though of course not so numerous as in 1866, they were sufficiently so to attract the attention of all persons who were out during the night; 354 were counted at Penzance in 5 hours, of which 146 were seen between 4 and 5 a.m.; the radiant was almost exactly the same as in previous years. At Naples the display was very well seen for Europe,



The thermometer at 1 ft. is in a box which gets very greatly heated, whence its high mean temperature. It will be noticed that the difference between the hottest and coldest month decreases with the depth, and vanishes altogether about 30 ft. below the surface.

The increase of mean annual temperature below 100 ft. has been so variously stated, that no general rule can be laid down; an increase is always found, but the rate of increase varies from one degree in 30 ft. to one degree in 100 ft., and this rate of increase is the subject of the present enquiry.

At the meeting of the British Association at Dundee, Professor Sir W. Thomson moved the appointment of a committee to investigate the temperature of the earth at great depths. The year ending with the Norwich meeting, in the autumn of the present year, was chiefly occupied in arranging the best modes of procedure, and the active operations of the committee may be said to date therefrom. On the present occasion we intend to confine our notice to one set of observations, namely, those which have been originated by Mr. Symons at the site of the late Hampstead Water Works in the Kentish Town Road, about half a mile south of Highgate Hill. A very few words will suffice to explain the origin of the opportunity of which advantage has now been taken. As far back as the time of Henry VIII. the Hampstead Water Works Company was formed, to supply certain villages with water; as time wore on, these villages grew, and eventually all have been united into suburbs thickly covered with first-class houses. The original sources of supply became inadequate, and a well was therefore sunk into the chalk to a depth of some 500 or 600 feet. For some years this yielded a sufficiency, but as both the individual consumption of water, and the number of consumers, increased, the supply again became unequal to the demand. The company, acting on the best advice, resolved to sink an artesian well, through the centre of the old well, down into the lower green-sand, generally an abundant source of sup-

ply. The boring was carried down 1300 ft. (a quarter of a mile), but the lower greensand was absent, no water was obtained, and the company was ruined.

As considerable geological interest is attached to this boring, we have reprinted from a scarce blue book an exact account of the various strata. We add also a section, giving some idea of the depth and details of this celebrated well, in the sketch of which we have inserted a house, 50 ft. high, as an indication of the scale of the whole. A description of the proposed experiments shall be given next month.

ARTESIAN WELL AT KENTISH TOWN.

"The new boring at Kentish Town was commenced in June, 1853, from the bottom of the old well, which had been sunk 540 feet deep. The work was abandoned at the end of 1855, no water having been obtained, even at a depth of 1302 feet, and an expenditure of £7500 having been incurred.

"The result of the undertaking was most unexpected. Considerable discussion has arisen among geologists as to the nature of the strata which have been met with, and much interest attaches to the subject. We are enabled by the courtesy of the engineer to append an entire section of the strata. It would be of importance to the cause of science if any means could be found for the continuance of the work.

Section of the Boring at Kentish Town.

		ft. in.		Depth.	
		ft.	in.	ft.	in.
CHALK, 536 ft.	TERTIARY STRATA, 234 ft. 6 in.	<i>London Clay</i> (236 ft.)	1. Yellow clay	30	6
			2. Blue clay, with <i>Septaria</i>	205	6
			3. Mottled (red, yellow and blue) clay ...	37	6
		<i>Woolwich and Reading Series</i> (61 ft. 6 in.)	4. White sand, with flint-pebbles ...	0	6
			5. Black sands; <i>passing into</i>	2	0
			6. Mottled green and red clay	1	0
			7. Clayey sands	3	0
			8. Dark-grey sands with seams of clay ...	9	6
			9. Quick-sands, ash-coloured	6	6
		<i>Thanet Sands</i> (27 ft.)	10. Flint-pebbles	1	6
			11. Ash-coloured sands	10	0
			12. Argillaceous sands	4	0
			13. Dark-grey clayey sands... ..	11	0
			14. Bed of angular green-coated flints ...	2	0— 234 6
			15. Chalk with flints	119	6
			16. Hard chalk without flints	8	0
			17. Chalk, less hard with few flints ...	31	6
		<i>Middle Chalk with flints</i> (244 ft. 6 in.)	18. Nodular Chalk, with three beds of tabular flints	13	6
			19. Chalk, with seams of tabular flint and a few nodular flints	32	6
			20. Chalk, with a few flints and some patches of sand	9	6
		<i>Lower Chalk without flints</i> (294 ft.)	21. Very light-grey chalk, with a few flints	30	0
			22. Light-grey chalk, with a few thin beds of chalk-marl subordinate	133	0
			23. Grey chalk-marl, with compact and marly beds and occasional pyrites ...	161	0
		<i>Chalk-marl</i> (47 ft. 6 in.)	24. Grey marl	20	0
			25. Harder grey marl, rather sandy and with occasional iron-pyrites... ..	27	0
			26. Hard rocky marl	0	6— 910 6

		Depth.	
		ft. in.	ft. in.
UPPER GREENSAND (72 ft. 6 in.)	27. Bluish-grey marl, rather sandy; the lower part more argillaceous...	58	9
	28. Dark-green sand, mixed with grey clay	13	9—983 0
GAULT (130 ft. 6 in.)	29. Bluish-grey micaceous clay, slightly sandy ...	39	0
	30. Ditto, with two seams of argillaceous greensand ...	6	7
	31. Micaceous blue clay ...	84	11—1113 6
188 ft. 6 in.	32. Red and yellow sands, and sandstone ...	1	0
	33. Compact red clay, with patches of variegated sandstone	4	0
	34. Pure dark red clay ...	4	7
	35. Red clay, whitish sands, and mottled sandstone ...	3	0
	36. Hard red conglomerate, with pebbles of syenite, greenstone, trap-rock, quartz, hornstone, red claystone-porphry, and fossiliferous schist, well rounded, and varying in size from a marble to a cannon ball ...	2	0
	37. Micaceous red clays, mottled in places ...	26	0
	38. Seams of white fissile sandstone and red sand ...	3	8
	39. Mottled sandstone ...	0	4
	40. Red sand and sandstone with small pebbles and <i>Belemnites</i> , and a few small phosphatic nodules ...	2	0
	41. Seams of red sandstone and white sands ..	4	0
	42. Pebbly red sands, and fissile sandstone ...	1	0
	43. White and red sandstone ...	5	0
	44. Fine light-red sands ...	2	9
	45. Hard fissile sandstone ...	0	3
	46. Very fine light-red sand ...	4	0
	47. Pure red clay ...	2	0
	48. Red and mottled clayey sands, with some iron-pyrites	1	3
	49. Red sandy micaceous clay with fissile sandstone ...	2	5
	50. Compact hard greenish sandstone ...	10	0
	51. Very micaceous red clay ...	1	0
	52. Grey and red clayey sands ..	1	1
	53. Light-coloured soft sandstone with fragments of <i>Ammonites</i> ...	2	1
	54. Red sand and sandstone (highly inclined ?) ...	6	2
	55. Greenish sandstone ...	4	0
	56. White and grey clayey sands, with iron-pyrites ...	2	0
	57. Reddish argillaceous sands, with seams of sandstone ...	3	8
	58. Micaceous red clay... ..	18	4
	59. Seam of greenish sandstone ...	0	5
	60. Red mottled and micaceous clay, with patches of light-coloured sand and fragments of <i>Ammonites</i> and of a <i>Scaphite</i> ...	14	6
	61. Red compact micaceous clay, with <i>Belemnites</i> ...	20	0
	62. Red quartzose and micaceous sandstone ...	2	0
	63. Brownish-red clayey sand and sandstone ...	4	0
	64. Very hard micaceous sandstone, with small pebbles of white quartz ...	4	0
	65. Light red argillaceous sand ...	10	0
	66. Red sandstone, micaceous and quartzose ...	8	0
	67. Light red clayey sands (with small angular fragments of chert or flint ?) ...	2	0
	68. Whitish and greenish hard sandstone (horizontal ?) ...	6	0—1302 0

(To be continued.)

REGISTRATION OF RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—Will you allow me to suggest another mode of dealing with thousandths of an inch of moisture, besides the one given in your editorial note at the foot of Mr. Griffith's letter. I would suggest that thousandths of an inch should be entered on the register as they are measured, but that they should not appear in reports containing only hundredths except so far as they go to swell the total amount of rainfall for the month. Thus, if $\cdot 007$ fell one day, and $\cdot 003$ on another, blanks would correspond to these days in tables accurate only to the hundredth of an inch, but the two falls together would appear in the total for the month, as they together amount to $\cdot 01$. This plan is open to the objection that in such tables the total would not exactly correspond with the sum of the figures whose total it appeared to be.

The plan you suggest seems to me open to a more serious objection than the above. Thus in the above supposed case, if the $\cdot 007$ be returned to the gauge, and $\cdot 003$ should fall on that day or night, the next morning you will find $\cdot 01$ in the gauge, and that day will be set down as one of the days on which $\cdot 01$ has fallen, while in reality only two very minute quantities should have been registered. It seems to me hardly fair to credit one day with $\cdot 01$ when the moisture may be due to the aggregate infinitesimals of several days, on none of which $\cdot 01$ has in reality fallen.—Yours obediently,

J. M. DU PORT.

Mattishall, Norfolk.

[The remarks on this subject on page 180 (and in which we fully concur) were in type before Mr. Du Port's letter arrived. We object *in toto* to returns which do not balance—*i. e.*, in which the sum of the daily entries differs from the monthly totals: how could such be checked? We cannot, therefore, accept Mr. Du Port's suggestion. One observer sends in returns professing to give the depth of rain to the hundredth thousandth ($0\cdot 00001$) of an inch; surely no one would advocate counting such a day as a day of rain. Theoretically, Mr. Du Port is quite correct in objecting to the "aggregate infinitesimals" not having a right to appear as $0\cdot 01$. But practically—and surely that should guide us—we do not see a better course than that we pointed out. Those who have been measuring only to tenths of an inch object to the delicacy of hundredths, and those who have been dealing, or thinking they deal, with hundred thousandths, or even thousandths, dislike the coarseness of hundredths, and between the two are the vast majority of observers, who believe that if we know the depth within the thickness of a sheet of paper, we know it near enough.

We hope that Mr. Du Port and Mr. Vernon will consider what we have above stated, also the remarks on page 180, the references to the subject in the various volumes of *British Rainfall*, the inevitable

roughness of many of the gauges, to which we believe we may add as a fact that no rain of less than one-twentieth of an inch ever raises the water in a reservoir, or reaches the London sewers, unless the ground was previously in a saturated state, no engineering publication recognises thousandths of an inch, nor do either of the Meteorological Societies, nor does the Meteorological Office.

Both Mr. Du Port and Mr. Vernon are able men, both have only one object in view, that of securing the best results; each would surely be unwilling to disturb a rule once generally adopted, unless it was evidently mischievous. We are, therefore, very sorry to differ from them, but at present we fail to see that their suggestions would lead to anything but confusion.—Ed.]

REVIEWS.

Proceedings of the Literary and Philosophical Society of Manchester.
Vol. VII., Nos. 7, 9, 10; Vol. VIII., No. 2. 8vo.

It is impossible to do more than briefly indicate the subjects discussed in these valuable papers. Two of them are mainly devoted to solar radiation, and as we hope before long to treat that subject in some detail, we postpone the consideration of those articles for the present. Mr. Baxendell contributes a criticism on Mr. J. P. Harrison's paper in the "Monthly Notices" of the Royal Astronomical Society, entitled "Inductive Proof of the Moon's Insolation," and also Mr. Glaisher's paper "On the Influence of the Moon on the Direction of the Wind," in the Proceedings of the Meteorological Society, 1867. Mr. Vernon contributes a note on the rainfall of 1867, and in the following sentence objects to the decision which Mr. Symons based upon the practice of the majority of observers, and which has been accepted throughout the length and breadth of the land:—

"It would seem that in our district we can safely reckon upon having rain on an average of about 180 days in the year, or that rain falls on about half the days of the year. Of course this includes every day upon which a measureable amount of rain falls, and it is only right that every day on which rain falls, and can be measured, ought to be included, notwithstanding Mr. Symons' limiting the amount to days only on which the fall reaches 0·010 inch. In 1867 there were no less than 16 days on which rain fell less than 0·010 inch in amount, and to leave these out must vitiate the result. Moreover, in places where the rainfall is much less than here, there will probably be a much greater number of days upon which a daily amount of 0·010 inch falls. Every day upon which a measureable amount of rain falls ought to be given, and if for any other purpose a limit in amount is wanted, it ought to be tabulated separately."

When a very large number of gentlemen have been for some years working at any given subject without the means of intercommunication, it is probable they will vary considerably in their modes of procedure; when they have consulted together and come to a definite system of working, and when that system has been approved by all the leading publications on the subject, we consider that such a

decision should only be called in question on really weighty grounds of objection.

We have no desire to re-open the question of what constitutes a rainy day. Ninety-nine observers out of a hundred accept 0.01 as the rule, and we trust they will not swerve from it, for if they do, we shall have a worse chaos than before it was agreed to and established.

Those who take any interest in the matter, can trace its progress in *British Rainfall* 1863, 1864, &c. We prefer to leave it with one parting remark. Mr. Vernon says, "Every day upon which a measureable amount of rain falls." What constitutes a measureable amount depends entirely on the construction of the gauge. It is probably possible to make a gauge which would record the rain drops formed by the condensed steam of a passing locomotive, and there are many useful and trustworthy gauges which will not show less than a tenth of an inch. Which is to be taken, or is the number of days to depend on the form of gauge used? With every respect for Mr. Vernon, we hold that he has not shown adequate ground for disturbing the decision arrived at some years since.

The last of these papers is a very elaborate discussion of ozone observations in all parts of the world by Mr. Baxendell, wherein he states that the discussion of the returns "has suggested to my mind the idea of a belt of ozonized air in the middle latitudes of our hemisphere, which has a motion to the northward during the spring months of the year, and a return movement to the southward during the autumn months, and that its mean position for the year varies with the increase or decrease of solar spot frequency, or with the increase or decrease of the disturbances in the earth's magnetic elements."

Results of Meteorological Observations taken at Christchurch, Hokitika and Bealey, Canterbury, New Zealand, for the year 1867, by R. L. HOLMES, Esq., Government Observer. Folio, 10 pages, large folding tables.

MR. HOLMES is going steadily on, pushing his stations into the interior, and obtaining very valuable results. His new station at Bealey (lat. $171^{\circ} 37'$ E., lon. $43^{\circ} 2'$ S., height above sea 2100 ft.) is almost as wet as Hokitika, the rainfall apparently averaging nearly, if not quite, 100 inches per annum. A vacuum black bulb max. arrived at Christchurch in September, 1867, and was laid on grass in a slightly sheltered spot. On December 30th this instrument read 156° . Unfortunately, along with this valuable addition to the apparatus, arrived a "thermometer in rays of parabolic reflector," but we think there is little fear of Mr. Holmes abandoning his old grass minimum for the sake of this new arrival. At any rate we beg to assure him that at present there is nothing better for observations of terrestrial radiation than a delicate spirit minimum thermometer on grass.

NOVEMBER, 1868.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which 41 or more fell.	TEMPERATURE.				No. of nights below 32° on grass.
		Total Fall.	Difference 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	1.03	— 1.38	.40	22	11	59.3	1	25.4	7	8
II.	Staplehurst (Linton Park) ...	1.78	— 1.41	.53	22	12	56.0	2	25.0	7	10
III.	Selborne (The Wakes).....	2.44	— 1.10	1.05	22	7	62.0	22	19.0	20	12
IV.	Hitchin	1.10	— 1.04	.42	22	15	58.0	1	25.0	6	9
V.	Banbury	2.07	— .13	.67	21	15	57.0	1	25.0	7	12
VI.	Bury St. Edmunds (Culford) ..	1.37	— 1.02	.36	22	12	59.0	1	23.0	6	8
VII.	Bridport	2.83	— .33	.93	21	11	57.0	1	24.5	6	10
VIII.	Barnstaple.....	2.21	...	.89	22	15	57.5	2	32.0	27	0
IX.	Bodmin	7.85	+ 2.87	1.99	21	16	59.0	22	32.0	7+	...
X.	Cirencester	2.23	— .56	1.03	22	6	53.0	1	32.0	7	0
XI.	Shifnall (Haughton Hall) ...	1.14	— .43	.18	22*	14	60.0	1	24.0	7	9
XII.	Tenbury (Orleton)	1.91	— .56	.53	25	13	63.6	1	24.8	6	...
XIII.	Leicester (Wigston)	1.36	— .80	.38	22	9	53.0	22	22.0	5, 28	11
XIV.	Boston	1.32	— .82	.25	22	19	61.0	1	28.0	7	6
XV.	Gainsborough .....	...	...	...	...	...	...	...	...	...	...
XVI.	Derby.....	1.06	— .57	...	...	12	60.0	1	26.0	7, 9	...
XVII.	Manchester	3.11	+ .35	.92	3	15	58.7	1	26.5	7	6
XVIII.	York	2.04	+ .06	.56	23	17	65.0	1	24.0	29	8
XIX.	Skipton (Arncliffe)	6.42	— .03	1.75	3	16	59.0	2	30.0	7	1
XX.	North Shields	2.23	— .47	.47	22	23	64.0	1	26.6	7	6
XXI.	Borrowdale (Seathwaite).....	9.43	— 7.24	1.80	1	16	...	...	...	...	...
XXII.	Cardiff (Town Hall).....	1.47	...	.60	21	8	...	...	...	...	...
XXIII.	Haverfordwest	4.74	— .93	1.10	30	9	56.5	1	25.0	11	13
XXIV.	Rhayader (Cefnfaes).....	2.91	— 1.67	.70	4	12	55.0	...	23.0	...	...
XXV.	Llandudno.....	2.78	— .38	.96	22	14	63.6	1	34.1	25	...
XXVI.	Dumfries	2.26	— .96	.33	30	12	55.0	3	25.5	7	6
XXVII.	Hawick (Silverbut Hall) ...	2.08	...	.36	2, 3	14	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	2.54	— 1.53	.80	2	12	60.0	1	18.0	7	13
XXIX.	Castle Toward	4.08	— .56	.86	3	11	57.0	1	17.0	7	19
XXX.	Leven (Nookton)	1.25	— 1.79	.46	30	12	58.0	1	26.0	7	8
XXXI.	Stirling (Deanston)	3.11	— .40	.69	2	15	57.8	1	19.5	7	17
XXXII.	Logierait	3.14	...	.81	29	9	...	...	...	...	...
XXXIII.	Ballater	2.19	...	.38	29	20	59.0	1	17.5	7	12
XXXIV.	Aberdeen	1.58	...	.59	30	17	60.0	1	28.1	7	16
XXXV.	Inverness (Culloden)	1.31	...	.38	14	...	55.4	1	27.5	7	9
XXXVI.	Fort William	5.43	...	1.51	2	15	...	...	...	...	...
XXXVII.	Portree	6.02	— 4.46	1.56	28	15	51.0	13	25.2	9	12
XXXVIII.	Loch Broom	4.52	...	1.15	2	16	...	...	...	...	...
XXXIX.	Helmsdale.....	3.32	...	1.04	2	16	...	...	...	...	...
XL.	Sandwich	2.66	— 1.34	.60	2	20	55.0	1	26.0	9	8
XLI.	Cork	5.83	...	2.50	29	13	...	...	...	...	...
XLII.	Waterford	4.58	+ .63	1.41	29	18	58.0	3	31.0	8	3
XLIII.	Killaloe	2.35	— 2.54	.35	29	17	58.0	1	24.5	24	6
XLIV.	Portarlington	1.67	— 2.25	.42	30	25	60.0	1	28.0	7	7
XLV.	Monkstown	3.48	+ .59	.75	29	20	58.0	21	29.5	25	...
XLVI.	Galway	2.63	...	.65	29	16	50.0	2	30.0	9	4
XLVII.	Bunninadden (Doo Castle) ...	4.58	...	1.00	30	15	50.0	3, 12	25.0	10+	12
XLVIII.	Bawnboy (Owendoon)	3.96	...	1.00	29	19	57.0	1	26.0	23§	8
XLIX.	Waringstown	2.57	...	.65	29	17	62.0	1	22.0	6	11
L.	Strabane (Leckpatrick)	4.70	...	.78	25	19	56.0	2	24.0	9||	16

* And 25th. † And 10th to 12th. ‡ And 14th, 16th, 24th & 27th. § And 24th, 26th & 27th.

|| And 10th & 24th.

+ 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.—High winds on the 2nd, 3rd and 22nd. A little S on the 8th; the dust blowing so as to be troublesome on the 1st, 3rd, and 4th, an unusual thing in November; fogs frequent, but not dense; wind mostly N.; bar. high till 20th, when it became unsteady.

SELBORNE.—The bar. was higher on the 13th than since the 19th March, and lower on the 22nd than since the 20th of April; prevailing winds from the 6th to the 20th N. and N.E., afterwards S. to S.W.; tempestuous wind on 4th and 5th; L on 21st at 10 p.m.; T with violent wind and R on the 22nd; white frosts on 6th, 7th, 8th, 16th, and 30th.

BANBURY.—Slight fall of S on 7th and 10th; high wind and low bar. on 22nd.

CULFORD.—Slight S on 7th; high wind 3rd and 4th; altogether a very mild and favourable November.

BRIDPORT.—S on 7th; bar. very high at the middle of the month, 30·65 on the 13th, but 29°·00 on the 22nd; several meteors seen between five and six a.m. on 14th, and a little L[?]; fine month to the 19th; heavy gale sprang up on the 20th, which lasted to the 22nd.

BODMIN.—Hawthorn in blossom at Wadebridge, six miles distant; second crop of pears and strawberries in my garden. On 21st 1·99 of R in 15 hours.

CIRENCESTER.—A rather cold month, with very little sunshine; gale from S.W. on 3rd; wind from 6th to 22nd chiefly N., N.E., and E.

HAUGHTON HALL.—First four days unusually mild, when a sudden change took place on the 5th, with storms of R and sleet; on the night of the 6th-7th an inch of S; the rest of the month alternate R and mist; on the 21st a sudden change of temp. from 39° to 50°, with falling bar. from 30·01 on the 19th to 28·61 on 22nd, accompanied by a severe storm on the night of 21st. The oaks retain their leaves this year later than any other tree, they still remaining at the end of the month; few berries on the hollies, abundance on the hawthorns; woodcocks unusually scarce, also few fieldfares and redwings; immense flocks of green plovers—the farmers best friend.

ORLETON.—The 1st very warm, followed by a great wind on the 3rd and 4th; cold but dry, with frequent frosts, much cloud and fog, to the 20th, then much warmer, with R, cloud and fog to the end. Bar. reached 30·37 on the 13th, and fell to 28·75 on the 22nd. On the night of 6th S fell, covering the earth one inch deep; temp. of the month nearly one degree higher than the average.

WIGSTON.—An unusually fine calm month; the temp. rather below the average, as well as the rainfall.

BOSTON.—Fine month on the whole, with temp. above the average; severe frosts on the 6th, 7th and 8th, with ice on the pools nearly two inches thick; gales from the S.W. on 3rd and 22nd; misty weather during the last week.

DERBY.—Rainfall rather below the average; the month has been one with little or no fog. The drought of summer is yet unrelieved so far as the springs are concerned, all are low, and many which then entirely failed continue still in the same state, and unless we have an abundance of R or S to relieve the want, the canals in this district will soon cease to be available for the traffic.

ARNcliffe.—An unusually high gale on the 3rd; the great fall, 1·26, of the bar. between 19th and 23rd was not followed by any particular storm, beyond a heavy fall of R.

NORTH SHIELDS.—H on 4th, 7th and 9th; S on 6th and 9th; lunar halo 25th and 28th.

SEATHWAITE.—A very cloudy month, with N.E. winds.

WALES.

HAVERFORDWEST.—Mild and damp until the 4th, then a sudden change to severe weather; considerable fall of S, the Precelly range completely covered, on the 6th; the weather then cleared, with sharp frosts until the 19th; after which, to the end, the weather was very stormy, cold and wet. Wind principally from

the N.W., E., and S.E.; heavy gales on the 21st, 22nd, and 30th; bar. fell from 30·362 at 9 a.m. on 20th, to 28·897 (corrected) at 9 p.m. on the 22nd.

CEFNFAES.—A cold tempestuous month; wind generally S.E. or N.E.; second crops of many garden vegetables, and spring and summer flowers in bloom.

LLANDUDNO.—At 6 p.m. on 5th, one tremendous peal of T, with L and H; lunar rainbow at 8.30 p.m. on 21st.

SCOTLAND.

DUMFRIES.—The first four days were stormy; from 5th to 20th frosty and fine; the close of the month wet; S on the 5th, 6th, and 25th; temp. rather below the average; the weather on the whole fine for November, with less than the usual amount of fog and gloom.

HAWICK.—A remarkably mild month; the hills were covered with a thin coating of S from the 5th to the 10th, but there have only been seven days on which we have had any frost, and that of so slight a nature as only to remind one of winter.

AUCHENDRANE.—The polar and equatorial currents nearly divided November between them, and the winds were not violent, except on 3rd from W., on 21st from S.W., and on 30th from W. and S.W., when gales occurred; bar. is about the mean of the last three Novembers, and the temp. considerably below; the weather was cloudy, but the number of rainy days less than the mean of the past 12 years.

CASTLE TOWARD.—The month has been gloomy, cold and frosty; the winds chiefly N. and N.E., the hills being covered with S.

NOOKTON.—Gale on 3rd; squally on 30th; fine in middle and at end of month.

DEANSTON.—The first four days wet and windy; from 5th to 22nd bright and frosty, with a little S on the 6th; the last week dull, damp and windy; between 3 and 5 a.m. on 14th many meteors seen.

LOGIERAIT.—Very keen frost from 6th to 21st; heavy rains at the beginning and end of the month.

BALLATER.—A sharp snowstorm on the 5th; S lying on the ground for a week after which, weather open to the end of the month; rainfall four-fifths of an inch under the average of the last eight years; temp. also below the average.

ABERDEEN.—A dull, dreary, cheerless month, dry and not cold, but far from comfortable. Days much colder and nights warmer than the average; much more than average of N.W. winds, but of less force. Auroræ on 6th, 7th, 8th, 15th and 23rd; silent L [?] and many meteors on morning of 14th.

FORT WILLIAM.—A good month on the whole; about the average rainfall, two-thirds of which fell in the first week; from the 6th to the 10th inclusive there was hard frost; S.W. gales on the 2nd and 21st.

PORTREE.—First week very cold and stormy, with heavy squalls, S, sleet and R; afterwards the weather cleared up, and generally continued frosty until near the end of the month, when R, sleet, and S with high winds again came on; but on the whole the month was favourable for cattle grazing; all the crops have been housed in wonderful good condition, though much later than usual, even in this part of the country.

LOCHBROOM.—Very high winds and heavy rains on the 2nd, continuing to the 7th, when a severe frost commenced, continuing more or less to the end of the month, giving us beautiful weather for the season, but doing great damage to the tender grass and to the potatoes still unlifted, which were many of the best in the country.

SANDWICK.—November has been very dry and cold; both the rainfall and temperature being far below the mean, the latter 3°·4; sleet on the 1st; gale, 40 to 45 miles an hour, on the 2nd; S on the 5th, 6th, 7th and 8th; auroræ on 6th, 8th, 9th and 16th; sun pillar on 14th, meteors seen at 6 a.m.

IRELAND.

DOO CASTLE.—Fine from 8th to 20th, with some severe frosts; beginning and end of the month exceedingly wet and disagreeable; TS with H on the 5th; 17th to 19th inclusive remarkably dark days.

OWENDOON.—A fine open month; S on 4th.

WARINGTOWN.—R and gale on 3rd; beginning and end of month unsettled, middle fine and bright.

LECKPATRICK.—Middle of the month very fine; sharp frosts every night; bar.

highest in the year, 30·75 (corrected), on the 13th ; from that time it fell gradually to 28·86 on the 21st ; from that date to the end of the month stormy and wet ; S on the 6th ; 34 frosty nights since the 1st of October, this has never been observed here before ; grass min. 18° on 10th.

[ERRATUM IN AN ERRATUM.—The correction notified last month against Owendoon really belonged to Doo Castle.]

THE INTENSITY OF STORMS REFERRED TO A NUMERICAL VALUE BY THE CALCULATION OF BAROMETRIC GRADIENTS.

To the Editor of the Meteorological Magazine.

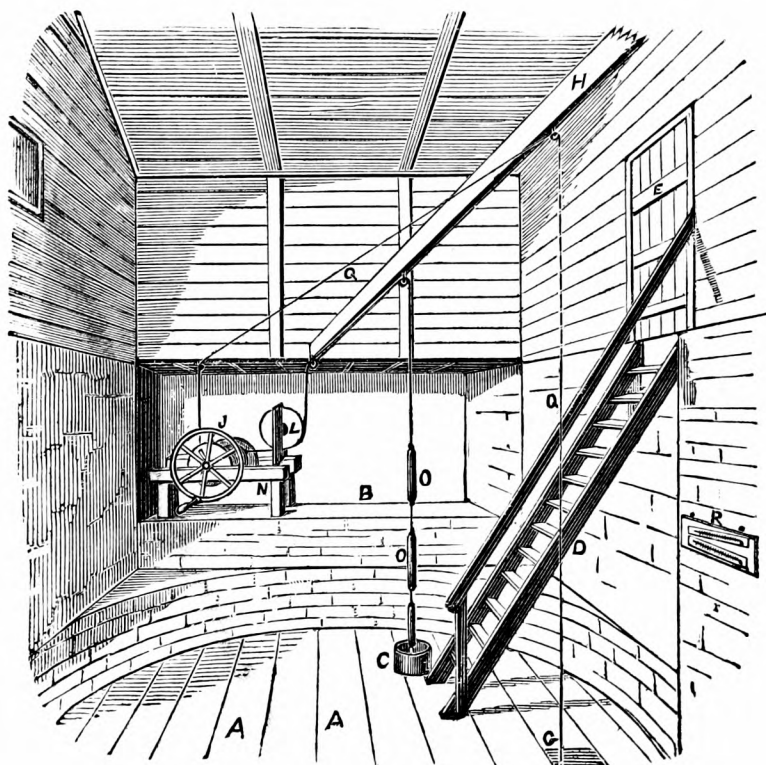
SIR,—Will you allow me to point out an error as to date, and also as to facts into which your reviewer of Mr. Scott's report has inadvertently fallen.

He there limits my claim to the employment of the term *Barometric gradient*. This is altogether a mistake. What I chiefly claim is *the first proposal to express the relative intensities of storms numerically by calculating Barometric gradients*. This proposal was first published, not in 1868 as stated in the review, but on 26th June, 1867, at the public General Meeting of the Scottish Meteorological Society, and the substance of it was also published in the journals of the day. If, therefore, the intensities of storms were ever reduced to a numerical value and published by any meteorologist previous to June, 1867, my claim falls to the ground, but not otherwise.

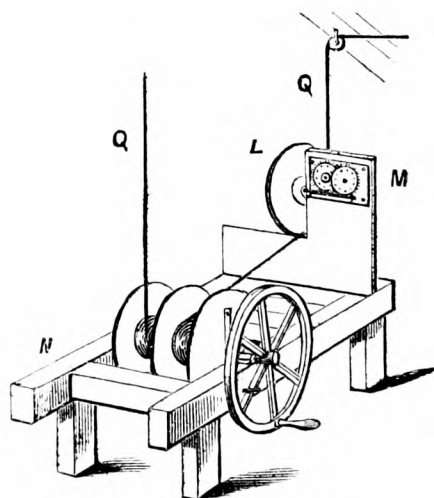
Permit me to observe that the first proposal of a method of reducing any natural phenomenon to a numerical value is far from being unimportant.—Yours very truly,
THOMAS STEVENSON.

SIR,—I have received the proof of Mr. Stevenson's letter, and in reply beg to state that it fails to convince me that either of the statements in the review are "errors." I am not, however, able at present to *prove* that anyone had previously proposed "to express, &c.," although Thom and others have gone very near it, and I *think* some one has actually proposed it ; still I may be wrong. Now as to the date. I did not state that it was first published in 1868. My words were, "a term suggested by Mr. Thos. Stevenson, C.E., in the *Journal of the Scottish Meteorological Society* for January, 1868." As I heartily concur in the concluding paragraph of Mr. Stevenson's letter, I think it may be beneficial to point out the strange complication of dates connected with this matter. I received on the 8th of April, 1868, the *Journal* dated January, 1868, (which by the bye is stated to be "for the quarter ending *September 30th*, 1867.") In this *Journal* I first saw Mr. Stevenson's paper, which was stated to have been read at the General Meeting, June, 1867. At the middle of the paper is a note dated February, 1868, and at the end a P.S. dated February 19th, 1868, and these in a publication dated *January*, 1868. I may add that in no part of the paper is there any intimation that it had been previously printed, and I therefore do not see that I was in error in avoiding all complication by taking the date of (reputed) publication, which was three months earlier than I received it.—I am, &c.,
YOUR REVIEWER.

KENTISH TOWN WELL.



OBSERVING ROOM.



WENDING APPARATUS.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

XXXVI.]

JANUARY, 1869.

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TEMPERATURE OF THE EARTH AT GREAT DEPTHS.

IN our last we gave the geological details of the Kentish Town Well, and its history up to the date of the issue of the fiat of abandonment by the Hampstead Waterworks Company. The next stage was the annihilation of the company, and the cession of their property to the New River Company, who, we believe, left matters *in statu quo* for many years, and eventually, about a year or so since, sold the building and plant for old materials. The builder who purchased the old bricks pulled the building down with more regard to economy than to the integrity of the lining of the well, which was broken through in two or three places to a depth of seven or eight feet, and covered only by a series of loose planks.

This was the state of affairs when Mr. Symons applied to Mr. Muir, the engineer of the New River Company, for permission to conduct a series of thermometric experiments at the abandoned site. Full and unrestricted leave having been granted in the most liberal manner, Mr. Symons made a careful examination of the condition of the well, and in addition to the details above-mentioned, ascertained that the bore tube was safely plugged and locked, *and 10 ft. below the level of the ground*. It was therefore inaccessible except by being lowered by ropes, and the plug was then found to be immovable by any force which could be applied to it; besides the danger of this procedure, and the difficulty of guiding the thermometers down the tube, the desirability of shutting out as far as practicable the effects of atmospheric variations, the necessity for some protection to the instruments and to the observer, combined to render it evident that a roof and a floor must be provided.

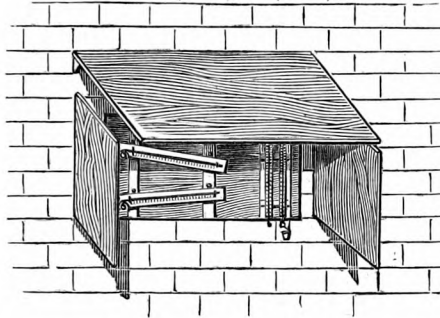
The frontispiece to this number gives a general idea of the arrangements which have been made—except that it does not show what is

beneath the floor from which the artist took his sketch, and what, as regards safety, is the keystone of the whole, namely, a set of extra-strong joists. The first process was to swing a stage 15 ft. down the well by ropes, then to cut notches in the brick lining for the joists, and lay down the floor (A), of course removing the temporary stage when done with; the broken walls were also repaired, and a wooden cabin built over the whole. After the framework of the cabin had been erected, it was found that what appeared to be solid earth, was in reality only consolidated rubbish, resting on the brick ledge (B), and when (B) was cleared out, a large opening remained; a sloping roof was therefore put over it, as Mr. Symons deems it very important to exclude external air as much as possible. The floor was fitted closely round the bore tube (C), and the wood has swelled so much with the damp that it is almost air-tight. Steps (D) lead to the door of the cabin (E). A small portion of the flooring (G) is removable as a trap-door, and affords access to the well. Crossing the cabin from one side to the other, is a stout beam (H), which carries pulleys leading the lowering cords (Q) over the trap and tube respectively. On (B) is the windlass, represented also on a larger scale, where (I) is the handle, (J) a fly-wheel, (K) iron drums, (wood was first used, but the string swelling by the moisture broke them), one carrying 600 ft. and the other 1300 ft. of stout string—by a very simple arrangement either of these drums can be disconnected and used independently; (L) is a registering apparatus showing, irrespective of any variation in the length of the cord consequent upon damp or continued strain, the exact depth at which the thermometers are; the design is very simple, merely a wheel whose circumference is 3 ft., round part of whose periphery the string passes with such tension as to ensure its revolution; the number of revolutions, *i.e.*, of yards, is by means of an endless screw and cog wheels, recorded on the two dials marked (M). The stand (N) which carries this apparatus is firmly fixed to the brickwork (B); (O) is a board carrying registering thermometers for the temperature of the observing room. A small arrangement is now in progress for measuring the variations in the depth of water in the well, but there *seem* to be some loose timbers floating in it which are much in the way; as the water is several hundred feet below the floor, it will not be very easy to remove them. About 90 ft. west of the well a rain gauge has been placed, and is observed in connexion with the water percolating the sides of the well and with the depth of water in it; (Q) are the strings for lowering the thermometers; (R) represents two ready for lowering, but concerning them more in our next.

THERMOMETER STANDS.

OWING to unforeseen difficulties in the engraving department, we are not able to describe so many of the stands this month as we had intended, but as even one is better than none, we annex a description of

MORRIS'S STAND,



which we have so termed because the best description of it that we have ever seen is given in his little manual*, in the following words :—

“ *The best position for the Thermometers.*—The shaded maximum and minimum thermometers, for finding the daily mean temperature, and the wet and dry bulbs, (hygrometer) should occupy the same spot, about four or five feet above the ground, and facing due north. The north side of a high strong wall, running east and west, will be a good position. First of all a broad wooden board should be firmly secured to the stone or brick wall as a kind of lining to the wall, and having small projecting screws, on which to hang the instruments. Next, to keep off rain, a kind of roof should be placed a foot or more above the instruments slanting outwards and downwards from the wall. Then again projecting sides of wood should be placed east and west to keep off the rising and setting summer's sun, and they should be bored with a dozen holes or more, of half an inch diameter, for the passage of air. The whole of this wooden enclosure should be very firm, so as to prevent vibration in stormy weather, and at the same time so contrived that there may be *free ventilation*. It will preserve the wood, and be less unsightly, if the whole is painted white. A small button of wood is also desirable to press the lower part of each instrument to the wooden frame at its back ; this will prevent any shifting of the maximum and minimum in windy weather.”

The engraving represents the sides without the holes, but fixed a little way from the board and roof, thus ensuring ample ventilation.

— — —
To the Editor of the Meteorological Magazine.

SIR,—I am glad to see the remarks of your correspondent, Mr. B. W. Smith on the high maxima recorded at Greenwich. On comparing them with the maxima I have observed here, it has occurred to me, as a possible solution on some occasions, that they may be due to an accidental omission on the part of the assistants to adjust the stand according to the position of the sun. *E. g.*, taking the month of July, on the 3rd the Greenwich maximum was $84^{\circ}3$, here it was 78° , and at Kew it was $77^{\circ}3$; and the mean of all the maxima for July at Greenwich was 82° , while here it was $79^{\circ}5$.

* A Treatise on Meteorology, by A. J. T. Morris. Edinburgh, 1866.

The following is a comparison of the maxima for July, August, and September, at Greenwich, here, and at Kew :—

	Greenwich.	Upper Tooting.	Kew.
July	96·6	93·0	90·2
August	90·5	87·5	85·4
September ...	92·1	91·0	86·4

My instruments are placed in a double-louvred box, constructed after Mr. Thomas Stevenson's design, on a lawn. In comparing observations with those at Kew, it must be remembered that the large box, in which the instruments are placed there, is on the northern side of the observatory, and is to some extent sheltered by it from the direct rays of the sun.

It is, I think, a question whether the max. so ascertained represents quite fairly and impartially the true max. temperature of the air. Perhaps you will favour your readers with your opinion?—Yours,

D. A. FREEMAN.

Upper Tooting, S. W., Dec. 19th, 1868.

[We have not at present made any comments on the various forms of stand, thinking it best not to do so until all had been described, and we retain that opinion. We are obliged by the various letters with which our correspondents have favoured us, and we hope to have many more. We hope that the arrangement of the experiments undertaken by Rev. C. H. Griffith will be sharply criticized when at length we have described all the stands and given a *resumé* of the whole. We take, however, this opportunity of stating that we cannot think the assistants who are constantly passing and in view of the Greenwich stand could ever omit to turn it.—ED.]

A POPULAR VIEW OF METEOROLOGY.

THERE is one thing that clamours for attention, and will be listened to : it is the weather. The procession of cloud and storm from the Atlantic for the last week has been so long, and the pace so terrible, that one wonders where it all comes from, and where the tail of the column is. Overhead, the whole sky is in perceptible motion, even to the distant horizon, where the motion must be much to show. Underfoot, where the soil is absorbent it is saturated ; where not it is deluged. You walk either on a sponge or in a pool. Our towns, indeed, can never be too much washed, and this is a time to test and to scour all our costly novelties in draining. But even the metropolis now seems drenched almost to excess. The only people who must feel a sort of moody satisfaction in this sort of weather are they who have seen too many Christmas Days, and have lost all relish for them. To many, of course, the season must be one for sorrowful recollections. The familiar faces of former days may not even be replaced by familiar faces of a newer date. These people are, however, generally kind enough not to interfere with the attempts of their juniors, or their more fortunate contemporaries, to get a little gleam of happiness out

of the occasion. There are some otherwise and most exceptionally disposed. They confess to having found the season an illusion and an imposture. It is to them an effort and an affectation. They would like to see it stamped out, washed away, and forgotten. Could wind and rain blow Christmas to the North Pole, or drown it in the German Ocean, they would have no objection to this sort of weather till next June. Already they have the comfort of seeing some of our traditional notions found at fault. Christmas has forgotten his throne of frost and robe of snow, his beard of icicles, and his crown of bright and wintry stars. Even his holly has lost much of its charm, when the fields are as green and the birds are as vocal as in May.

Winter, however, is the season for winds; and winds, we know, cannot come long from one quarter without giving way to a counter-current from another. Our meteorologists, we apprehend, would have no great difficulty in making out, by such records as they possess, that the present fashion of winter is not so new as might seem. We must have set up a tradition somewhat at variance with historical fact, or, what comes to the same result, we must have constructed an idea of mid-winter by a select and partial induction, taking only into account winters of exceptional severity. Last winter, for example, was a very severe one, so far as regards the degree and the continuance of the cold, and already it has put almost out of remembrance the very different character of the winter before. But what is science about that it cannot form any system, or establish a single principle, or give us the slightest trustworthy prognostication as to weather? Beyond a safe belief in cycles, a dependence on averages, and certain utterly unverified ideas of lunar influence, there has been no addition made to the science of weather, and it is as far from being a science at all as in the days of our painted predecessors in this island. We can discover all about planets thousands of millions of miles off, and utterly beyond our unassisted vision, but we cannot even guess the history and movements of the blast which makes sport of us, our houses, and our property. It is fair to admit that great efforts are made, and materials are collected that may, or may not, be turned to good purpose by future meteorologists. But even the path of tropical cyclones and the course of the rotating storms that have devastated our temperate clime have not been laid down with any certainty, or in such a way as to yield any warnings of their recurrence. It frequently happens that a good and well-appointed ship leaves a port with a valuable cargo, many passengers, a first-rate captain, and a picked crew, only to be driven back, within twenty-four hours, with much damage, loss, and delay, unless, indeed, it come to worse disaster; whereas it is evident that this need not be the case if we knew anything about the weather in a scientific way.

Well, there is one consolation in this. It gives us something to be found out. This is no mere corner of physical creation; it is no collection of microscopic facts, with an interest only to the curious, or to the purely scientific, or to the philosophers bent on discovering

some new law of life and being. Here is one of the grandest, most important, most present, and most urgent of subjects waiting, not analysis, but some slight impression on its huge bulk. If the light of science could but illumine a fringe of this great cloud, that would at least prove wind and rain to be amenable to scientific investigation. Can it be said that we know anything whatever of the elements upon whose apparent caprice depend our harvests, our commerce, our communications with our distant neighbours, and our comfort day by day? The importance of such a knowledge is so great that a man possessing it would be able to levy a tax on the whole human race, for there is not a people that is not deeply interested in knowing what weather to expect, and that would not be ready to pay high for the knowledge. For example, in our country, in the year now drawing to its close (1868), many agriculturists accumulated, at great cost, live stock, which the drought compelled them to sell for just what they could get; and many had to sow their fields three or four times over before the descending rain would assist the seed to germinate. A forecast of weather is everything to a farmer, and in this respect he finds his case the same as that of the sailor and the merchant. They are all in the same boat and under the same sky, and whoever shall be able to assist one will do the same for the other. We don't seem to be even approaching the first stage of a science that shall produce this all-important knowledge, and he will be a great discoverer and an earth's benefactor who plants his foot on its very threshold.—*The Times*, December, 1868.

MONTHLY CHRONICLE—DECEMBER.

On 6th and 7th violent gales.

8th.—Shock of earthquake at Gibraltar.

10th.—At Prospect Hill Park, Reading, the nest of a bottle-tit was found with six freshly-laid eggs in it. At Nettlebed, Oxfordshire, a luxuriant crop of field beans might be seen, about 18 inches high, and with many plants in flower; they had shelled out plentifully during the gathering of the previous crop in August. In South Wales, the fields and woods were adorned with daisies and other wild flowers in full bloom.

12th.—A very remarkable phenomenon was experienced in the neighbourhood of Neath. During the whole of the day there was an incessant fall of drizzling rain, which terminated between 9 and 10 o'clock, and the night seemed inclined to be fair, but about 10·30 all of a sudden a tremendous gale sprung up, with torrents of rain coming from the south-west, threatening with destruction all buildings facing it, and alarming many of the inhabitants to a great degree. The most remarkable fact is, that during the whole of the storm, which lasted from ten to fifteen minutes, it was accompanied by a peculiar *continuous* roaring and rumbling sound as of distant thunder. Two or three flashes of lightning of a vivid redness were also observed during the gale. The storm in the above time, abated as suddenly as it commenced, and immediately afterwards all appeared a perfect calm.

13th and 14th.—Heavy gale on the Devon and Cornish coasts.

16th.—Continuous heavy rain produced serious floods in Cornwall.

"**TERRIBLE DEATH FROM LIGHTNING.**—The whole of South Wales was visited on the afternoon of the 16th by a thunderstorm of great severity, and among the hilly districts, especially Merthyr, was its force most heavily felt. The lightning was extremely vivid, and one flash followed another from about two until four, with but brief intervals. At Cefn-coed-y-cymmer, a village near Merthyr, a woman and two donkeys were killed by the electric fluid. The deceased woman, whose name was Elizabeth Harris, went on to the mountain to pick up sandstones, taking with her the donkeys to bring them back. She was on the mountain during the whole of the terrific storm, and not returning in proper time her neighbours became alarmed and went in search of her. Her body was found about eight o'clock, and a short distance off were those of the two animals, all dead. The bodies presented a shocking appearance, and were completely blackened."—*Standard*.

Serious floods in many parts of Ireland.

"**TERRIFIC STORM.**—On Saturday morning, 19th December, the town of Towyn, on the Welsh coast, was visited by a tremendous storm of hail, accompanied by vivid flashes of lightning and heavy peals of thunder—a very unusual thing at this time of year. It commenced about half-past 11 and lasted ten minutes. About two miles from the town, on a farm called Braichyrhiw, seven sheep were killed by the electric fluid, and a woman who was crossing the same field was blind for a considerable time. The hailstones were as large as marbles. Had it not been calm at the time a quantity of glass must have been broken."—*Times*.

21st.—Severe storm at Wick, seriously injuring the harbour works. Short but violent thunderstorms at Stockton-on-Tees in the afternoon.

23rd.—Large tracts of land in the Thames valley flooded, especially round Oxford and Eton.

24th.—Barometer in London at 2.30 p.m. down to 28.699 in., reduced to sea level. In 1859, on 26th of December, it fell to 28.629 in., at 6 a.m., and on the 11th of February, 1866, at 4.30 p.m., to 28.606 in.; these are the only other readings below 28.7 in. during at least 10 years. At Nottingham it fell to 28.609 in. at 2 p.m.

26th.—Slight thunderstorm in Liverpool at 4.15 p.m. Storm, with sleet and vivid lightning at Nottingham at 6 p.m. Gale at night.

"**SERIOUS LIGHTNING ACCIDENT.**—A shocking accident is reported to have occurred at a farmhouse at Up-hill, near Weston-super-Mare, on Wednesday, during the prevalence of a very severe storm. A young lady named Harse was standing in front of a looking-glass, when a vivid flash of lightning first played upon the glass and then struck the unfortunate lady. The effect of the stroke was to blacken and completely paralyse one half of Miss Harse's body. Dr. Martin, of Weston, was sent for, and under his treatment the sufferer is said to be progressing towards recovery. After striking Miss Harse, the flash appears to have travelled through the house, smashing glass and doing other damage in a most extraordinary manner."

27th.—Violent gale, especially in Lancashire.

"**A CLERGYMAN IN A TYPHOON.**—The Rev. W. Barclay, a Church of England clergyman, chaplain to the Cheddar Valley and Yatton Railway labourers, narrates in a Bristol paper an extraordinary storm which he encountered last Sunday in the Mendip Hills. The rev. gentleman prefaces his story with the remark that if he had heard it a week ago of anybody else he would not have believed it. Here is the tale, just as Mr. Barclay tells it:—"I halted a moment to draw my plaid more tightly round my shoulders, and then went forwards, after

casting a glance towards Shut Shelf and its clump of pines. Flying across them in my direction (due south) came a ribbony cloud, seemingly about 200 feet long, and the same height above the trees. It was coming, javelin-fashion, full at my back, yet gyrating like a misty corkscrew. I took no particular notice of it, as the flying mists play strange pranks in these hills, and plodded on towards Axbridge, thinking over my sermon. Suddenly a rush and roar of wind arose from behind me. I was struck in the back with a sensation as if two or three stout cudgels had been simultaneously laid across me; was shot forward at the top of my speed like a stone from a catapult; ran, or rather flew, in this fashion for about 100 yards, during the last twenty of which my feet scarcely touched the ground; and was finally hurled to the earth with great violence, and rolled over half-a-dozen times by the same overmastering typhoon! In a second or two it had passed, and I sat up in terrified bewilderment. I found myself on some newly-laid stones, stunned, bruised, and bleeding, my coat sleeves torn to shreds, and myself be-plastered from top to toe with mud. My hat was fast disappearing in the remote distance. One of a pair of gloves which I was carrying in my left hand had flown no one knows where; the other I had stuck to, but it was mangled out of all decency by the stones over which I had been rolled. I staggered on to my legs, dazed, giddy, and deadly sick, as the first heavy fall had been flat on to my stomach. I felt my right elbow, which I feared was out, but there was no displacement. Then the fingers of my left hand, about which I was by no means so sure; then picked up my scattered senses, and went on to Axbridge, picking up also my hat about half a mile from the scene of the catastrophe, bedaubed with mud inside and out. I went into a good Samaritan's, hard by the mission room, where they helped me off with my damaged coat, pared the mud from the rest of my garments, washed my bruises, and lent me another coat, in which to officiate. I just managed to get through the service, and played the harmonium with the blood oozing from my knuckles; then 'went to surgery,' and was properly looked after; sent a message to Cheddar to stop my distant evening service; and after some food, and lying down for an hour, got home before dusk in considerable pain and soreness, but very thankful that I had had no limbs broken."

28th.—Thunderstorm at Sydenham at 3.30 p.m. Large dish of mushrooms gathered from fields at Otford, in Sussex.

MAGNETIC VARIATION.

To the Editor of the Meteorological Magazine.

SIR,—Your notices of suitable thermometer stands are most useful. Mine have hitherto hung at the end of a wall (on a board nailed to the wall, but kept off from it $1\frac{1}{2}$ inches by blocks) facing north, the wall being 16 ft. long, and at right angles to the wall of the house; but I fear in summer at 9 a.m. my indications are too high, and the minimum too high as well. I mean to adopt a stand, but I write this chiefly to ask you to give in your next paper the deviation of the compass in three or four different parts of England, to enable parties to set their instruments right. Some years ago the magnetic north was $22\frac{1}{2}$ degrees W. of true north for the south of England. I do not know now what it is, but you may be acquainted with some of the Greenwich Observatory people, who could tell you.—Yours, &c.,

F. J. MITCHELL.

Llanfrechfa Grange, Caerleon, Mon., 24th December, 1868.

[The above request is so reasonable, and one so often made, that we have been at some pains to satisfy it. We believe no data of the kind have been collected or published by the Greenwich authorities, whose

observations are exclusively made at the Royal Observatory, and the only recent tables known to us are in the *Report of the British Association*, 1861, and are reduced to January 1st, 1857. The twelve years which have since elapsed have caused such material changes, that we have roughly corrected the 1857 values to *approximate* ones for January 1, 1869. According to them the line of 20° now passes from Worthing to Cromer; that of 21° from Portland to Hull; that of 22° from Falmouth to Hartlepool, and that of 23° from Pembroke to Alnwick; but probably the most handy mode of giving the values is the tabular form below.

We by no means pledge ourselves to the accuracy of the following table, but believe it is in no case more than 1° in error, and rarely so much, and that that is sufficiently correct for all ordinary purposes.

Approximate Westerly Declination of the Magnetic Needle in 1869.

Latitude.	Longitude.								Latitude.
	5° W.	4° W.	3° W.	2° W.	1° W.	0	1° E.	2° E.	
55° N.	25°	24°	24°	23°	22°	..	...	...	55° N.
54	24	24	23	22	22	21°	...	...	54
53	24	23	22	22	21	21	20°	20°	53
52	23	23	22	21	21	20	20	...	52
51	23	22	21	21	21	20	20	...	51
50	22	22	21	21	20	20	19	...	50

The table gives the degrees of westerly declination at 40 places in and near England and Wales, the places being the intersections of the lines of each degree of latitude and longitude. The table, therefore, reads thus—in latitude 55° N. and longitude 5° W., the declination is now 25° W. The mode of using the table is very simple; suppose that at Birmingham, lat. $52^{\circ}30'$ N. long. 2° W., a true meridian line has to be set out, inspection of the table immediately shows that in long. 2° W., and lat. 53° , the declination is 22° , and in lat. 52° it is 21° , and therefore in lat. $52^{\circ}30'$ it is about $21\frac{1}{2}^{\circ}$, and the needle at Birmingham points between 21° and 22° W. of true north.—ED.]

REVIEWS.

On the Meteorology of Port Louis in the Island of Mauritius, by CHARLES MELDRUM, M.A. [From the Report of the British Association, 1867.] 8vo, 42 pages.

PROFESSOR MELDRUM prefaces his paper with a very clear and appropriate description of the physical characteristics of Mauritius, an isle some 40 miles by 30, of volcanic origin, with a table land about 1000 feet high in the interior, and with chains of mountains running up to 3000 feet, with their lower slopes covered almost to the sea-shore with sugar plantations.

“For beauty and variety of scenery, for bold mountains, generally clothed half-way up their steep sides with evergreen trees and shrubs, and rearing their heads against skies of softest blue, for rugged precipices, fantastic knolls, peaks, and ridges, for tangled forests, deep ravines and caverns, picturesque waterfalls, shady groves and rich fertile plains and valleys, this little island is perhaps unsurpassed.”

Professor Meldrum groups his notes on the observations 1860-66, under twelve heads, which we will rapidly notice. I. *Temperature*. The coldest hour of the day is 6 a.m., and its temperature $75^{\circ}6$, the hottest hour 1 p.m., and its temperature $79^{\circ}4$. The mean daily temperature is $77^{\circ}1$ from the hourly observations, and $77^{\circ}8$ from the self-registering thermometers, from which we also learn that the *daily* range averages only $6^{\circ}7$; the monthly range is $9^{\circ}7$, the hottest month (January) being $81^{\circ}7$, and the coldest (July) $72^{\circ}0$. The hottest *day* is about February 4th, and the coldest August 7th. The highest temperature in the seven years was $90^{\circ}0$ on February 4th, 1865, and the lowest $62^{\circ}8$ on the 29th of August, 1866. A vacuum black bulb thermometer, 40 feet above the ground, averaged $117^{\circ}6$ in January, and $101^{\circ}2$ in July, being probably *below* what it would read in this country. II. *Elastic force of vapour*. Harmonizes exactly with temperature curve. III. *Humidity*. The air is driest ($63\cdot6$) at 1 p.m. and most humid about 3 a.m. ($69\cdot9$.) During seven years the air was never saturated, the nearest approach being on August 21st, 1860, when it was $96\cdot7$, and driest on June 10th, 1861, when it was $46\cdot3$. IV. *Atmospheric Pressure*. Barometer reaches its first daily max. at 9 a.m. of 30·090, falls to 30·017 by 3 p.m., rises to 30·086 by 10 p.m., and again falls to 30·037 by 4 a.m. The mean reading of the barometer reduced to sea level is 30·089 in., and its range 1·391 in. V. *Pressure of Dry Air*.

"The phenomenon of the double maximum and minimum exhibited by the diurnal march of the total atmospheric pressure has received from M. Dové, and after him, from General Sabine, Sir John Herschell, and others, an explanation founded on the supposed effect of one of the constituents of the total pressure, namely, the aqueous pressure. Assuming that observations of the wet and dry thermometers enable us to determine the whole pressure of vapour in the atmosphere, and finding in many instances that when the vapour pressure thus obtained is deducted from the total pressure, the march of the residual dry pressure presents a single progression, having one maximum and one minimum corresponding with the hottest and coldest hours. It has been inferred that the double maximum and minimum of the total pressure is owing to the march of the vapour pressure being contrary to that of the gaseous pressure, an increase of temperature causing an increase of vapour pressure but a decrease of dry pressure, and vice versa."

Professor Meldrum examines his observations when cleared of the Elastic Force, and continues—

"We are thus led to conclude that if the observations of the dry and wet bulb thermometers afford the means of determining the vapour pressure, the gaseous pressure at Mauritius has a progression in every respect similar to that of the total atmospheric pressure, and, therefore, that the phenomenon in question cannot be accounted for by the direct action of the vapour pressure.

"A similar progression of the dry pressure at Bombay has been referred to the relations which arise from the juxtaposition of land and sea causing land and sea breezes. At Mauritius, surrounded on all sides by the Indian Ocean, the double progression of the dry pressure occurs in all kinds of weather, and from whatever quarter the wind may come, and is most marked on those days when the trade wind blows steadily, and hence it is presumable that it occurs at sea, away from the influence of land."

VI. *Direction of Wind*.—Situated in the south-east trades, it is almost superfluous to note that more than two-thirds of the observa-

tions are between E. and S.E. The wind almost always veers (or, as we should say in this northern hemisphere, retrogrades) with the sun from S.E., through E. to N., N.W., &c. It rarely veers in the other direction, except when a hurricane is passing on the E. of the island.

VII. *Force of Wind*.—The observations indicate that the greatest force occurs at the warmest hours, and that the pressure varies as the temperature. The greatest pressure observed was 40lbs. on February 15th, 1861.

VIII. *Cloud*.—The nights and mornings are comparatively cloudless ; towards 10 a.m. the clouds gather ; by 2 p.m. it is often wholly overcast, and in the evening clears again. The mean amount is 4·7, *i.e.*, rather less cloud than in this country.

IX. *Rainfall*.—The rainfall in Mauritius appears to be tropically irregular, although rarely tropical in amount. The gauge at Port Louis is unfortunately 40 ft. above the ground, and therefore no guide to the true fall at that station. When will observatories learn to observe the rainfall as well and as carefully as private individuals ? Professor Meldrum has organized a corps of observers all over the island, about 30 in number, and half their returns are more trustworthy than their chief's ; we sincerely hope that when the Professor returns to his island home he will take care that none of his subsidiary observers shall be better provided with apparatus than himself ; but he really must start a gauge somewhat less than 20 in. by 10 in., and not quite 40 ft. above the ground. We said the rainfall was tropical in its irregularity—the mean fall by this 40 ft. gauge at Port Louis was 37·87 in. ; the maximum 68·76 in. in 1861, and the minimum 20·56 in. in 1866, that is to say, the mean being 100, the max. is 182, and the min. 54, a variation about 10 per cent. greater than in this country. It is, however, in the monthly falls that the peculiarities become evident. In one month, February, 1861, 46·57 in. was registered at Port Louis, being more than the average yearly fall, and more than fell in the whole of the two years, 1864 and 1866. At another station, Vacoas, 13 miles S. of Port Louis, 99 inches fell in that month. Professor Meldrum discusses with much skill the returns from his numerous stations, but as no map is given in the report, we cannot reproduce it, and it is not easy to convey ideas of geographical distribution unless the positions of the stations are clearly impressed on the reader's mind. Suffice it therefore for the present to say that the effects of elevation, aspect and configuration of country, appear almost identical with those known to prevail in the British Isles, and the annual quantities also resemble those we have here, the highest being 192 inches, and the lowest 21 in.

X. *Thunder and Lightning*.—Thunderstorms are most prevalent in afternoons in January, February, March, and April.

XI. *Hurricanes*.—The "Mauritius" hurricanes have long been celebrated for their violence, and the details on this head are so ample as to be almost overwhelming, but one fact crops out and claims notice, namely, that the greatest pressure ever recorded is only 40 lbs., whereas

we have recently been told that a pressure of 80lbs. occurred near Liverpool on the 27th of December, 1868. We have therefore had twice the strength of a Mauritius hurricane on our own shores without knowing it.

XII. *Synopsis of results.*—A brief summary of the leading facts of this able paper, which terminates with a series of 42 tables of rainfall, temperature, pressure, &c.

Handy Book of Meteorology, by ALEXANDER BUCHAN, M.A., Secretary of the Scottish Meteorological Society. Second edition. W. Blackwood and Sons. Small 8vo, x-371 pages, 8 charts, and 58 woodcuts.

EIGHTEEN months ago we awarded almost unqualified praise to the first edition of Mr. Buchan's book. The public have apparently formed a similar estimate of its merits, since a second edition has for some months been waiting notice. Mr. Buchan has long been known as a hard worker, he is rapidly rising to a first rank among meteorologists, and therefore when he publishes a second edition of a work intended for popular use, and sure of a large circulation, we should neglect our duty if we did not note all its errors with unsparing severity. But Mr. Buchan has corrected the few slight ones we pointed out in the first edition, and left us hardly anything to complain of. We must enter a protest against the following paragraph concerning rain gauges :—

“ There being often great difficulty or trouble experienced in replacing the glass measure when it chanced to get broken, the late G. V. Jagga Rao, a wealthy zemindar of Vizagapatam, proposed a gauge in the form of a funnel having a diameter of 4·697 inches, or a receiving area of 17·33 square inches. Now, since a fluid ounce contains 1·733 cubic inches of water, it follows that for every fluid ounce collected by this gauge the tenth of an inch of rain has fallen. The measure can of course be graduated to any degree of nicety, and it can easily be reproduced if required. It is also the cheapest rain gauge, costing only 7s. 6d. when made of copper, and 4s. 6d. when made of tin.”

Some years since Messrs. Knight, of Foster Lane, London, made a number of rain gauges 5·05 inches in diameter, because the area was then exactly 20 square inches ; after the lapse of years the glasses got broken, and in several instances the observers asked for new ones “ for a 5 inch gauge ;” they obtained that for which they applied, and all their subsequent observations were 2 per cent in excess of the truth. The same error will arise with those above-mentioned, and the mischief will be greater though not so widespread ; greater because the error will be 13 per cent. instead of 2 per cent., and not so widespread, because fewer persons will mistake 4·7 for 5, than 5·05 for 5. But why incur the risk at all ? If ordinary medicine glasses were always correct, and decimally divided, there would be something to recommend Jagga Rao's gauge, but as they are not, and the makers of the gauge supply a divided glass closely resembling those sent with 5 inch gauges, it does not seem intended that medicine glasses should be used. We therefore think it a pity to mention it without reprobation. The idea *seems* good, but we have no doubt will lead to harm.

The parts of the book which seem to require most attention in the next edition are those on Thunderstorms and on Meteors and Shooting Stars.

In all other branches of meteorology Mr. Buchan's book not only retains its previously high position, but in several respects materially surpasses it. The chapter on, and charts of, barometric pressure all over the world are perhaps the most important contributions to the science since the publication of the kindred work by Dové "*On the Distribution of Heat, &c.*" and though not so likely to be popular, we shall not be surprised if Buchan's "Isobars" are not really more important than Dové's "Isotherms." It is impossible, without reproducing the beautiful maps, to convey an idea of the course of these lines, but we cannot refrain from pointing out the wide range in the mean annual pressure at the level of the sea, which varies from 30·2 inches near the Equator to 29·4 inches in the Arctic and Antarctic circles, thus corroborating Maury's views. High praise must also be accorded to the chapter on temperature in its relation to atmospheric pressure, wherein several recent hot and cold periods are demonstrated to be solely due to unusual air currents resulting from abnormal distributions of atmospheric pressure. There is one statement in a capital chapter on the temperature of the sea, which is so remarkable that we do not like to comment upon it, but would rather reproduce it, and enquire if similar results have been elsewhere or at any other time obtained ?

"When Her Majesty's ship Nile was going from Halifax to Bermuda, in May, 1861, Admiral Sir Alexander Milne found the temperature 70° at the bow, while it was only 40° at the stern, as he entered the Gulf Stream, thus showing a difference of 30° of temperature within the short distance of a ship's length."

The following is a fair specimen of Mr. Buchan's style, and with it we must conclude our notice of his able, interesting, and instructive book :—

"In the schools of the United States of America, meteorological observations, and the keeping of meteorological registers, form a part of the common education of the people. Also in the higher schools of France, and some other European countries, systematic instruction is communicated on this subject. But in this country few even of the liberally educated classes are able to read from a vernier; they are ignorant of the use of the moveable cistern of a barometer; they have not the elementary knowledge to give an intelligible interpretation to the fluctuations of the barometer as indicative of coming changes of the weather; and when required to send their barometers to a distance for repair, so ignorant are they of their construction, that they forward them by rail as ordinary parcels, thus almost to a certainty securing their destruction. This state of things is the necessary consequence of the general neglect which meteorology receives in our educational system. There are, however, a few noteworthy exceptions. Meteorology has been taught for upwards of thirty years in the Dollar Institution, which has long been distinguished for the lead it has taken in incorporating science into its curriculum of study. This example has recently been followed by the Roman Catholic College at Stonyhurst, the Grammar School of Aberdeen, the High School of Inverness, Lerwick Educational Institute, Elgin Institution, Larchfield Academy, and other schools in the country. But the objects of meteorology can never hold that place in the public mind to which they are entitled, till the science becomes, as in America, a recognised branch of education."

DECEMBER, 1868.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 91 or more fell.	TEMPERATURE.				No. of nights below 32° on grass
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.				
				Dpth	Date.			Deg.	Date.	Deg.	Date.	
I.	Camden Town	inches 5.12	inches. + 3.62	in. .53	31	27	58.2	6	31.5	30	1	
II.	Staplehurst (Linton Park) ...	5.78	+ 3.95	.62	16	22	55.0	5	29.0	12	4	
III.	Selborne (The Wakes).....	8.54	+ 5.79	.74	15	27	64.5	6	28.0	20	3	
IV.	Hitchen	3.97	+ 2.66	.52	29	27	56.0	6	29.0	31	2	
V.	Banbury	5.34	+ 3.67	.55	14	29	56.0	6	30.0	30	5	
VI.	Bury St. Edmunds (Culford).	4.04	+ 2.55	.62	29	21	56.0	6	25.0	31	4	
VII.	Bridport	6.88	+ 3.51	.64	26	27	57.0	6	25.0	31	2	
VIII.	Barnstaple	6.78	+ 3.66	.80	27	31	59.5	7	37.5	30	0	
IX.	Bodmin	9.56	+ 4.32	1.03	2	30	58.0	6	37.0	30+	0	
X.	Cirencester	6.70	+ 4.41	.75	21	27	...	...	...	...	...
XI.	Shifnall (Haughton Hall) ...	5.52	+ 3.84	.58	28	29	54.0	6, 21	26.0	31	4	
XII.	Tenbury (Orleton)	6.65	+ 4.19	.67	6	31	57.5	6	29.5	12	4	
XIII.	Leicester (Wigston)	4.95	+ 3.43	.47	28	26	55.0	11	22.0	31	7	
XIV.	Boston	5.59	+ 4.10	.58	28	28	56.4	6	31.1	30	1	
XV.	Gainsborough .....	...	...	...	...	...	...	...	...	...	...
XVI.	Derby.....	6.88	+ 5.33	.79	8, 28	27	56.0	22	32.0	30	0	
XVII.	Manchester	8.12	+ 5.79	.73	7	29	55.3	4, 5	31.0	12	2	
XVIII.	York	5.95	+ 4.15	.78	6	29	53.0	4, 11	25.0	30	4	
XIX.	Skipton (Arnccliffe) ...	12.24	+ 7.69	1.22	26	27	54.0	5	33.0	30	...	
XX.	North Shields	3.59	+ 1.39	.43	20	25	57.0	4	29.0	3	3	
XXI.	Borrowdale (Seathwaite) .....	...	...	...	...	...	...	...	...	...	...
XXII.	Cardiff (Town Hall).....	7.95	...	1.13	26	29	...	...	...	...	...
XXIII.	Haverfordwest	10.48	+ 5.65	.96	26	26	56.0	10	26.5	31	3	
XXIV.	Rhayader (Cefnfaes).....	7.77	+ 4.48	1.02	26	27	55.0	...	25.0	...	...
XXV.	Llandudno....	8.22	+ 6.02	1.20	6	29	62.6	9	33.0	12	...	
XXVI.	Dumfries	7.05	+ 3.59	.70	21	27	54.0	10	29.0	12	...	
XXVII.	Hawick (Silverbut Hall)...	5.68	...	.66	4*	25	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	7.09	+ 2.91	.94	21	24	58.0	16	21.0	12	10	
XXIX.	Castle Toward	7.47	+ 2.12	1.04	21	25	54.0	6	23.0	31	11	
XXX.	Leven (Nookton)	4.71	+ 1.93	.85	10	19	53.0	4	24.0	30	4	
XXXI.	Stirling (Deanston)	6.81	+ 2.61	.89	21	27	55.5	10	21.0	12	14	
XXXII.	Logierait	6.27	...	.96	14	20	...	...	...	...	...
XXXIII.	Ballater	6.10	...	1.21	14	18	54.0	10	21.0	25	13	
XXXIV.	Aberdeen	5.72	...	.95	13	25	56.1	10	27.2	12	17
XXXV.	Inverness (Culloden)	2.15	...	1.02	11	12	54.9	10	27.4	31	4	
XXXVI.	Fort William	11.39	...	1.99	10	22	...	...	...	...	...
XXXVII.	Portree	15.04	...	1.95	10	21	...	...	...	...	...
XXXVIII.	Loch Broom	4.63	...	1.00	26	22	...	...	...	...	...
XXXIX.	Helmsdale	3.01	...	.43	10	22	...	...	...	...	...
XL.	Sandwick	5.15	+ 1.18	1.15	9	21	55.4	11	28.9	31	3	
XLI.	Cork	9.99	...	1.31	2	29	...	...	...	...	...
XLII.	Waterford	9.81	+ 5.39	1.12	20	29	58.0	3	34.0	31	...	
XLIII.	Killaloe	6.67	+ 3.18	.61	20	27	54.0	10	28.0	31	6	
XLIV.	Portarlinton	5.10	+ 1.90	.69	21	31	56.0	4	30.5	30	2	
XLV.	Monkstown	6.20	+ 3.58	.64	2	24	60.0	10	28.0	30	2	
XLVI.	Galway	6.49	...	.61	3	29	52.0	18	31.0	29+	2
XLVII.	Bunninadden (Doo Castle) ...	7.81	...	1.00	17	21	54.0	10	16.0	28	6	
XLVIII.	Bawnboy (Owendoon)	7.73	...	.75	21	27	56.0	10	28.0	18§	3
XLIX.	Waringstown	4.55	...	.53	20	24	57.0	10	26.0	11||	6
L.	Strabane (Leckpatrick)	4.77	...	.65	9	24	56.0	10	23.0	20	10

* And 14th & 21st. † And 31st. § And 29th & 31st. || And 29th.

+ 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.

STAPLEHURST.—A mild, wet month; bar. very unsteady, fluctuating over an inch in 24 hours on 8th and 9th; frequent high winds; floods, but not high ones, in the river nearly the whole month; T on the 24th. Scarcely any frosts, and the fields as green and the birds singing as if it were April; many tender plants, as geraniums, &c., are still fresh in the garden; the mildness of the past month presenting a greater excess above the average than even last July.

SELBORNE.—The mildest December I have ever recorded, and the most tempestuous; prevailing winds S.W., with very little exception; T on 15th, 22nd, 24th and 28th; 16th, H at 9 a.m., ther. fell suddenly from 45° to 41°; thrush in full song on the 4th. L on 24th.

HITCHEN.—The lowest reading of the bar. I ever observed, on the 24th, and the greatest number of days on which R fell, I have ever recorded.

BANBURY.—Very wet month, with high winds and low bar.; draba verna in blossom on the last day; L on 9th, TS on 14th and 24th. Bar. 28·525 at sea level at 3 p.m. on 24th.

CULFORD.—A month of mild weather for the season, with much R; bar. extremely low nearly all the month, but rose rapidly during the last two days; average temp. more than two and a half degrees higher than the preceding month (November); on the 18th loud T and vivid L were heard and seen here, and was the more noticed from it being so late in the year. T on 24th.

BRIDPORT.—Very mild but stormy month, only four days on which R was not registered, and the greatest monthly fall registered here for 12 years except September, 1866, when 7·39 inches fell; heavy S.W. gales on 6th and 14th, and westerly gales on 27th and 28th; L on 14th, 16th, and 27th. Crocuses in flower in the garden.

BODMIN.—Singular oscillations of the bar., and the chart quite a curiosity.

CIRENCESTER.—The wettest December I have ever registered (24 years), 4·25 more than the average, it has brought up the annual fall to more than the average. The R of this month has been accompanied by T and L but not distinct storms, under the scud might often be seen electrical forms of cloud. The water in my deep well (100 ft.) in the upper oolite has, on the 31st, 44 ft. of water in depth, having risen from 6 ft. 7 in. in October.

HAUGHTON HALL.—Only two days without R, by far the wettest December ever experienced here, for 36 years at least, (my registering commencing in 1835,) the nearest approach was in 1860, when 3·69 fell; the temp. too has been high, no day the max. of which was below 40°. Much L on night of 14th, with heavy TS in the west of the county, the same with much R and sleet at 6 p.m. on 26th; the old adage is fully confirmed this year—

“No one so surely pays his debt,
As wet to dry and dry to wet.”

Gales on 4th, 6th, and 21st; severe storm on 27th from W., slight S with R on 28th from W.; throstle singing on the 20th; snowdrops up and whiten, 19th; peas and beans up for next year's crop on 15th.

ORLETON.—A very warm and rainy month; temp. about 5° higher than the average, and the fall of R greater than any December for 38 years, the nearest approach being 5·58 in December, 1860; R fell on every day except the 31st, when there was a heavy dew; distant T heard on 28th, and L seen at night on 7th, 14th, and 26th; S on the Cleve hills on the 28th, 29th, and 30th; River Teme very high all the month, frequently level full; great winds on the 4th, 5th, 10th, 14th, 16th, and 27th, greatest force from 1 to 4 p.m. on the 27th. Bar. 28·55 on 24th.

WIGSTON.—The rainfall this month has been more than double the average of the month, notwithstanding this and the large fall in August, the mean average

of the year is about three inches under that of the last 30 years. The temp. has been considerably higher than the average mean of the month, and vegetation has assumed more the aspect of April than December.

BOSTON.—A very wet and stormy month with high temp. ; bar. very unsteady, fluctuating very much, and falling to 28·300 on the afternoon of the 24th during a heavy gale. The ten districts of Lincolnshire have suffered severely from the sudden storms and heavy rainfall, thousands of acres were completely under water, and the Witham nearly overflowed its banks ; S on 28th, 29th, and 31st ; roses and pinks were in flower in the open air on the 15th, and strawberries were gathered in a garden at Louth.

ARNCLIFFE.—An unusually wet month ; it is remarkable that the ther. has never been below 32° during this month, and in fact has been nearly all the month wonderfully high ; a heavy fall of S on the 30th.

W A L E S.

HAVERFORDWEST.—A month of violent storms with constant and very heavy rains, the temp. high throughout ; polyanthes in flower so late as the 22nd ; bar. very low all the month, but lowest on the morning of the 24th 28·625 (corrected) 50 ft. above sea level. General direction of wind, W., S.W., and N.W., five days it was E.S.E. T and L on 14th ; tremendous gales on 14th, 16th, 17th, 23rd to 25th, 27th, and 28th, accompanied by heavy H storms ; on the 30th the Precelly range covered with S ; the wettest December of the last 20 years, and the most stormy.

CERNFAES.—A wet and stormy month, much B with a little S occasionally ; frequent H storms with T and L ; wind high and boisterous, chiefly N.W. and S.W.

LLANDUDNO.—The wettest month in my experience of Llandudno, now more than 10 years ; S on 20th ; T, L, and H at 4.15 p.m., 26th.

S C O T L A N D.

DUMFRIES.—Only four days during the month on which no B fell ; the wettest December since 1852 ; mean temp. 3°·33 higher than the corresponding month of last year ; bar. unusually low, being 28·14 on 27th. T on 14th ; S on 27th.

HAWICK.—The heaviest rainfall of any December since 1856 ; heavy gales on 23rd, 24th and 27th. The unseasonable mildness was very unfavorable to health ; cutaneous diseases very prevalent. The last three days frosty, with a little S.

AUCHENDRANE.—Bar. and temp. below the average ; winds chiefly equatorial, and in mean force much less than the December means ; gales have occurred on the 10th, 14th, and 21st, with heavy B 24th and 27th, but several of the severe storms were not felt in this locality ; the river has been in constant flood, and the monthly height of water on the gauges is 20, the standard being 9.

CASTLE TOWARD.—A mild, wet, month ; heavy gales on 10th and 16th ; 27th and 28th, slight fall of S and a heavy fall on the hills ; T and L on the 30th ; snowdrops beginning to flower.

DEANSTON.—Great part of the month very dark and wet, but very mild for the season ; gales on the nights of the 4th and 10th ; very little sunshine during the month ; no S till the 26th and then one shower only, but the hills very white ; half-an-inch of S on 27th ; bar. 28·20 on 27th.

LOGIERAIT.—A remarkably wet month ; keen frost after the 29th, and ground white with S.

BALLATER.—1·15 in. of rain in six hours on 21st ; very changeable, with large rainfall ; bar. remarkably low, 28·43 at sea level on 27th.

ABERDEEN.—Aurora 10th, 16th, and 17th. Mild, but wet, tempestuous month, with very unsteady bar., which was above 30 in. only on one day ; the reading on the 27th (28·19 in.) was the lowest on record at Aberdeen ; L on 12th.

CULLODEN.—A little S on 11th ; fog on 16th and 19th ; strong gale on 14th.

FORT WILLIAM.—A very wet month ; nearly 2 in. fell on the 10th ; 1 in. had fallen on the previous day.

PORTREE.—Very stormy, cold, and wet month, with frequent T and L, snow, sleet, and heavy hail showers. Sheep stock keeping healthy and strong.

SANDWICK.—December has been wetter and colder than the mean, with a remarkably low bar., it having reached 30 in. only on the morning of the 9th, while it was below 29 in. on 8 mornings and 11 nights, but the weather was fine during most of that time, on the 4th at night it fell to 28·650, and on 27th at noon to 28·280 ; a gale of 50 miles an hour on the 21st, from noon till 9 p.m., and another of 40 to 45 miles an hour from 9 p.m. on 27th to 4 a.m. on 28th ; first S on 28th ; auroræ on 11th and 17th.

I R E L A N D.

KILLALOE.—Frequent violent storms ; much sheet L on different nights ; remarkable oscillation of the bar. ; seldom two fine days together.

GALWAY.—Storms prevalent during the month ; T on evening of 28th.

DOO CASTLE.—Wet month ; coughs and colds very prevalent ; no farming operations ; gales on the nights of 10th and 27th.

OWENDOON.—The floods in this neighbourhood have been very high.

WARINGSTOWN.—The whole month wet, stormy, and gloomy, with very little interruption.

LECKPATRICK.—Very stormy month ; temp. high ; shrubs showing early starting of buds ; wasps seen the day before Christmas day flying about in full activity. December two and a half degrees warmer than November, consequently there are grounds for expecting the winter to be mild. Bar. fell to 28·432 on 27th in the morning. The following are the lowest readings of the barometer for six years—

1863, Jan. 8th.....	28·548.	1866, March 23rd.....	28·572
1864, Nov. 14th ...	28·469.	1867, Jan. 8th	28·548
1865, Jan. 13th ...	28·321.	1868, Dec. 27th ...	28·432

EARTHQUAKE OF OCTOBER, 1868.

To the Editor of the Meteorological Magazine.

SIR,—I have just seen your earthquake map and notice of the October shock. Compared with the shake, lift, and crash of 1863, this last movement was a mere nothing. I was in the dark at the time, and consequently could not mark the exact moment of the shock, but that moment was certainly between 10·35 and 10·38 p.m.

Yours faithfully,

EDWIN J. ISBELL.

3, Richmond Place, Hereford, Nov. 1868.

To the Editor of the Meteorological Magazine.

SIR,—I am not aware whether there has been an earthquake felt in other parts of England, but at any rate we have had a slight shock here. At 10.40 p.m., October 30th, my house was manifestly shaken, causing the floors of up-stairs rooms to vibrate as if persons had rushed hastily over them, and causing jugs, water-bottles, &c., to jingle ; this was the effect up-stairs. I remarked a dull, heavy noise down-stairs, as if a heavy weight had fallen on one of the up stairs floors, but not the one over-head. I hear that this slight shock was remarked by others, and that it was also observed at Instow and Barnstaple. The last time we had an earthquake it fell much more heavily on the Exmoor range, and on the other side of the estuary of our two rivers.

I. H. GOSSETT.

Northam Vicarage, Bideford, N. Devon, Nov. 2, 1868.

To the Editor of the Meteorological Magazine.

SIR,—You ask for particulars of the earthquake on 30th October,

I was sitting alone reading, night very still. I first heard a curious movement of the shutters, a sort of straining of the whole house, which passed off in a few seconds, with a rattling of some glass shades on a marble table. I was in an up-stairs room; walls of house very thick and strong; floors rather springy; I immediately conjectured the cause, and looked at the time, which was as near as possible 10.35 p.m. I had felt the earthquake of 1863, and this did not seem to be so violent.

I am certain of the time to within one or two minutes of Greenwich time.—I am, Sir, yours obediently,

WHITEHALL DOD.

Llanmerch, St. Asaph, January 5th, 1869.

POSITION FOR SOLAR RADIATION THERMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—I feel I ought to redeem the promise I made of sending you some account of my investigations on this subject. I obtained at the end of August from Mr. Casella half-a-dozen solar thermometers *in vacuo*, having the bulbs and one inch of the stems covered with lamp black. Having carefully compared their readings in steady sunshine, and obtained, by taking the mean of 40 observations, corrections by which I might reduce their readings to the same standard, I set to work on the 1st September, in the most favourable weather. To the external glass jacket of each of these solar thermometers I attached a small unblacked mercurial maximum thermometer, the bulb of which being scarcely, if at all, more absorptive of solar heat than transparent glass, might be expected to furnish a tolerably accurate indication of the temperature of the glass with which it was in contact. Five of the instruments were then placed thus:—(1) on cut lawn grass; (2) on the surface of a painted black board placed on the ground; (3) on a similar board, sheltered by being sunk four inches below the level of the grass; (4) on a similar board raised 3 ft. above the ground; (5) freely suspended in the air at 4 ft., near my shade thermometers.

The following are the means of 28 observations made between the 4th and 13th September, and of the daily maxima throughout the month, respectively:—

	(1)	(2)	(3)	(4)	(5)	(Air at 4 ft.)
4th to 13th	133.9	129.0	132.5	125.0	119.2	74.1
Month	127.2	122.7	125.5	—	116.8	68.8

It was found that, though in each position a different reading of the black bulb *in vacuo* was obtained, the difference between that reading and that of the attached unblacked thermometer was the same, viz., about 41° or 42° on an average, in all positions. Difference of position, therefore, does not affect the excess of the temperature of the black bulb over that of the outer jacket, an excess which is caused by the direct rays of the sun, and the amount of which is a test of their intensity. Were the temperature of the glass jacket the same as that

of the air, this excess would be the exact measure of solar radiation. But the rays of the sun are partially absorbed by the glass, which thus becomes heated above the temperature of the air to a small extent, even when the instrument is suspended in the air; and when the instrument is placed on the ground, the heat of which, as well as of the air next to it, is much greater, there is in addition a large and fluctuating quantity, which enters into the temperature registered. An example will best show my meaning. On the 7th September the black bulb *in vacuo* read on the grass 147° , and at 4 ft. 132° , the shade maximum being 87° . The 132° was made up somehow thus: 87° (shade temperature), $+ 5^{\circ}$ (excess of glass above air temperature), $+ 40^{\circ}$ (excess of black bulb over glass jacket.) In the 147° there was the same $87^{\circ} + 40^{\circ} + 5^{\circ}$, but in addition there was an excess of temperature on the ground above that at 4 ft., which raised the temperature of the glass jacket, and therefore also of the bulb inside, 15° more. Out of the 132° only 5° were liable to be affected by wind, &c., whereas of the 147° no less than 20° were fluctuating and uncertain, dependent on the heat and dryness of the ground, and the varying condition of vegetation. At all events, on the 29th, a bright and windy day after rain, although solar radiation was equally powerful, the 20° was diminished to 6° , while at 4 ft. the 5° were diminished only to $3^{\circ} \cdot 2$. It is fair, then, to conclude, that if we wish to make exact comparative observations of solar radiation alone, it is best to place the black bulb *in vacuo* at 4 ft., exposed to a free circulation of air; but for those who desire to find the heat received by vegetation, of course the grass is the place. Both are important objects, but the former is that which I particularly wish to investigate. Let everyone choose for themselves. I shall be very glad, if I can induce a few observers to join with me, in making daily observations at 4 ft. with comparable instruments. By these means we shall soon know a great deal more about the comparative power of the sun's rays at different places and times than is known at present.

I will only add, that I think it desirable to place the instruments so that the bulbs are directed, not towards the midday sun, but to the S.E. or S.W. Perhaps S. 50° E. is the best direction. Whether owing to the thickness of the external glass near the end of the instrument, or from some other cause, I have found that when the bulb was directed towards the sun, the temperature of the black bulb thermometer fell 2° or 3° ; but when turned away from it through any angle not less than 20° or more than 100° , a uniform result was obtained.—I am, Sir, your obedient servant,

F. W. STOW.

Tunbridge Wells, December 24th, 1868.

[Uniformity is of such high moment that we shall gladly do all in our power to assist; we would suggest that those who are able and willing to fulfil the above conditions should communicate with the Rev. F. W. Stow forthwith, and we shall gladly insert the results.—Ed.]

RAINFALL REGISTRATION.

WHAT IS TO BE DONE WITH 1000TH OF AN INCH OF RAIN?

To the Editor of the Meteorological Magazine.

SIR,—At the risk of appearing to be pertinacious, I would once more refer to the solution of the above question; first of all, however, premising that if you assure me that the majority of observers follow the plan recommended to Mr. Griffith in your November number, I will give up my private fancies, and most scrupulously return $\cdot 007$ of dew to the gauge, to be evaporated and thus disappear from the register altogether, or as the case may be, to be increased by $\cdot 003$ on the following night, and then enter it on my register as $\cdot 01$, and add that day to my list of days on which $\cdot 01$ of an inch of rain has fallen.

If, however, you think that observers differ in their practice (and I have reason to believe that they do), I would suggest, as a third method, one which is the basis of all observations in almost every other department of science—viz., that any amount below $\cdot 005$ should be thrown away and not entered at all, and that $\cdot 005$ and over should be entered as $\cdot 01$. From the tenor of your concluding remarks, I infer that this system would be in considerable favour with yourself. Whichever plan is adopted, the variations in the totals will be very small, but for uniformity's sake, it were well if all observers would follow the same method.—Yours truly,

J. M. DU PORT.

Mattishall, Norfolk, Dec. 26th, 1868.

SIR,—It appears to me that the correct way of measuring small quantities of rain is to register it as $\cdot 01$ inch whenever it exceeds $\cdot 005$; for as every one registers the rainfall to the *nearest* hundredth of an inch, unless it is under $\cdot 01$, why should there be any exception in this case? When the fall is less than $\cdot 005$, I would suggest that it be returned to the gauge, to increase the next measurement. The plan you recommend, and which is consequently adopted, causes the curious anomaly, that if $\cdot 009$ falls one day and $\cdot 007$ the next, the first is recorded as $\cdot 00$, but the latter (there then being $\cdot 016$ in the gauge) as $\cdot 02$.

As to the question of *how many* days a measurable amount of rain falls on, it is quite an independent one.—Yours truly,

T. W. BACKHOUSE.

Sunderland, Dec. 26th, 1868.

SIR,—I am much amused at Mr. J. M. Du Port's anxiety about registering thousandths of an inch of rain. There can be no doubt that we are quite low enough in the $0\cdot 01$, and that your present system cannot be improved on.—Yours,

J. LIDDELL, Com. R.N.

[We shall be glad to know if any of our readers have any objection to Mr. Du Port's suggestion, if not we have none.—Ed.]

END OF VOL. III.

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