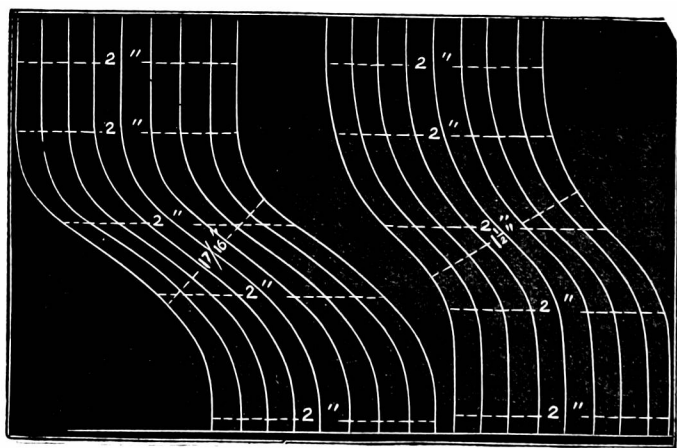


*Sun Pillar seen near Sidmouth, April 4th, 1871.—(See p. 96.)*



*Diagrams showing that the greater the angle at which rain drops fall the nearer they approach each other; also that a horizontal rain gauge will collect the same quantity whether the rain falls vertically or obliquely.—(See p. 93.)*

# SYMONS'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

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LXVI.]

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### WEATHER MAPS.

“ Is Old England on the Wane ? ” the title of a modern song, rises to our mind in sober earnestness after carefully examining some maps and tables recently issued by the War Department of the United States, comparing them with those issued through all her troubles by distracted France, and then reflecting that nothing of the kind is being done in England. We have no desire to write depreciatingly of many good works carried on in this country, but why is the subject at the head of this article utterly neglected ?

One reason which may occur to some readers is the expense. We most emphatically deny that that can be a valid argument in a country which is always ready to pay liberally, when it sees a reasonable prospect of money's worth being returned for money granted. And here it may be well to remark that, however true it may be that there are in meteorology, as in most other matters, cases of individual maltreatment, there is no question but that the gross sum, probably £20,000 per annum, paid by the State, is ample, if only it were properly administered. But let us descend to particulars, just sufficiently to show that in asking for a daily map of the weather prevalent in the British Isles, we are asking for nothing in the slightest degree original, difficult, or expensive. Even if it were all three, we should advocate such a publication, but we fail to understand why it is not done when, as we purpose to show, not one of these objections exists.

1. As to *originality*. Passing over the capital organization arranged some 20 years ago, between Mr. Glaisher and the proprietors of the *Daily News*, which merited very much heartier support than it received ; we come to Admiral Fitz Roy's daily weather reports, and in 1861 a proposal, by a private firm, to republish his data on a map, a proof of which is now before us. Why the gallant Admiral declined to support the praiseworthy venture, or to adopt a similar course himself, we have no information. Later in the same year, Mr. F. Galton, F.R.S., undertook the great task of mapping the weather of the whole of Europe during the month of December, the result of which was published in his *Meteorographica*, issued in 1863, and from which we must quote one paragraph :—

"A sustained series of publications of this kind, extending over two or three years, would give an extraordinary impetus to the scientific study of Meteorology. They would supply the necessary materials, in a manageable form, for arriving at a general knowledge of the distribution of the various elements of the weather; they would afford means of testing the extant theory of "forecasts," with a rigour impossible at the present time, and they would necessarily improve it."

About this time, also, our neighbours across the Channel added to their daily bulletin a daily map, with direction of wind and isobaric lines.

And then the Admiral died, all the arrangements were altered, the office was placed under a specially-appointed Committee, and three times the previous expenditure was authorized; still nothing was done in this matter, and now from across the Atlantic come weather maps, of considerable excellence, suggesting once more the question, Why have we not a daily weather map of the British Isles?

Having dwelt at some length on the first branch of the subject, in showing that the proposal is by no means original, we have partly anticipated the evidence as to its being neither difficult nor expensive. It is not our duty to show how it ought to be carried out, but no one acquainted with what has been done could fail to accomplish it, both easily and cheaply. As to cost, we should not be at all surprised to learn that the sale of the maps more than covered the expenditure.

## PROFESSOR RAULIN ON ALGERIAN RAINFALL.

[TRANSLATION.]

*To the Editor of the Meteorological Magazine.*

SIR,—I have to reply to the observations on the above subject in page 95 of the *Meteorological Magazine* for 1870.

For Djidjeli the monthly details for 1862 do not, at first sight, lead one to suppose that any numerical error had crept in, to raise the annual quantity so much above the mean, for no month has a larger quantity than had previously fallen therein. However, on looking more closely, it appears that the month of April had a quantity greater by 300<sup>mm</sup> (11·81 in.) than eight other Aprils, it may not be impossible that this quantity is too large, and that the Algerian copyist wrote 418<sup>mm</sup> instead of 118<sup>mm</sup>.

For Bougie the monthly details for 1866 lead to exactly the same result, for the month of April the Algerian copyist may have written 471<sup>mm</sup> instead of 171<sup>mm</sup>.

But it is necessary, while admitting these errors, which had their origin in the records of the Ponts et Chaussées, to remark that these large annual totals at Bougie and Djidjeli are only three times the respective minima ( $\frac{1884 \cdot 2}{761 \cdot 5}$   $\frac{1805 \cdot 1}{622 \cdot 8}$ ), confirming that which occurs at other stations, where similar errors are improbable.

I have for each Algerian station the necessary indications of the diameter and position of the rain gauge.—Yours, &c.,

V. RAULIN.

*Bordeaux, May 28th.*

# OBSERVATIONS AT PATRAS.

[The following letter so completely meets our ideas of the details which should accompany notes on local climates, that we gladly avail ourselves of the Rev. H. A. Boys' permission to use it in any way we think fit, and as perhaps our answers to his queries may be useful to others, as well as himself, we also insert them.—ED.]

*To the Editor of the Meteorological Magazine.*

SIR,—I send you with this note some tables which you may find of use, but before I discuss them, I will say a few words as regards instruments. I brought with me,

1. A Rain gage, tin japanned, price £1 1s. Negretti and Zambra.
2. A Maximum Registering Mercurial Ther. do., price 8s. 6d.
3. A Minimum do. Spirit do. do., price 3s. 6d.\*
4. A do. do. do. Pastorelli. price 5s. 6d.
5. A Hygrometer, by Casella, price £1 5s.
6. An Aneroid Barometer, price £4 10s., by Casella, (a pocket size).

These instruments, you may say, are very far from reliable ; however, in such a place as Patras, they are quite sufficiently good, because of the danger of breakage and the difficulty of securing proper positions for them. I live in a very large house, built round a court 20 ft. by 30 ft. The outside measurement of the house must be 70 ft. by 80 ft. The walls are 38 ft. high and the roof rises some 12 ft. higher. The house stands not N., S., E., and W., but as nearly as possible N.W., S.E., N.E., S.W. The house has eaves, projecting perhaps 18 inches inside and out. The house has only two stories, is open on S.E. and N.E., has houses opposite it on S.W. and N.W. The only available side is N.E., S.E. being simply a huge blank wall ; from the windows on the N.E. side may be seen an amphitheatre of mountains : to the right, at a distance of about 8 miles, the peak of Mount Voidhia, 6000 ft. high, whose last snow will disappear in a day or two ; right in front, *i.e.* due N.E., is the whole range of Parnassus, with summits from 7000 to 8000 ft., retaining even now a great deal of snow, and bare, rather from the snow sliding and being blown from its steep sides, than from actually melting. This range is from 30 to 40 miles distant, and includes 40° of the horizon. To the left are other mountains from 3000 to 5000 ft. high, and exactly N. may be seen two or three peaks of Pindus, certainly 7000 ft. high and 40 miles away. The nearer mountains are from 7 to 20 miles distant, and between them and us is the sea. On a window commanding such a view as this I have hung my thermometers, 20 ft. from the ground, with the bulbs an inch from the wall, therefore, as regards the minimum, I have no fear as to its being pretty near the truth. As regards the maximum it is unfortunate that the sun is not off the wall till about ten o'clock ; however, it shines so obliquely that it has not yet brought the max. above 93°, when exposed to its full glare, but I generally set a Venetian shutter open so as to shade the thermometer during the early hours, and then set it at 11, 11.30, or 12, and, as the maximum is generally from 2 to

---

\* This is kept in my room, and is not referred to in the tables.

3 in the afternoon, I don't think that the morning sun has any undue influence : the greatest heat is generally the effect of a hot S.E. wind, which invariably hides the sun in a grey haze, though leaving the mountains afore-mentioned distinctly visible. Before quitting the subject of temperature. I will observe that I did not get settled in this house till the end of October, but carried on observations irregularly from my arrival here on September 15, from which I can say that September, October, and November, were almost alike in their temperature, September being unusually cool, and November unusually warm. The winter again has been most unusually mild, the snow never having descended on the mountains within 3000 ft. of the sea, whereas the winter before it snowed in Patras itself by the sea, and remained some days within 600 ft. of sea level. The summer so far has been mild. The month of June on two consecutive days gave us max.  $90^{\circ}$ ,  $91^{\circ}$ , and min.  $67^{\circ}$  and  $66^{\circ}$ , this with a hot wind, otherwise from  $80^{\circ}$  to  $83^{\circ}$  and from  $60^{\circ}$  to  $63^{\circ}$ . Twice only has the max. been below  $80^{\circ}$ , and on the second of these days it was the effect of a thunderstorm on the previous evening, which I shall presently allude to. From all I can make out I may expect in July a course of  $90^{\circ}$  and  $70^{\circ}$ .

I will now pass on to the rain question. Finding no ground site which combined even moderate fitness and safety, I hit on the expedient of suspending my gauge in the court and drawing it to my own window with pulleys, it is thus fully 18ft. from the ground, the horizontality of the mouth not seriously affected, investigated most readily by the observer, seeing that it comes to him, but it is no doubt far too much shaded by the roof. I have so slung the gauge that it is least sheltered on the S.W., and I draw it nearer to one side of the court or the other as the wind may be. But I fancy that the least angular elevation of the roof is as much as  $40^{\circ}$ , and the greatest, perhaps,  $60^{\circ}$ ; against this it may be said that inside the court it is still in the strongest gales, and that the rain falls, as a rule, most decidedly unaccompanied by wind. The roof has an excellent water-spout all round, but I cannot give my results as certain. I am rather disposed to think, from my English experience, that my gauge gives under the mark than over, but it is very difficult to say. Still, no doubt, this table will give you a notion of Greek rain. The table explains itself. I may observe that October and November are said to me to have very much more rain usually than they had this time, and December not quite so much. January is usually a dry, cold month, February about the average, but at the end of March and through April there ought to be much more rain than there has been; May had more than usual, and June was graced with a thunderstorm this year, to our great delight. We cannot reckon on any rain from May 1st to end of July, and sometimes from April 1st to September 15th, there is none. You probably know pretty well how much dependence is to be placed on popular reports of weather, but I give you the best information I can get. The autumn rains, and the first part of the January ones, were almost invariably accompanied with thunder and lightning, but nothing

remarkable for noise or brilliancy, nor, fortunately, for danger. As to wind, no satisfactory estimate can be made in Patras; we are near the mouth of a huge funnel, between the mountains that are on each side the strait at the entrance to the gulf of Corinth, consequently weathercocks show either E. or W.; observation of the clouds, hygrometer, and temperature, tell one best what it really is, but I can tell now with tolerable accuracy whether the wind is S.E., N.E., N.W., or S.W. Looking at December, I see no E. at all, at January only four; and since I came only eight of the rainy days have an E. to them. As regards the strength of the wind, I should say there is less of it here than in England, but now and then when it does blow, it blows furiously. On the 1st of January there was a very strong gale, which lasted a day; it almost took one off one's legs. I was out in the worst of it, and was afraid, for the tiles began to fly. The strongest gales are generally from Mount Voidhia, S.E., very hot, and they spread a grey haze over the sky.

Earthquakes need little remark; they appear to be entirely unconnected with barometer or any other meteorologic states, so far as I can see. Patras is, happily, out of the line of the worst. The Ionian Islands and Delphi suffer terribly; near Delphi the shocks are continual, many a day.

#### BAROMETER.

My barometer, I think, can scarcely be right; it keeps so wonderfully high. My room is only 60 ft. above sea level, and it has shown such averages as this:—November, 30·407 in.; December, 30·227 in.; January, 30·235 in.; February, 30·52 in.; March, 30·464 in.; April, 30·294 in.; May, 30·262 in.; *i.e.*, average of the readings taken daily at 8 a.m. The lowest I have seen was 29·55 in., and the highest 30·86 in. From February 18th to March 16th, it never went below 30·50 in., and was frequently above 30·70 in.; the E. wind blowing all the time. No doubt it is set too high. [Yes, probably 0·60 in.] Curiously, the only other barometer I have seen agrees with it. I have compared it with one ship barometer, which makes it just ·50 too high, and with that in the ship I came out in, which makes it ·20 too high. There is a screw in the back of the instrument,—can you tell me what it is for? [For setting, *i.e.*, rectifying such an error as the above.] Next, as I have frequent opportunities of going up heights, will you give me two or three rules for observing altitudes. [See *Meteorological Mag.*, Vol. I., pp. 52 and 60.] I have walked occasionally to very nearly 2,000 ft. high, and the rules that are good for the first 500 ft. would hardly apply to elevations of 1,500 ft. The barometer is very stationary here, keeping close to the same spot for weeks, then dipping suddenly, and rising again.

#### HYGROMETER.

I have been utterly unable to get a good place for this. Hitherto I have kept it in my window, looking into the court, whose paved floor is generally kept wet purposely, and in an unduly damp atmosphere. And to make things worse, it became gradually choked with dust, and

I wondered to see such great dampness registered in the dry E. wind of February and March, nor did I discover the cause till the end of April, since then I have washed the cotton wick fortnightly, though it is a perilous operation. The November and December readings may be trusted, with allowance for position of instrument; they are—

November, average reading at 8 a.m., 75·6, greatest 85 (<sup>25</sup>), least 66 (<sup>16</sup>),

December „ „ „ 83·7, „ 93 (<sup>17</sup>/<sub>31</sub>) „ 72 (<sup>1</sup>),

May „ „ „ 64·3, „ 79 (<sup>8</sup>) „ 53 (<sup>27</sup>),

June hitherto has varied between 74 (on the 15th), and 58 (on the 7th). I may, perhaps, succeed in getting a better place before long.

[We presume that the above are “degrees of humidity,” computed from the Dry and Wet bulb, by Glaisher's tables. Perhaps Mr. Boys will correct us if we are wrong.]

#### CLOUDS.

I have made notes of these, too, marking against each day 0, 1, 2, up to 10, according to the amount of cloud, 0 representing perfect clearness; 1, 2, clouds hanging on mountains only; 3 up to 7, different degrees of cloudiness over Patras, and 8 to 10, different densities of clouds when the sky is covered entirely all day. The annexed table shows how many days of each sort there have been from the beginning of each month, and the average for each month. This is an unscientific method of registering, but you can take it for what it is worth. I am not acquainted with the proper cloud nomenclature; any hint that you can give me about this I shall be grateful for.

Scale.	Jan.	Feb.	March.	April*	May.	June*
10—8	13	6	1	1	1	0
7—3	16	7	18	11	14	10
2—1	2	10	9	9	14	7
0j	0	5	3	0	2	1
	6·3	3·5	3·4	3·5	2·8	2·8

\* April omitting 12-20. June only up to 18.

We had a fine Aurora here on Oct. 25th, from 7 to 9. There was an earthquake just before. The day had been rainy, but cleared up well at night. The Aurora was from N.W. to N.E., a deep red, very bright, the finest I ever saw. The people were terrified. Such things are seen here once in about ten years, and connecting it with the earthquake, they said a volcano must have opened. It was a steady red blaze with little or no shooting rays. It was a fine sight to see it along our horizon. Our view of the mountains, with the strong flame-colour behind them, was magnificent.

I hope another year to send you a more complete report, and to have found better places for my instruments. The ground given for our Church is open on all sides, and if I remain here long enough to see Church and house built, I may arrange a proper stand for all the instruments.

If any of your richer meteorological friends are disposed to aid an

English Church in Greece, either on this or higher grounds, I can assure you that subscriptions are really needed.—Yours sincerely,

HERBERT A. BOYS.

Patras, Greece, June 17th, 1871.

*Rainfall Table.*

Date.	1870.				1871.					
	Sept. 15-30.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June 1-18.
1...		...	·37	·60	...	...	...	...	...	...
2...		...	·46	·87	·96	...	...	·02	...	...
3...		...	...	·56	·21	...	...	·01	...	...
4...		...	...	·03	·49	...	...	...	...	...
5...		...	...	·02	...	...	...	...	...	...
6...		...	...	·03	·07	·23	...	...	...	...
7...		...	...	·31	...	·17	...	...	...	...
8...		...	...	1·25	·25	·24	...	...	·03	...
9...		...	·46	·72	·54	...	...	...	...	...
10...		...	·33	·14	·60	·36	...	...	...	...
11...		·66	...	...	·39	·74	...	...	...	...
12...		...	...	...	...	·14	...	·01	...	...
13...		...	...	...	·25	·01	...	...	...	...
14...		...	·01	...	·32	...	...	...	·05	·41
15...	...	...	...	...	·18	...	...	...	...	...
16...	...	...	...	·02	...	...	...	...	...	...
17...	...	...	...	...	...	...	...	...	...	...
18...	...	...	...	·19	...	...	...	...	...	...
19...	...	...	...	...	...	...	...	...	...	...
20...	...	...	...	·04	·57	...	·19	...	...	...
21...	...	...	...	·47	·04	·16	·21	...	...	...
22...	·33	·44	...	1·41	·68	...	·18	...	...	...
23...	...	·01	...	·38	...	...	·44	...	...	...
24...	...	·03	...	·32	...	...	...	...	...	...
25...	...	·16	...	·09	...	...	...	...	...	...
26...	·10	...	...	...	·50	...	...	...	...	...
27...	...	...	...	...	·03	...	...	...	...	...
28...	...	·04	...	·03	·83	...	·03	...	·08	...
29...	...	·56	·10	·21	·35	...	...	...	...	...
30...	...	...	...	·20	...	...	·04	...	...	...
31...	...	...	...	·08	...	...	·24	...	...	...
Total..	·43	1·93	1·73	7·97	7·26	2·05	1·33	·04	·16	·41

*Register of Earthquakes.*

1870.				1871.					
Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.
			4 .			11 .		3 .	
			5 .			19 .		4 .	
		19 .	6 . . .			22 .		10 .	
	25 .	29 .	24 .	22 .				18 .	
			29 .						

The figures represent the days of the month on which earthquakes took place, the dots their number, and the size of the dots their severity; the worst shook ground and houses sensibly to the feeling of any one in the streets, as I was.



*Temperatures.*

	1870.				1871.											
	Nov.		Dec.		Jan.		Feb.		March.		April†		May.			
	Deg.	Day	Deg.	Day	Deg.	Day	Deg.	Day	Deg.	Day	Deg.	Day	Deg.	Day	Deg.	Day
Average max. temp. ....	68·3	...	60·3	...	57·1	...	56·3	...	61·7	..	71·0	...	76·9	...		
Greatest max. temp. ....	75·0	3	70·0	28	64·0	13	62·0	22	76·0	20	78·0	21	88·0	14		
Least max. temp.	58·0	29	54·0	10	49·0	29	47·0	16	49·0	3	62·0	1	70·0	9		
No. of max. between 89 & 80	...		...		...		...		...		...		5			
79,, 70	10		1		...		...		4		13		26			
69,, 60	19		16		6		9		15		8		...			
59,, 50	1		14		24		15		11		...		...			
49,, 40	...		...		1		4		1		...		..			
Average min. temp. ....	49·0	...	44·0	...	40·2	...	40·6	...	44·2	...	51·3	...	56·8	...		
Greatest min. temp. ....	59·0	12	50·0	7	49·0	26	49·0	7	58·0	19	57·0	30	69·5	19		
Least min. temp.	40·0	28	35·0	4	32·0	31	30·0	18	30·0	3	43·0	1	47·0	8		
No. of min. between 69 & 60	...		...		...		...		...		...		7			
59,, 50	14		1		...		...		6		15		22			
49,, 40	16		24		15		15		15		6		2			
39,, 33	..		6		15		11		9		...		...			
32,, 30	..		...		1		2		1		..		...			

† The April register omits any account of the days from April 12–20th inclusive. I was in Athens at the time, but have reason to suppose that the weather in Patras during that time was quite regular, and that the omission scarcely affects the truth at all.

## THE DECREASE OF RAINFALL WITH ELEVATION.

*To the Editor of the Meteorological Magazine.*

SIR,—This question appears to me to be exceedingly simple, and one which, luckily for myself, can be discussed without any knowledge of mathematics or the dead languages. The promoters of the new theory, if I understand them aright, say the amount of rain is the same at (say) 50 feet above the ground as on the surface, but that the reason why a horizontal gauge collects less at 50 feet is owing to the greater angle at which the rain falls at the higher level. The old theory assumed that the amount of rain was less at a given elevation than on the surface of the ground, and that the rain increased in quantity, in some unknown manner, as it fell. Let us apply the test of a little common sense to the subject. We are all agreed, I presume, that no matter how the rain falls, it must reach the earth at last. Now, the most ardent supporter of the new theory must allow that a horizontal gauge, placed on the ground, must catch the same amount

of rain no matter at what angle it falls : then, if on the ground, why not 10, 20, or 50 feet above it, as, according to the new theory, the same amount of rain exists at all elevations? It is no slight satisfaction to find that, on taking this view, I am supported by so great an authority as the late Sir John Herschel. Sir John, in his *Meteorology* (p. 104, sec. 109), says : “ Still less can the effect (the decrease of rainfall with elevation) be due to a greater obliquity of fall at a higher than at a lower level, since the same quantity of rain must fall on the same horizontal surface after changing its obliquity as before.”

Mr. Stow, in his letter in the last number of your Magazine, says :— “ The new theory rests on an assumption that when the falling rain deviates from its original path the drops are not brought closer together.” A most amazing assumption, indeed ! The real fact is (and it admits of the readiest demonstration) that the greater the angle at which the rain falls, the nearer the drops approach each other. If it were not so, a tipped gauge would *not* collect more than a horizontal one. This brings me to another passage in Mr. Stow's letter, above referred to. He says : “ It is impossible to deny that a horizontal gauge presents a smaller area of aperture to rain falling obliquely than to that which falls vertically.” No doubt of it ; but when the rain falls at an angle, the drops being closer to each other in proportion to the angle, cause the same amount of rain to fall on the smaller area as would fall on the larger area if the drops fell perpendicularly.

Yours truly, JOHN THRUSTANS, F.M.S.

*Merridale, Wolverhampton, June 20th, 1871.*

---

*To the Editor of the Meteorological Magazine.*

SIR,—Do not inclined and vertical gauges register an erroneous rainfall in consequence of their inclined and vertical position? and is not this a fact to be proved by mathematical reasoning? Let us suppose a 5-inch circular horizontal gauge placed at the same elevation with a similar gauge inclined at an angle of  $45^{\circ}$  : a shower of rain falls at an angle of  $45^{\circ}$  : as Mr. Du Port stated, in last month's Magazine, a cylinder of rain discharges its volume into the horizontal gauge (the base) ; during the same period the inclined gauge receives the volume of a cylinder of rain ; now the diameter of the inclined gauge is *not* the diameter of the base of the cylinder, but the straight line at right angles to the axis, terminated by the superficies of the cylinder : therefore the base and volume of this cylinder can be proved to be much larger than those of the horizontal gauge, and consequently the inclined gauge registers a larger amount of rainfall than is due to a circle of the ground 5 inches in diameter. Must we not then reject as of no value the comparison of the returns of a similar horizontal and inclined gauge at any elevation?—Yours truly,

G. WARREN.

*Merton Villa. Cambridge, June 23rd, 1871.*

*To the Editor of the Meteorological Magazine.*

SIR,—*A tu quoque* is generally a feeble argument ; however, I think it will help to clear the way towards the solution of our problem, if I attempt to show that the statement, which Mr. Stow tells us some might call an axiom, is not accurate. The basis of Mr. Stow's theory is that the rain-drops are not brought closer together as the falling rain deviates from the vertical. Now, surely we may consider the rain as falling in straight lines for an appreciable time, though a short one, say while it is falling through a foot. Now, the deviation from the vertical will be caused by the rain-drops being moved through some horizontal space by the motion of the air : it would only complicate matters to estimate this force, even if we could estimate it, and, for all practical purposes, we may suppose this horizontal translation of the rain-drop in a certain time to be that exactly due to the velocity of the wind, which, too, for a small time, we may consider uniform. Now, let anyone take three or four strings, each a foot long, and fasten one end of each to one of three or four equidistant points on a knitting needle, and the other end of each string to a corresponding point on another needle ; lay the whole system on a table ; pull the needles apart, so that the strings are at right angles to both needles ; this will represent rain falling from one needle on to the other vertically : draw one needle aside, say through 3 or 4 inches, keeping all the strings tight, the strings will then represent the path of rain falling obliquely : it is manifest that the whole of the rain which fell directly from one needle to the other will also fall upon this other, whatever be the inclination of the strings to the needle, or, in other words, of the rain to the horizon. It is further manifest that, although the rain-drops in any horizontal stratum at any moment are not drawn nearer together, nevertheless the paths of the rain-drops are, since the distance between two parallel lines is the line perpendicular to both.

To put the matter briefly and on mathematical grounds : the fact, that all parallelograms upon equal bases and between the same parallels are equal in area, is inconsistent with Mr. Stow's theory, and further disposes of his question, on page 70, " why not for vertical, or, indeed, gauges at any angle ?" Any person by drawing a diagram may satisfy himself of these two consequences.

The weakness which Mr. Stow thinks he has discovered in Dr. Burder's theory, as to the incidence at  $90^\circ$ , is really a crucial test of its accuracy : it is no more than the physical expression of the fact that the secant of an angle becomes infinite as the angle passes through  $90^\circ$ .

Dr. Burder's clear letter in the number for June ought to be sufficient to convince. I have only ventured to add my mite to the correspondence, because I think I have discovered a mathematical inconsistency in Mr. Stow's communication.

J. M. DU PORT.

*Mattishall, Norfolk, July 3rd, 1871.*

*To the Editor of the Meteorological Magazine.*

SIR,—In replying to the letters of Mr. Stow, and others, in your last number, I wish to confine myself strictly to the issue which my first letter was intended to raise. I do not, therefore, propose to enter at all into the question of what is the real cause of the decrease of rainfall with elevation, but simply to show that the cause assigned by Mr. Stow is founded on a misconception. The former question is one of a class that may legitimately admit of difference of opinion; the latter is one on which a very moderate amount of controversy ought, I think, to bring about an agreement.

Mr. Stow objects to my illustration, that it is "impossible," and that the exact thing supposed could not occur in nature. The same objection will apply to a diagram, or to any method by which the component parts of a problem are singled out for separate investigation. I cannot see the force of the objection, and will therefore ask your readers to draw for themselves a very simple diagram on the following plan. First, let a number of vertical lines be drawn at equal distances apart, say, 12 lines at distances of a quarter of an inch. At a certain level, let these lines be all deflected at an angle of  $45^\circ$ , preserving their parallelism. Next take a scale on which is marked off a length of just over 2 inches, and count the number of lines that are included within this space, holding the scale horizontally, at first across the vertical lines, and then across the diagonal lines. In each case it will be found that 9 may be included. Next count the number of diagonal lines that can be included within the same space when the scale is held at right angles to these diagonal lines. It will be found that the number is now increased to 12. Can anything further be required to show that the rain-drops, by falling obliquely, *are* "brought closer together," and that the rain *is* "altered in density," with respect to a receiving surface placed at right angles to the course of the drops? Yet Mr. Stow, in the first paragraph of his letter, seems clearly to state the reverse of this proposition, as the assumption on which his theory is founded.

Again, Mr. Stow, in his fifth paragraph, points out as a "weakness" in my argument, that it involves a sudden diminution in the amount collected from the entire quantity to nothing, when the angle of the falling rain reaches  $90^\circ$ . But if he will so far overcome his repugnance to the kind of illustration, as to follow out the matter with the aid of the diagram above described, only varying the angle, he will find that the result must be exactly that which he considers incredible. But, after all, is the result strange? So long as the rain falls at all, no amount of obliquity will diminish the quantity that falls, but to say that the angle is  $90^\circ$ , is to say that the rain no longer falls.

I will only add, with especial reference to Mr. Kearney's letter, that I cannot see what is gained in this discussion by the use of mathematical formulæ. They seem to me only to obscure the argument, and to render that complex which in itself is perfectly simple.

The real difficulty is so to isolate this particular question from its surroundings as to perceive its simplicity.

GEORGE F. BURDER, M.D.

Clifton, July 9, 1871.

### SOLAR HALOS.

*To the Editor of the Meteorological Magazine.*

SIR,—My attention has been drawn to several communications which appeared in the May number of your Magazine, describing what are there called "Solar Halos." The unusual features in the sky were, by all the observers, uniformly noticed on Wednesday, April the 5th. It seems that though perpendicular bands of light revealed themselves strongly both above and below the sun, they were also and further accompanied by circular, or by horse-shoe-shaped halos, and these bands and halos were visible whilst the sun was still in full brilliancy above the horizon. These appearances differ considerably from a phenomenon which I had the opportunity of seeing on the preceding evening, namely, Tuesday, April the 4th. Mr. Heineken and myself had been out from the morning on Broad Down, about five miles north-east from Sidmouth, examining some tumuli, and towards evening we were returning westward, in full view of the setting sun. I wish to observe that, whilst the sun was above the horizon, nothing unusual attracted our attention. Coming to the brow of Salcombe Hill, a hill 500 feet high, that closes in the eastern side of the valley of the Sid, we descended the steep road at a slow pace, with the drag on the wheel. As soon as the sun's disc had disappeared behind the opposite hill, a column of yellow light stood perpendicularly over the sun's place. It was of the same diameter as the sun throughout its length, thus making its sides parallel. It rose to the height of from 12 to 15 degrees, gradually fading away to nothing at its upper part. As daylight diminished the column grew fainter, but it was discernible for 20 minutes. It continued perfectly steady, with its edges clear and persistent. There were no halos whatever. The sky was clear, or nearly so, with a moderately strong purple haze along the horizon. Remember, this occurred on Tuesday, the 4th: on the 5th, I again observed the sunset, but nothing unusual was visible from Sidmouth. Within a day or two, I communicated these circumstances, together with a coloured sketch (similar to the one I enclose),\* to Professor Airy, C.B., of the Royal Observatory, Greenwich. His answer was very satisfactory to me, but I have no authority to make quotations from his letter.

P. O. HUTCHINSON.

Sidmouth, May 16th, 1871.

### THUNDERSTORM OF APRIL 29TH.

*To the Editor of the Meteorological Magazine.*

SIR,—A heavy storm of rain and hail, accompanied with lightning and thunder, passed over here on Saturday afternoon, April 29th.

\* See Frontispiece.

The storm lasted about twenty to twenty-five minutes, during which 0.95 in. of rain fell. The register on the morning of the 30th gave 1.22 in., which is the greatest fall except one during the past eleven years. The road sides on the hills are washed away to the depth of 6 inches. Wind N.W., but calm.—Yours truly,

EDWARD ROBINSON.

*Englefield, Reading, May 2nd, 1871.*

## THE WEATHER IN JUNE.

*To the Editor of the Meteorological Magazine.*

SIR,—On Saturday, 17th inst., about one o'clock p.m., a thunder-storm passed over the town, and for an hour we had a local deluge. The rain came down in torrents, flooding the streets and many houses. It is many years since we had such heavy rain; my rain gauge measured 0.66 in. in the hour.—Yours truly,

HENRY TUCKER.

*Spring Cottage, Lyme Regis, June 21st, 1871.*

*To the Editor of the Meteorological Magazine.*

SIR,—I send you a short account of the weather during the last few days, thinking it may be of interest. The thermometers are by Negretti and Zambra, on a thermometer stand facing north. The rain gauge is 5 inches in diameter, and 2 feet above ground.

1871. June.	Wind.	Temperature at 4 ft		Rain.	Remarks.
		Max.	Min.		
13...	S.E.	62.0	46.0	0.37	
14...	S.	68.0	57.0	0.73	Thunder in the night.
15...	S.	70.5	58.0	0.07	Distant thunder.
16...	S.S.W.	72.0	55.5	0.13	
17..	S.S.W.	65.5	54.0	0.24	Thick fog till 11 a.m.
18...	S.	67.0	51.5	0.11	
19...	S.W.	66.0	52.5	0.26	{ Thunder in the morning; thunder-storm from 7.45 to 9 p.m.
20...	W.	69.5	52.0	0.73	{ Thunder in the morning; violent thunderstorm from 1.50 to 5.45 p.m.
21...	W.	65.5	51.0	0.20	Distant thunder.
22...	E.N.E.	58.0	49.0	0.47	
23..	N.E.	58.8	49.0	0.05	

Total rain, 3.36 in. in 11 days.

The thunderstorm of the 20th was very severe. It first appeared in the N.W. about 1 p.m., and from 1.30 to 3.15 was very heavy to the north of us, the lightning being very bright and the thunder loud. After 3.15 till 4.20 p.m. the storm was right overhead, the forked lightning being exceedingly vivid and followed immediately by loud peals of thunder, there being seldom more than one or two seconds between the flash and the thunder. After 4.20 the thunder was farther off, and the last lightning was seen at 5.45. There was very little rain

till 4.20, but after that it rained steadily till 9 p.m. and at times in the night. Total rain at 9 a.m. next morning, 0.73 in.

Yours faithfully, EDWARD C. MORRELL.  
*Broughton Lodge, Banbury, June 24th.*

*To the Editor of the Meteorological Magazine.*

SIR,—I really think that the cold of this season must be almost unprecedented. In March we had 8 days on which the maximum temperature exceeded  $55^{\circ}$ , but 5 only in April, 13 in May, and in June hitherto only 8 out of 26. There was not much wind in the latter half of March and in April and May, but June set in with successive northerly gales, the anemometer registering 900 miles in the 24 hours ending at 2 p.m. on the 3rd, and no less than 1246 miles in the 24 hours ending at 2 p.m. on the 7th, indicating an average velocity of 52 miles an hour—a speed not maintained for a whole day since February, 1870. During the gale the thermometer varied from  $41^{\circ}$  to  $49^{\circ}$ , and the cold was intense, making many persons unwell. Trees which were covered with green leaves previously, had nothing green about them after the gale, and those which were partially sheltered were made brown as in autumn. I believe this result is due less to the violence of the wind than to the salt spray with which the air was laden; at all events, the effect of the gale is much less perceptible a few miles from the sea.

Has Mr. Brumham no comfort in prospect for us? I thought he told us lately that a great equality of temperature during spring was a sign of an extreme summer, but I fear I am wrong. The mean of maxima and minima was in February  $40^{\circ}.3$ , March  $44^{\circ}.1$ , April  $43^{\circ}.5$ , May  $47^{\circ}.7$ , and with Glaisher's corrections these figures become  $39^{\circ}.9$ ,  $43^{\circ}.1$ ,  $42^{\circ}.0$ ,  $46^{\circ}.0$ . Perhaps the extreme to follow is an extreme of cold, with skating instead of grouse shooting. Horrible thought!

I am, Sir, your obedient servant, F. W. STOW.

*Hawsker, June 26th.*

P.S.—On Monday, June 19th, the weather was remarkable. Apparently it was fine over the sea all day. On the coast showers fell from 11 a.m. to 4 p.m.—amount, 0.07 in.—and inland there was intense blackness almost all day, and thunder was heard frequently in that direction. I only observed one flash of lightning.

### EXTRAORDINARY MIRAGE IN THE FIRTH OF FORTH.

For some time past the atmospheric phenomena at the mouth of the Firth of Forth have been of a remarkably vivid and interesting character, and have attracted a great deal of attention. During the past week especially, scarcely a day has passed without exhibiting extraordinary optical illusions in connection with the surrounding scenery, both at sea and on shore. As an instance of the unusual nature of these phenomena, the whole of the Broxmouth policies, mansion-house, and plantations, were one day apparently removed out to sea. One of the finest displays of mirage, however, occurred on Saturday afternoon. The early part of the day had been warm, and there was the usual dull, deceptive haze extending about half-way across the Firth, rendering the Fife coast invisible. The only object on the Fife coast, indeed, which was brought within the range of the refraction was Balconie Castle on the "East Neuk," which appeared half-way up

the horizon, and in a line with the Isle of May. The most extraordinary illusions, however, were those presented by the May island, which, from a mere speck on the water, suddenly shot up in the form of a huge perpendicular wall, apparently 800 or 900 feet high, with a smooth and unbroken front to the sea. On the east side lay a long low range of rocks, apparently detached from the island at various points, and it was on these that the most fantastic exhibitions took place. Besides assuming the most diversified and fantastic shapes, the rocks were constantly changing their positions, now moving off, and again approaching each other. At one time, a beautiful columnar circle, the column seemingly from 20 to 30 feet high, appeared on the outermost rock. Presently the figure was changed to a clump of trees, whose green umbrageous foliage had a very vivid appearance. By and bye the clump of trees increased to a large plantation, which gradually approached the main portion of the island, until within 300 or 400 feet, when the intervening space was spanned by a beautiful arch. Another and another arch was afterwards formed in the same way, the spans being nearly of the same width, while the whole length of the island, from east to west, seemed as flat and smooth as the top of a table. At a later period the phenomena, which were constantly changing, showed huge jagged rifts and ravines in the face of the high wall, through which the light came and went as they opened and shut, while trees and towers, columns and arches, sprang up and disappeared as if by magic. It is a singular fact, that during the four hours the mirage lasted, the lighthouse, usually the most prominent object from the south side of the Firth, was wholly invisible. The last appearance which the island assumed was that of a thin blue line half-way up the horizon, with the lighthouse as a small pivot in the centre; and the extraordinary phantasmagoria were brought to a close about seven o'clock by a drenching rain, which fell for two hours.—*Scotsman*.

## REVIEWS.

*Introductory Text-Book of Meteorology.* By ALEXANDER BUCHAN, M.A.; F.R.S.E., crown 8vo., 218 pages, 8 plates. Blackwood and Sons.

WE are rather surprised that Mr. Buchan has neither stated on the title page of this work, nor intimated in the preface, that it is to all intents and purposes a cheaper and revised edition of his excellent "*Handy Book of Meteorology*." Some paragraphs on the more difficult branches of the science are omitted, as, for instance, all those referring to the polarization of the atmosphere; on the other hand, the author's investigations as to the prevalent winds in different parts of the earth's surface are utilized, as are also the recent observations of sea temperature, and some rainfall tables, whence we quote the following paragraph:—

"There is very great diversity in the rainfall of *Australia*. At Somerset, at the north-east point, the annual rainfall is 87 inches; Brisbane, 47 inches; Sydney, 49 inches; Melbourne, 28 inches; Adelaide, 20 inches; and Freemantle, 31 inches. At Deniliquin, on the Murray River, only 12 inches fall annually. The rainfall of this continent is extremely fluctuating from year to year. In *Tasmania* the annual amounts vary from 59 inches in King's Island, to 21 inches in Goose Island. At Hobart Town the average is 27 inches, which is probably the average of the open districts on the east side of the island; on the west much more rain falls. In *New Zealand* the differences are still greater. At Hokitika, in the west, 120 inches fall annually, and at Bealey, 118 inches; whereas, at Christ Church, on the opposite side of the island, the average is only 25 inches. At Southland the annual fall is 44 inches; Dunedin, 34 inches; Nelson, 58 inches; Wellington, 50 inches; Tranaki, 56 inches; Auckland, 49 inches, and Mongonui, 54 inches. In *South Africa* very great differences prevail, the annual amounts being 40 inches at Wynberg; 32 inches at Pietermaritzburg; 30 inches at Simon's Town; 27 inches at Somerset West; 23 inches at Cape



Town ; 19 inches at Alwali North ; 14 inches at Graff Reinet ; 12 inches at Worcester ; 10 inches at Concordia ; and 8 inches at Keerom, Namaqualand ; and at all these places the annual rainfall is subject to great fluctuation. In the south of *South America* the annual amounts are 48 inches at Buenos Ayres ; 22 inches at Punta Arenas, near Cape Horn ; 109 inches at Valdivia, and 102 inches at Puerto Montt ; but at Santiago de Chili it is only 17 inches."

While upon the subject of rain, we may call Mr. Buchan's attention to an error of a single figure, transferred from his larger work to page 118 of the present, where he quotes the rainfall at the Styne as 38·9 inches in January 1831, it should be 1851.

The excellent Maps, which have been specially drawn for this work, represent the most recent data as to winds, pressure, and temperature, in a clear and intelligible manner.

*Second Annual Report of the Bournemouth Meteorological Society.*

8vo., 27 pp., 1870. Offer, Bournemouth.

*Third Annual Report of the Bournemouth Meteorological Society.*

8vo., 16 pp., 1871. Sydenham, Bournemouth.

WE are glad to find that this Society is continuing in the path of usefulness on which it entered. We do not, however, share the Secretary's satisfaction with the balance sheet ; he has the balance on the right side, *because* the Society have reduced the dimensions of their reports. Ordinarily, we are opponents of quantity, and advocates of quality, but in these reports the quality is such that we should gladly see the bulk of the first one again adopted. Possibly the Society might increase its members and its funds, by accepting non-residents as members, either on the same terms as residents, or on half terms.

When reviewing the first report (*Meteorological Magazine*, Vol. V., p. 11), we objected to the returns of the temperature of the sea, as far too high (the mean for July, 1868, was 70°·1) ; to this criticism, Mr. Newnham replied, on p. 120 of the same volume. Sea temperatures are not mentioned in the Second Report, but in the third the following remarks are made, and foot-note given :—

"The mean temperature of the sea for the six months, April to September inclusive, was 57°·7 as compared with 63°·3 [63°·5 ?] in 1868. In 1868, however, the air temperature was 2½ degrees warmer than in the corresponding period of last year. The highest reading was 68° against 72° in 1868, and the lowest registration 42½ as compared with 49°.\*

We reprint the mean temperatures in part of 1870, adding those for the corresponding months of 1868, and the differences :—

\* The sea temperatures were taken by a "Six's thermometer," made expressly for the purpose by Casella, Hatton Garden. The instrument was fixed at the end of the pier, 4 ft. from the bottom of the sea, and about 4 ft. from its average surface. No continuous registrations were taken in 1869, but in 1868 the instrument then used was a standard "bucket" thermometer, and observations were taken but once daily, consequently the "mean" given in the report for 1870 [1869 ?] was the mean temperature at one hour of the day, which was probably some 3° in excess of the true mean.

	April.	May.	June.	July.	August.	Sept.	Mean for 6 Months.
1870 ...	46°·4 ...	53°·1 ...	59°·1 ...	62°·8 ...	64°·1 ..	60°·5 ...	57°·7
1868 ...	52°·7 ...	60°·0 ...	64°·4 ...	70°·1 ...	68°·5 ...	65°·5 ...	63°·5
Excess in 1868 ...	6°·3 ...	6°·9 ...	5°·3 ...	7°·3 ...	4°·4 ...	5°·0 ...	5°·8

We think that few persons can now deny that our objection was valid; we hope that the Society will resume these observations with every possible precaution, for the important element of sea temperature on the English coasts is, to our English discredit, almost unknown. It is otherwise in Scotland: let Bournemouth set the example, and we believe that other health resorts will follow suit. Bournemouth has taken the lead; it is free from the disturbing influences of any large outflow of fresh water, and in every respect has eminent facilities for maintaining a first position.

The importance which we attach to this subject has induced us to devote so much space to it, that we can at present simply recommend to the notice of our readers an able paper on "Lunar Influence on the Weather," by Mr. Newnham, which is only second in importance to sea temperature.

*Quarterly Weather Report of the Meteorological Office.* Part IV., October to December, 1869. 4to, 30 pages, 37 plates.

The original degree of accuracy is maintained, and the rate of publication so much accelerated that the arrears will soon be overtaken. Among the miscellaneous tables, at the end of this part, are two which will be especially useful and interesting to many of our readers, and which we therefore reprint.

*Extremes of Pressure at Sea Level in 1869.*

Observatory.	Maximum.	Date.	Minimum.	Date.	Range.
	in.		in.		in.
Valencia .....	30·605	Oct. 22, 10 a.m.	28·410	Jan. 28, 7 p.m.	2·195
Armagh .....	30·677	Dec. 6, 1 a.m.	28·437	„ 28, 11 p.m.	2·240
Glasgow .....	30·702	„ 6, 9 a.m.	28·340	Dec. 13, 8 p.m.	2·362
Aberdeen .....	30·686	Apl. 28, 1 p.m.	28·259	„ 13, 10 p.m.	2·427
Falmouth .....	30·580	Feb. 13, 6 p.m.	28·670	Sep. 11, 11 p.m.	1·910
Stonyhurst .....	30·666	Dec. 6, 11 a.m.	28·712	Jan. 29, 2 a.m.	1·954
Kew .....	30·600	„ 5, 11 p.m.	28·751	Sep. 12, 5 a.m.	1·849

*Extremes of Temperature in Shade.*

Observatory.	Maximum.	Date.	Minimum.	Date.	Range.
	deg.		deg.		deg.
Valencia .....	82·3	Aug. 27, 3 p.m.	27·7	Dec. 27, 11 p.m.	54·6
Armagh ... ..	78·1	July 17, 4 p.m.	20·7	„ 28, 6 a.m.	57·4
Glasgow .....	79·0	„ 17, 3 p.m.	13·0	„ 28, 7 a.m.	66·0
Aberdeen .....	78·3	Aug. 25, 2 p.m.	20·0	„ 2, 9 a.m.	58·3
Falmouth .....	78·4	July 18, 2 p.m.	26·0	„ 26, 11 p.m.	52·4
Stonyhurst .....	83·2	Aug. 28, 3 p.m.	14·3	„ 28, 9 a.m.	68·9
Kew .....	88·3	July 22, 2 p.m.	20·3	„ 29, 3 a.m.	68·0

JUNE, 1871.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which fall or more fall.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.  Deg.		Date.	Min.  Deg.	Date.			
				Dpth	Date.								
											inches	inches.	in.
I.	Camden Town .....	3.49	+ .44	.67	19	16	76.0	16	39.0	4	0	0	
II.	Maidstone (Linton Park) .....	2.92	+ .18	.47	23	17	81.0	15	38.0	6	0	...	
III.	Selborne (The Wakes) .....	3.77	+ .54	1.05	14	12	71.0	16	33.2	4	0	2	
III.	Hitchen .....	2.43	- .21	.58	17	20	73.0	16	36.0	4, 5	0	...	
IV.	Banbury .....	3.99	+ .71	.85	20	16	72.2	16	35.5	5	0	...	
V.	Bury St. Edmunds (Culford) .....	3.30	+ .72	1.08	17	18	78.0	15+	34.0	5	0	4	
V.	Bridport .....	2.04	- 1.20	.49	19	11	68.0	17	36.0	3	0	...	
"	Barnstaple .....	2.43	- 1.69	.50	18	15	75.2	1	38.0	5	0	...	
"	Bodmin .....	2.81	- 1.23	.90	18	14	70.0	28	40.0	5	0	0	
VI.	Cirencester .....	3.00	- .38	.65	13	10	...	...	...	...	...	...	
"	Shiffnal (Haughton Hall) .....	2.31	- .80	.70	22	15	73.0	16	36.0	3	0	...	
"	Tenbury (Orleton) .....	3.45	- .07	.94	22	18	72.7	16	34.0	5	0	1	
VII.	Leicester (Wigston) .....	3.87	+ 1.10	2.00	16	16	77.0	16	35.0	24	0	...	
"	Boston .....	3.20	+ 1.01	.80	17	17	77.2	16	39.5	25	0	0	
"	Grimsby (Killingholme) .....	2.79	- .75	.75	14	15	72.0	16	40.0	25	0	...	
"	Derby .....	4.16	+ 1.27	1.66	15	17	70.0	14	41.0	3, 5	0	...	
VIII.	Manchester .....	2.66	- .68	.52	15*	15	74.0	14	37.0	3	0	0	
IX.	York .....	3.72	+ 1.62	1.39	15	14	70.0	16	40.0	4	0	0	
"	Skipton (Arncliffe) .....	2.77	- 1.33	.72	15	12	74.0	13	33.0	5	0	...	
X.	North Shields .....	2.54	- .20	.95	15	13	68.0	30	39.5	5	0	0	
"	Borrowdale (Seathwaite) .....	2.82	- 7.69	1.22	28	9	...	...	...	...	...	...	
XI.	Cardiff (Town Hall) .....	...	...	...	...	...	...	...	...	...	...	...	
"	Haverfordwest .....	1.50	- 2.15	.50	22	8	71.5	17	35.0	4	0	1	
"	Rhayader (Cefnfaes) .....	3.73	- .25	.80	11	11	69.0	...	31.0	...	...	...	
"	Llandudno .....	2.27	- .02	.86	15	8	74.4	14	39.4	5	0	...	
XII.	Dumfries .....	2.35	- .55	.68	15	13	74.0	11	38.0	24	0	...	
"	Hawick (Silverbut Hall) .....	2.87	...	.81	15	12	...	...	...	...	...	...	
XIV.	Ayr (Auchendrane House) .....	2.13	- 1.22	.48	15	14	75.0	10	32.0	9	0	2	
XV.	Castle Toward .....	2.65	- .84	.78	16	10	...	...	...	...	...	...	
XVI.	Leven (Nookton) .....	2.32	+ .08	.50	14	14	66.0	18+	36.0	9	0	4	
"	Stirling (Deanston) .....	1.87	- 1.05	.46	15	13	71.5	19	35.3	3	0	1	
"	Logierait .....	2.18	...	.45	16	12	...	...	...	...	...	...	
XVII.	Ballater .....	1.48	...	.40	14	7	68.5	17	31.0	24	1	...	
"	Aberdeen .....	1.23	...	.58	14	14	65.9	17	39.3	25	0	6	
XVIII.	Inverness (Culloden) .....	.92	...	.33	5	11	64.9	12	44.5	24	0	0	
"	Portree .....	1.33	- 3.45	.27	28	14	...	...	...	...	...	...	
"	Loch Broom .....	.72	...	.16	30	10	...	...	...	...	...	...	
XIX.	Helmsdale .....	1.07	...	.27	14	15	...	...	...	...	...	...	
"	Sandwick .....	.33	- 1.21	.12	3	7	67.9	17	40.8	26	0	2	
XX.	Cork .....	4.22	...	.84	12	20	...	...	...	...	...	...	
"	Waterford .....	3.74	+ .75	.50	22	22	71.0	21	45.0	3	0	...	
"	Killaloe .....	2.75	- .88	.45	18	20	79.0	27	42.0	26	0	...	
XXI.	Portarlington .....	2.33	- .92	.45	20	18	71.0	16	39.0	.2	0	0	
"	Monkstown .....	2.28	- .33	.54	20	16	...	...	...	...	...	...	
XXII.	Galway .....	3.50	...	.40	13+	19	74.0	1	40.0	5, 7	0	...	
"	Bunninadden (Doo Castle) .....	3.65	...	.57	17	18	68.0	23	32.0	24	0	...	
XXIII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...	
"	Waringstown .....	2.64	...	1.04	18	16	78.0	15	37.0	9	0	...	
"	Strabane (Leckpatrick) .....	2.54	..	.36	15+	18	...	...	...	...	...	...	

\* And 22.      † And 30.      ‡ And 19.      || And 16, 17.      § And 27.

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

# METEOROLOGICAL NOTES ON JUNE.

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.—Early part of the month dull and cold; middle rather wet; finer towards the end. T and L frequent during the month; thunderstorms from noon to 3 p.m. on 19th, and from 1 to 4 p.m. on 20th.

LINTON PARK.—A dull, cold month, with some heavy rain; TS very near and for some hours on 20th, but the rain rather continuous than heavy; several foggy mornings, and cold almost approximating to frost. Winds mostly northerly and bar. high in the early part of the month, but changeable towards the middle. Wheat later coming into ear than in any season during twenty years, except 1860.

SELBORNE.—A cold, ungenial month; much hay spoiled in this neighbourhood by wet; during the whole of May and first five days of June, only .205 in. of rain fell, the least I ever measured, except in September, 1865, in which month the same quantity fell. Potatoes cut by frost on the 4th; prevailing winds first and last ten days, N. and E. Frequent TSS; coachman and horse near Winchester killed during one, which occurred about half-past one o'clock on the 21st.

BANBURY.—Frequent thunderstorms with hail; unusually cold; max. temp. below 60° on eight days; Sunday, 4th, temp. at noon, 45°, and max. of the day 53° and 57° at 9 a.m. on 5th.

CULFORD.—On 1st, 3rd, 5th, and 26th, the grass quite crisp with frost; the wind from N. and E. on 24 days; the coldest June that I can remember.

HAUGHTON HALL, SHIFNAL.—A cold, ungenial month; prevailing winds, N., N.W., and N.E. Strange to say, mushrooms came up in numbers towards the end of the month, in spite of the cold; swedes and mangold wurzel did well after the rain of the 18th; fruit trees of all sorts much blighted, and infested with aphides, &c. The hawfinches breed here now, and make sad work with the peas. [*Errata last month*—"Oats" for "oaks," and "seringa" for "seringa."]

ORLETON.—A very cold, ungenial month; much cloud and but little sun, with frequent rough wind; temp. about 4° below the average; cold and dry till the 15th, much rain during the remainder of the month. T on 17th, 18th, 19th, 20th, 21st, and 25th, but no heavy storms here.

WIGSTON.—Mean temp. some degrees below that of which I have any record. A most extraordinary fall of rain on the night of the 14th and during the day of the 15th, measuring 2.75 in. in about 18 hours, more than a third of which fell in two hours in the afternoon of the 15th. A very violent TS on the 20th. Owing to the low temp., the grazing land has been starved.

BOSTON.—Weather dull and cold, with N.E. winds up to the 12th. Much rain, with electrical disturbance of atmosphere, from 14th to 24th. TSS on 15th, 16th, 19th, and 20th.

GRIMSBY.—Cold month, the early part especially so. Ther. in shade did not reach 60° until the 13th. Grass abundant; corn crops, on the whole, indifferent, with a prospect of a late harvest. The polar currents continued till the 28th. High tide in Humber on 6th. TS between 1 and 2 a.m. on 16th; TS with heavy hail on the Wolds on the 19th; T in W. and S. from 4.45 to 5.30 p.m. on 20th. Wild roses began to flower on 19th; wheat in ear on 21st.

DERBY.—The character of the month has been cold and wet, with a few exceptions, with nearly double the usual number of days of E. wind. Mowing has commenced, and the quantity of grass is said to be prodigious.

YORK.—Our rain gauge being small and shallow, the exceedingly violent rains of the 14th and 15th are believed to be imperfectly registered, owing to splashing out of the gauge. Gauges in other parts of this city, of different construction, registered considerably more during those days.

NORTH SHIELDS.—T on 17th, 18th, 19th, 28th, and TS on 30th.

## WALE S.

HAVERFORDWEST.—A cold ungenial June; prevailing wind, N.E.; vegetation backward, hay crop light, the E. came too late to benefit it, and has seriously

interfered with the saving of the scanty crops ; great blight of insects on fruit trees. General health good, hooping cough prevailing, small pox cases few and of a mild type.

CEFNFAES.—Month cold and ungenial, the last half especially so.

LLANDUDNO.—A splendid double rainbow on 18th. Hay cut on 5th.

#### S C O T L A N D.

DUMFRIES.—First half drouthy and cold, second showery and favourable for vegetation. On low ground potatoes injured by frost on 24th. At the close of the month crops looking well, but two or three weeks later than last year.

HAWICK.—Cold and changeable month, with easterly wind. TS on 19th.

AUCHENDRANE.—The frequency of polar winds has caused a great difference between this June and last. The mills, fisheries, &c., on the river have suffered greatly from want of water. The only TS was on the afternoon of the 20th, with N. wind and small rainfall.

CASTLE TOWARD.—A favourable month for the farm and garden ; pasture plentiful and all other crops looking well ; heavy TS on 19th and 20th ; air much cooler since.

DEANSTON.—Till the 15th very chilly at night, but sunshine and warmth at times during the day, and very dry, only '130 of rain to that date ; TS on 19th and 20th, afterwards chilly night and morning ; last week milder and some rain.

LOGIERAIT.—Generally low temperature, with easterly winds prevailing ; T on 19th, T and H on 30th.

ABERDEEN.—Rainfall less than mean ; winds light and mostly either N.W. or N.E. A cold dry month, day temperature especially low ; frequent fogs from 9th to 17th ; distant T on five days ; much injury done by ground frost on 25th ; min. on grass, 27°·4 in.

PORTREE.—Much frost during the month, which blackened the potatoes in exposed situations and young tender garden trees. For the past three months the drought has been unprecedented in this locality ; the consequence is that all kinds of crops (except potatoes) are stunted.

LOCHBROOM.—The driest month we ever had ; crops and hay are exceedingly short, as the last three months have been dry.

SANDWICK.—This June has been 2° colder than the mean of the previous 44 years, and the driest during that period ; the only month that was drier was April, 1852, when there was only '11 in. of rain. Both the coldness and the dryness were probably owing to the prevalence of northerly and easterly winds. A sun-pillar at sunset on 25th, continuing for 30 minutes.

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

DOO CASTLE.—Two-thirds of the month wet. The oat crop, although improved by the rain of this month, will be short, as it fell out of season. T on 11th, 14th, and 16th. Ther. down to freezing point on 24th. None of the heat of summer as yet.

WARINGSTOWN.—Cold, the latter part wet ; on the whole a most disagreeable month.

### ICE AND SNOW IN JUNE.

*To the Editor of the Meteorological Magazine.*

SIR,—I see from Mr. Joyner's letter to you that snow fell at Harrow on the 4th ; on the following morning my min. at 4 ft had sunk to 37°·7, on grass to 33°, and a thin coating of ice was observed on a pond at a farm close here. So we have both ice and snow in the same 24 hours, within a few miles of London, on a June day.

Yours very truly,

FRANCIS NUNES.

*Heathfield Lodge, Chislehurst, June 20th, 1871.*

NOTE.—In spite of an extra four pages given this month, several reviews and some important articles have to stand over.