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DEW-POINT AND OTHER HYGROMETERS.

THE investigations as to the amount of evaporation from a water surface, resumed by Mr. Dines in 1869, have led to some rather unexpected results, and suggest, nay demand, prosecution at the hand of some person with more leisure time. We, therefore, with Mr. Dines's permission, will endeavour to place before our readers a *résumé* of part of what has been done, hoping thereby to induce one or more of them (there is work for several) to continue the enquiry.

A balance, capable of weighing with extreme accuracy, was arranged with a small vessel of water in one of the pans (A). A very delicate thermometer was suspended from the A end of the beam, so that its bulb was just immersed in the water. Weights were placed in the other pan B, until the water, &c., was exactly counterpoised. If the water in the vessel evaporate, weights must be removed from B to preserve the equilibrium; if it be cold enough to condense vapour from the air it will become heavier and weights must be added to B. It was found that if the water were hot it evaporated rapidly, and gradually less until the immersed thermometer was at a temperature *below* the dew-point temperature as computed by Mr. Glaisher's tables. And, conversely, it was found that if the vessel were filled with pounded ice, condensation occurred, A became heavier, and weights had to be added to B. Condensation, however, always ceased some 3° to 4° below the computed dew-point temperature. These results lead to three alternatives:—(1) That there is some error in the experiments. (2) That there is some error in the hygrometrical tables. (3) That the dry and wet bulb thermometers do not enable us to ascertain the dew-point correctly.

The second phase of the investigation is so clearly and concisely given in the *Proceedings of the Meteorological Society*, for March 1871, that we reproduce the note *verbatim*.

"While making some experiments connected with evaporation (see *Proceedings of Meteorological Society* for November 15, 1870), it was found that when the difference of the dry and wet-bulb thermometers amounted to 8° or 9°, evaporation commenced from the surface of water at a time when the thermometer immersed in the water showed a temperature of from 3° to 4° below the temperature of the

dew-point as obtained by calculation; but on repeating the experiments in air saturated with moisture, when the dew-point temperature could be obtained direct from the thermometer, the dew-point temperature, and that of the water when evaporation commenced, agreed with each other. As no satisfactory reasons have been assigned for this discrepancy, I made other experiments, as follows:—small globes and cylinders, both of glass and metal, were used, the substance of which was made as thin as possible; these were filled with iced water; a thermometer, with the bulb 1½ inch in length, was inserted in the water, the stem of the thermometer passing through the centre of the stopper; the whole was then suspended from the beam of a delicate balance. The outsides of the vessels were, of course, immediately covered with condensation, the amount of which was only occasionally noted, the one object of the experiments being to determine the exact temperatures of the water at the time when condensation ceased upon the surface of the vessels, and the moisture deposited upon them commenced to evaporate; that time was clearly shown by the stationary position of the index-rod attached to the balance, just previously to its commencing a retrograde movement. If the thermometer immersed in the water at the time this change took place fairly represented the temperature of the outside of the vessel, it would, without doubt, give also at the same time the true dew-point temperature. Every care was taken with the covering and supply of moisture to the wet-bulb thermometers; and as an additional precaution two sets of dry and wet-bulbs were used, the differences (8° to 9°) of which did not vary much from each other; but those which gave the widest readings, and consequently the lowest dew-point, were taken. Whether the vessels used were larger or smaller, of glass or of metal, or whether the moisture upon the outside was allowed to accumulate almost in drops, or the film of moisture so thin as to be scarcely weighable, the results were nearly the same; condensation ceased and evaporation commenced from the surface of the vessels at a time when the water inside the vessels was 3° to 4° below the temperature of the dew-point as obtained by calculation.

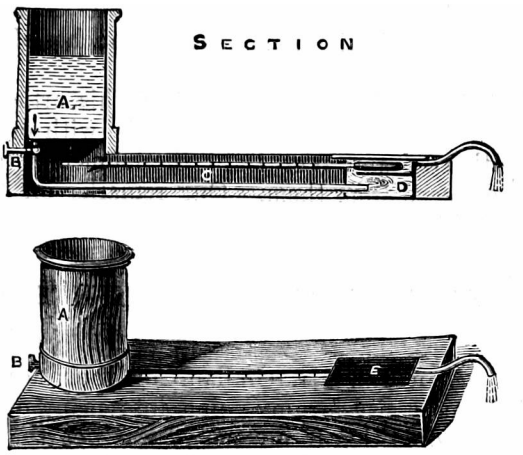
"It will be objected to these experiments that the thermometer placed in the water does not give the true temperature of the outer surface of the vessel from which the evaporation takes place; I fully admit the force of this objection; but does it not apply with equal force to both Daniell's and Regnault's hygrometers as at present used?

"There are, however, these differences in the method of operation; in one case the ether in which the thermometer is immersed is gradually cooling, whereas in my experiments the water is gradually getting warmer; again, in one case the eye is used to determine the time at which condensation begins; in my experiments a delicate balance is substituted for the eye; but I can see no reason in these differences why the results should vary so greatly. I have not compared the results obtained by the wet and dry-bulb hygrometer with those of Daniell's and Regnault's; this has been done by others, and found to agree very nearly; and I have therefore no reasons to conclude that the factors given in Table I. of Glaisher's Hygrometrical Tables are incorrect, as far as their agreement with Daniell's and Regnault's hygrometers are concerned.

"The experiments noticed in this paper have been made at night by artificial light, and therefore under some disadvantages; as the summer advances, I hope to repeat some of them by daylight, but, judging by former experience, do not expect it will alter the results. I cannot at present see my way out of the difficulty; and as the importance of a correct determination of the dew-point temperature cannot be overrated, I have taken an early opportunity of calling the attention of the Society to these experiments, with the hope that some one with more favourable opportunities than myself may be induced to take up the question."

We now come to the third and last phase of the inquiry, viz., to the consideration of the arrangement, designed by Mr. Dines, for ascertaining the dew-point by direct observation, and to which the maker, Mr. Casella, has given the name of "Sensitive Hygrometer." Sensitive,

indeed, is it beyond all comparison, and we are inclined to think as correct as it is sensitive. Let us explain its construction:—A is a



small zinc-lined wooden reservoir, which is to be supplied with water at a temperature a few degrees below the probable dew-point; B is a tap for regulating the flow of water from A, through C to the chamber D. The black horizontal line in this chamber represents a partition inserted to secure thorough mixture of, and equability of temperature in, the water, at the instant of its passing the bulb of the thermometer and being discharged by the outlet pipe. E is an extremely thin sheet of black glass, and it is assumed that the temperature of its upper and under surfaces (perhaps 0·015 inch apart) are nearly the same. The lower one is in contact with the water, and the latter, as will be seen, circulates around the thermometer bulb. Independent of actual trial, it seems difficult to believe that the temperature of the thermometer bulb and of the glass slab can differ more than 0°·2 or 0°·3, and this is confirmed by experiment. The mode of observation is thus explained in Mr. Casella's descriptive paper:—

"In using this instrument, water of a little lower temperature than the dew-point is required, well water being frequently found sufficiently cold for the purpose, or it may be cooled by adding a little ice. Fill the reservoir A with water, as above, then turn the tap B attached to the pipe C, that the water may flow through the small chamber D, and cool the thin black glass E, with which it is covered. Immediately the dew appears upon the surface of the glass, turn off the tap B, and observe the attached thermometer, which will then indicate the temperature of the dew-point. When this is known approximately, but greater accuracy is required, the tap B should be slightly turned off, so as to allow the water in D to pass very slowly as it approaches this temperature, so as to cool down gradually. By using a piece of wash-leather to dry the glass, successive deposits of dew may be rapidly obtained, when the dew-point will be found sometimes to vary considerably in a short time, the dew upon the glass appearing and disappearing several times in a minute.

"Should any obstruction occur in the pipe, it may be easily removed by blowing through the outlet."

To ourselves the special charm of this instrument is its extreme

sensibility, and the perfect control which the observer possesses over it. While it is essentially an apparatus for experimental research, its moderate price, and interesting indications, will commend it to all those who are interested in the more delicate branches of meteorological inquiry.

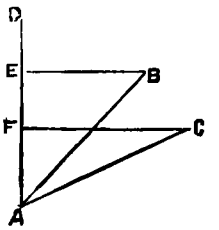
As we indicated at the commencement of this article, our special desire is to secure thorough comparison of this with other Dew-Point instruments. with Dry and Wet Bulb thermometers, and with the Dew-Point as deduced from them. Our remarks on these subjects must be deferred till our next number.

THE DECREASE OF RAINFALL WITH ELEVATION.

To the Editor of the Meteorological Magazine.

SIR,—Mr Strachan and Mr. Crallan, by their admirable letters, have obviated the necessity for my going into many of the details of the question. The objection to my theory was not that it was improbable, but impossible. Both these gentlemen have in different ways shown that decrease *may* be due to difference of angle, and, further, that the presumption of probability is against the objectors. Mr. Crallan has shown that if no part of the decrease in elevated gauges is due to the effect of change of angle, it is necessary to suppose, with Dr. Burder, a perfectly horizontal discharging surface devoid of thickness. Mr. Strachan has shown that it is necessary to suppose the rain to be deflected in a perfectly horizontal plane, and I may add *simultaneously* deflected, so that no gusts or irregularities in the wind can on any account be allowed.

Now, I submit that these suppositions are unlikely to be realized in nature. That a cloud possesses thickness and discharges rain from various heights is so obvious, that it is scarcely necessary to prove it by the experience of mountain walks in wet weather, especially as the clouds are not unfrequently obliging enough on the sea-coast to descend very nearly to the sea-level during a fall of rain, as happened here only a few days ago. Taking into consideration the thickness of a cloud, we may consider the rain near the ground to consist of two components—that discharged from a horizontal and that discharged from a vertical surface. The drops from the former will diverge as they approach the ground, *but preserve the same horizontal distance ;* and those from the former will approach each other, *but preserve the same vertical distance.* The former therefore should affect vertical and not horizontal gauges, but the latter should affect horizontal but not vertical gauges. The increase in vertical gauges should be due to the former, the decrease in horizontal gauges to the latter. If each cloud were as high as it is long, and discharged rain uniformly from all parts, these two tendencies in the mixed rain would just counteract one another, and therefore the density of the rain would be, as at first I supposed it to be, the same at different heights above the ground. This state of things is represented in fig. 1.



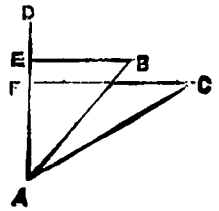
Let A B, A C, represent the amounts received in gauges the mouths of which are at right angles to the path of the rain, at the heights of 1 ft. and 10 ft. respectively. A B, A C, are therefore measures of the density of the rain at those heights.

Let D A B, D A C, be the angles which the path of the rain makes with the vertical at the same heights; E A, F A represent the amounts caught in horizontal gauges; E B, F C, the amounts caught in vertical gauges.

Then if A B = A C, the relation between these amounts is—

$$E A^2 + E B^2 = A F^2 + F C^2.$$

Certainly, I see nothing monstrous in such a supposition (which although exaggerating, as I doubtless did, its importance, I *avoided* calling an axiom), but it must be given up. The results of the experiments show that A C is always greater than A B. The real state of things is correctly represented in fig. 2, from which it is obvious



that the increase in vertical gauges is much greater than the decrease in horizontal gauges. I need hardly point out how this result confirms what Mr. Crallan has written, since it is highly probable that the length of a cloud is generally much greater than its height.

I am much obliged to Mr. Du Port for his explanations. By the "aperture which a gauge presents to falling rain," I mean the area of a section (made at right angles to the axis) of the cylinder which may be supposed to contain the rain. The area of this section would evidently decrease as the rain fell more obliquely.

I will add a few remarks, if you have space for them, on some of the theories started or favoured by your correspondents.

(1) Evaporation is a real cause of decrease with elevation, but it cannot be the principal cause for two reasons:—First, its effect was eliminated in the experiments at Calne, Strathfield Turgiss, and Rotherham, by conducting the water from the elevated gauges by means of pipes into bottles or other receivers on the ground. Next, it

would make the decrease immensely greater in summer than in winter, which is the exact reverse of the fact.

(2) Eddies.—No doubt a gauge, like any other obstacle, may cause eddies in the wind, but these eddies can only be formed behind or at one side of the obstacle, and cannot affect the rain which falls from in front and above. If the eddies spoken of are *in* the gauge, they would have the effect of placing the rain into the pipe, an effect which I have witnessed in the case of light snow.

But I think it very likely that the fall near the ground is, in certain situations, considerably increased by the wind rushing downwards in gusts and bringing the rain almost vertically into the mouth of the gauge. Here, however, the effect, though irregular, is still the result of a change of angle in the path of the rain.

(3) With regard to the wind blowing away rain-drops which alight on the rim, I cannot see why it is not as likely to blow them in as to blow them out.

(4) "Coalescence of spray."—I feel difficulty in believing in the existence of bodies not acted upon by gravitation, and as elevation differences are always small in heavy rain, when this theory would require them to be greatest, no more need perhaps be said.

Mr. Pennant's letter refers apparently to bodies falling *in vacuo*, while acted upon by some horizontal force, since he takes no account of the resistance of the air.

Lastly, let me remind your readers of some of the conclusions arrived at by the Rainfall Committee of the British Association in their report for 1867-8. The Committee includes some of the highest authorities on meteorological matters.

"The ratio of the fall on the ground to that at 25 ft. above it, bears a nearly constant relation to the angle of fall."

"The relation of these results to their cause, wind, is shewn," &c., "and the accordance would doubtless have been more complete if," &c.

My only comment on this is, that the force of the wind is not an exact measure of the decrease with elevation, because it is not an exact measure of the angular deflection, which depends also on the weight of the rain-drops.

It cannot then be denied that there is a relation between angle and decrease with elevation; and the step from this to my theory—that when rain is deflected by wind it is spread over a somewhat larger area than when it falls vertically, and therefore that less falls on the same horizontal surface in proportion as the angle with the vertical is increased—is not a long one.—I am, Sir, your obedient servant,

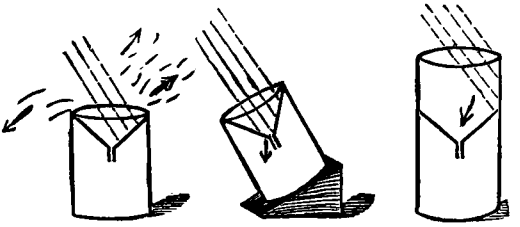
FENWICK W. STOW.

Hawsker, Sept. 26th, 1871.

To the Editor of the Meteorological Magazine.

SIR,—It appears to me that there is a *vera causa* for the decrease of rain-fall with elevation, which would go far to reconcile Mr. Stow's theory with Dr. Burder's physical law, that equal quantities of rain fall upon

equal horizontal surfaces, whether the drops arrive in an oblique or perpendicular direction. It is simply this :—the "surface" of a rain-gauge on which rain falls is not the same thing as the area of the orifice or funnel, it is not horizontal or nearly so; if it were, the loss from splash would be very great. But the sides of the funnel of all good gauges slope at an angle suitable for the reception of rain drops at their average inclination at the level of the ground, the drops, therefore, fall on an inclined plane, and glide from it into the receptacle prepared for them.



How is it, however, with the same, or a similar rain-gauge when exposed to showers at higher levels, while the rain falls, say, at an average angle of 45° ? In this case the drops strike upon the sides of the funnel at right angles, or nearly so, and that with some violence. Consequently, there must be a considerable amount of splash, and a corresponding loss of water. If a rain-gauge, then, at an elevation of 20 or 30 feet were to be inclined at an angle of 40° or 45° in the direction of an approaching shower, it would, probably, be found to receive more rain than one set horizontally. A like result would follow if the walls of a gauge, set in the ordinary manner, were carried up a sufficient height above the funnel to direct the drops downwards into the receptacle. Very possibly other causes may assist in producing the full results.—I am, Sir, &c.

J. PARK HARRISON.

Ewhurst, Surrey, Oct. 4, 1871.

To the Editor of the Meteorological Magazine.

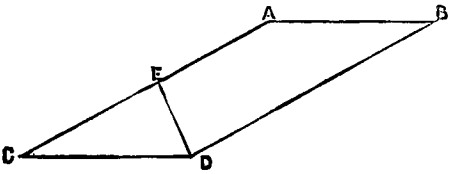
SIR,—I expect the majority of your readers who have carefully followed the correspondence on this subject must have come to the conclusion that Dr. Burder is right, and Mr. Stow wrong.

It has not, I think, been sufficiently borne in mind that hitherto rainfall has invariably been defined as the amount of rain falling on a horizontal surface; until this is clearly understood and admitted we can never agree.

Mr. Stow's pertinacity about vertical gauges is amusing. No one, I take it, would be so infatuated as to deny that the nearer at right angles the surface of a gauge meets the rain, the greater will be the amount collected. All we contend for is, that inasmuch as we cannot tilt up our fields to meet the rain at right angles, neither must we so tilt up our rain gauges.

Mr. Du Port's argument and diagram in your last number appear to me to prove the fallacy of Mr. Stow's conclusions as to vertical gauges beyond all question.

It is, I think, easily shown to what extent inclined gauges give erroneous results. During a shower falling at an angle of 60° with the vertical, let us imagine, at a short distance from the ground, a square, horizontal surface, whose side is A B.



The rain which falls on A B_2 would, if not interrupted, fall to the ground between the lines A C and B D, and cover C D_2. Now if we interpose an inclined surface, as E D, at right angles to the direction of the rain, we find that the whole of the rain due to C D_2 is intercepted by the rectangle E D, D C; and since E C D is an angle of 30°, E D is half D C, the rect. E D, D C is half C D_2, and therefore collects twice as much rain as is due to its *horizontal area*. The greater the obliquity of the shower, or in other words, the greater the disparity between E D and D C, the greater will be the excessive horizontal area monopolized, so to speak, by the rect. E D, D C, and the greater the *excess* of rain intercepted by it. If, therefore, we wish to measure the amount of rain due to C D_2, by a gauge inclined at right angles to the rain, we should take, say a 5 in. gauge, reduce the area of its receiving surface in the proportion of the rect. E D, D C : C D_2, and then the amount of rain collected, if measured in the proper glass for a 5 in. gauge, would tell us the true horizontal rainfall of C D_2. If the rain falls vertically, the rect. E D, D C becomes identical with C D_2, and at whatever angle it falls, the argument holds good. I should feel inclined, therefore, to state it as a general law, that—"The ratio of the amount of rain collected by a gauge whose receiving surface is kept at right angles to the showers, varies as the cosecant of the angle which the rain makes with the horizon." Of course we are all aware that at present we have not succeeded in constructing a gauge whose surface shall always meet the rain at right angles; all I wish to prove is, that such gauges are theoretically incorrect.

The fact that the rain-drops do not travel in straight lines seems to me to be just as inimical to Mr. Stow's theory as to any other, and I cordially concur with Dr. Burder that horizontal rainfall can only be fairly measured by horizontal gauges.—I am, Sir, yours, &c.,

REGINALD BUSHELL.

Hinderton, Neston, Cheshire. Oct. 4th.

P.S. Will you allow me to suggest, that if any limit is to be put to this discussion, you should declare beforehand what that limit is to be, and then adopt some means of *dividing* upon the question? It

would at least be interesting to know the opinion of the majority of your readers.

[We agree with Mr. Bushell that it will be most desirable to ascertain the general opinion upon the points at issue, but before a verdict there must be the summing up. Although conscious that we are not capable of discharging this duty so well as could be wished, we intend to attempt it in our next issue.—ED.]

THE SEPTEMBER RAINS.

THE fall of rain during the last eight days of September was so heavy as to claim full examination, we have therefore drawn up, from some of the many returns with which we are favoured, the following tables.

The rainfall of September, 1871, is noticeable for two features, one to a considerable extent dependent on the other: the first is, that the monthly total is at many stations greater than before recorded, and even in the longest registers very few equal to it are to be found. Let us take two illustrations: at Cobham the record goes back to 1825; the fall last month was 4·72; during the forty-six years there have only been two Septembers in which the fall has been greater, viz., 1826, = 5·17, and 1839 = 5·74. At Haughton Hall, Shifnal, the fall has been 5·27, and during thirty-seven years this has only once been equalled, viz., in 1866, when 5·40 fell. Of the stations quoted in our usual table the relative excess has been greatest at York (2·84 times the average), Orleton, Shifnal, and Selborne; at Manchester it only just exceeded the average, and in Scotland was far below it.

A few words as to the last eight days will appropriately close this brief notice.

Sept. 23.—A fall of about half-an-inch over the greater part of England, and of between 1 in. and 1½ in. in the South Eastern counties.

24th.—Very little rain, except in the Northern counties. The entry for Linton Park must surely belong to the 23rd.

25th.—About half-an-inch at most English stations; less in the North, and considerably more in the South Midland counties.

26th.—The average fall nearly the same as on 23rd and 25th, but rather heavier in the West and South-West of England than on previous days. A heavy but somewhat local fall in the South of Ireland.

27th.—The average fall rather heavier than on any of the preceding days, especially in Yorkshire and the North of England.

28th.—About one-tenth of an inch fell at most stations; more is reported from one or two isolated ones, but we believe that this is solely through failure to comply with Rule IX.*

29th.—At the majority of stations this was the day of much the largest fall; it reached an inch at most English stations, and 2 inches at several, although as it happens only two such cases are quoted in the following table.

* "The amount of rain measured at 9 a.m. on any day is to be set against the previous one; because the amount registered at 9 a.m. of say 17th contains the fall during 15 hours of the 16th and only 9 hours of the 17th."

30th.—For this day rain was recorded at nearly every station, but its amount was not considerable.

At Ballachulish, Argyle, no rain fell during the eight days.

Rainfall during the period September 23rd—30th, 1871.

		SEPTEMBER.								TOTALS.	
Div.	Station.	23rd	24th	25th	26th	27th	28th	29th	30th	Mnth	8 dys.
I.	Regent's Pk. (R. Bot. Soc.)	·96	...	·67	·32	·76	·11	1·16	·47	5·17	4·45
,,	Camden Square	·97	...	·68	·34	·75	·04	1·22	·44	5·28	4·44
,,	Hampstead (Squire's Mt.)	·73	·02	·63	·30	·59	·20	1·08	·44	4·86	3·99
,,	Harrow(Northwick House)	·46	·01	·64	·39	·42	·06	1·07	·07	4·20	3·12
,,	Winchmore Hill	·81	...	·79	·31	·58	·08	1·07	·46	4·93	4·10
II.	Guildford (Guildown)	1·00	...	·38	·44	·71	·02	1·05	·81	5·53	4·41
,,	Dorking (Denbies)	1·76	·03	·45	·43	1·24	·12	1·02	·76	6·41	5.81
,,	Cobham (Pyports)	·95	·01	·53	·29	·40	·01	1·16	·63	4·72	3·98
,,	Croydon (Tanfield Lodge)	1·63	·03	·26	·20	·80	·05	·90	·46	5·01	4·33
,,	Balham	1·00	...	·63	·22	·96	·02	·83	·53	...	4·19
,,	Maidstone(Linton Park)...	·13	1·38	·04	·47	·33	·79	·23	·15	4·44	3·52
,,	Riverhead, Sevenoaks	·72	...	·49	·40	·75	·06	1·00	·39	4·71	3·81
,,	Margate (Acol).....	·90	...	·68	·13	·24	·07	·42	·17	3·28	2·61
,,	Chiselhurst	·87	·01	·62	·22	·72	·03	1·23	·30	4·77	4·00
,,	Beckenham (Parkside) ...	1·65	·01	·63	·24	·53	·03	·97	·46	5·35	4·52
,,	,, (Fox Grove) ..	1·62	·01	·63	·22	·58	·03	·91	·43	5·19	4·43
,,	Eltham Green	1·47	·01	·67	·20	·60	·03	1·21	·50	5·57	4·69
,,	Worthing.....	·91	...	·34	·21	·16	·05	·60	·30	3·07	2·57
,,	Pevensey	·94	...	·37	·34	·30	...	·28	·13	3·13	2·36
,,	Hastings (High Wickham)	1·31	..	·62	·58	·53	...	·36	·18	4·50	3·58
,,	Osborne.....	1·28	·32	·26	·21	·06	·70	·48	·06	...	3·37
,,	Lymington	·81	...	·58	·66	·18	·09	1·07	·48	5·82	3·87
,,	Selborne	·88	...	·58	·58	·66	·06	·68	1·06	6·44	4·50
,,	Strathfield Turgiss	·42	...	·64	·61	·19	·06	·70	·41	4·20	3·03
,,	Wantage	·82	...	1·17	·56	·32	·14	1·50	·20	...	4·71
III.	Hitchin	·72	·15	·47	·30	·27	·15	1·38	·26	4·40	3·70
,,	Great Missenden	·60	...	1·10	·53	·50	·55	·75	...	...	...
,,	Banbury	·70	·03	·54	·66	·42	·09	1·60	·16	5·41	4·20
IV.	Ramsay (Wix).....	·44	·02	·54	·42	·33	·18	1·31	·26	...	3·50
,,	Bury St. Edmds. (Culford)	·45	·13	·21	·22	·35	·11	1·65	·43	4·40	3·55
,,	Diss	·34	·07	·14	·25	·33	·11	1·60	·18	3·67	3·02
,,	Brandon (West Tofts).....	·43	·08	·12	·24	·60	·15	1·56	·29	4·32	3·47
,,	Norwich (Thorpe)	·47	·17	·05	·19	·89	·12	1·99	·26	5·07	4·14
,,	Swaffham	·52	·16	·04	·24	·27	·19	1·34	·35	3·99	3·11
,,	Hillington	·48	·20	...	·20	·24	·20	1·33	·33	3·64	2·98
V.	Chippenham	·62	...	·89	·67	·38	·07	1·04	·29	5·93	3·96
,,	Bridport	·25	...	·32	·70	·41	·16	·91	·66	4·50	3·41
,,	Shaftesbury	·35	...	·57	·79	·41	·10	·69	·21	4·31	3·10
,,	Dartmoor Prison	·89	·03	·84	·70	1·94	·28	1·00	·86	9·65	6·54
,,	Tavistock (KilworthyHill)	·31	...	·29	1·04	·46	·11	·74	·62	5·73	3·57
,,	Okehampton.....	·62	·01	·82	·54	·53	·16	1·27	·50	6·51	4·45
,,	Holsworthy (Court Barn)..	·31	..	...	·33	·78	·67	·11	1·50	5·26	3·70
,,	Barnstaple	·39	...	·30	·33	·27	·81	·95	·24	4·37	2·61
,,	Bodmin.....	·36	·05	·59	·98	·70	·10	1·28	·67	8·52	4·73
,,	Crewkerne (Bincombe) ...	·60	...	·46	·66	1·08	·10	1·24	·38	5·80	4·52
,,	Taunton (The Castle).....	·58	...	·72	·43	·56	·08	·75	·17	4·97	3·29
VI.	Cirencester (The Firs).....	·56	...	·55	·81	·97	·11	·98	·20	5·60	4·18
,,	,, (Further Barton)	·63	...	·65	·95	·70	·16	1·27	·27	6·70	4·63
,,	Ross (Archenfield)	·38	...	·70	·66	·59	·11	1·66	·10	6·62	4·20

		SEPTEMBER.								TOTALS.	
Div.	Station.	23rd	24th	25th	26th	27th	28th	29th	30th	Mnth	8 dys.
VI.	Orleton	·46	·05	·28	·42	1·16	·07	2·02	·28	7·25	4·73
,,	Shifnal	·51	·06	·04	·60	·85	·02	1·36	·13	5·27	3·57
,,	Shrewsbury (Monkmoor)	·24	...	...	·53	·83	·01	1·43	·07	4·42	3·11
,,	Henley-in-Arden	·37	·38	·37	·73	·55	·06	1·54	·17	5·75	4·17
,,	Bickenhill Vicarge	·61	·07	·20	·70	·52	·04	1.54	·37	5·64	4·05
VII.	Wigston	...	·15	·33	...	·50	·60	1·45	·23	4·50	3·26
,,	Boston	·39	·15	...	·19	·63	·07	1·03	·27	3·79	2·73
,,	Killingholme	·39	·57	·02	·26	·73	·02	1·23	·23	6·12	3·45
,,	Derby	·58	·22	·01	·38	·74	·01	1·25	·20	4·92	3·39
VIII.	Neston (Hinderton)	...	·15	...	·23	1·09	·01	1·16	·07	3·95	2·71
,,	Manchester	·05	·18	...	...	1·20	·04	·47	·13	3·82	2·07
IX.	Tickhill	·25	·16	...	·16	·76	·05	1·37	·20	5·23	2·95
,,	York	·03	·62	...	·06	1·90	·01	·65	·23	6·60	3·50
,,	Arncliffe	·35	·32	...	·06	1·30	·04	·32	·55	6·04	2·94
X.	Darlington (Gainford)	·54	·81	...	·14	1·63	...	..	...	...	...
,,	N. Shields	·31	·72	...	·09	1·08	·03	·27	·22	4·01	2·72
,,	Grasmere (High Close)	·13	·29	...	·03	·15	...	·08	·71	3·73	1·39
,,	Seathwaite	·62	·18	·28	...	·34	...	1·08	...	5·53	2·50
XI.	Haverfordwest	·08	...	·15	...	1·00	·06	2·54	·74	7·48	4·57
,,	Cefnfaes	·05	·10	1·00	...	...	·40	1·10	·40	4·15	3·05
,,	Wrexham (Trevalyn Hall)	·04	·09	...	·18	1·64	·03	1·43	·13	4·80	3·45
,,	Llandudno	·08	·89	...	·33	·25	...	·84	·07	3·59	2·46
,,	Beddgelert (Pen-y-gwyrd)	·25	·25	·50	·25	...	·25	·25	·25	5·00	2·00
,,	Carnarvon (Plas Brereton)	...	·44	...	·10	·17	·02	·57	·30	3·14	1·60
XII.	Dumfries (March Hill)	·27	·56	...	...	·07	...	...	·33	2·63	1·23
,,	Hawick (Silverbut Hall)	·12	·18	·02	·03	·29	·02	·04	·09	1·95	·79
XIV.	Glasgow (Cessnock Park)	·07	...	...	...	·08	...	·06	·12	1·52	·33
,,	Ayr (Auchendrane)	·13	...	...	...	·04	...	·03	·06	2·08	·26
,,	Patna (Hole House)	·12	...	...	...	·05	...	...	·24	2·45	·41
XV.	Castle Toward	·39	·11	·01	...	...	...	...	...	1·61	·51
,,	Ballachulish	..	...	...	...	...	...	...	...	2·67	...
XVI.	Leven (Nookton)	·03	·03	·02	...	·21	...	·03	...	1·44	·32
,,	Deanston	·02	·01	...	...	·04	·01	·01	·28	1·90	·37
XVII.	Aberdeen	·40	·03	·01	...	·08	·15	·01	·06	2·17	·74
,,	Ballater	·05	...	...	...	·40	·33	...	·35	3·46	1·13
XX.	Cork (Queen's College)	...	...	...	1·89	·31	...	...	·46	4·59	2·66
,,	Fermoy (Glenville)	..	...	...	1·57	·43	...	...	·52	4·77	2·52
,,	Killaloe	..	..	·01	·30	...	...	...	·50	2·02	·81
XXI.	Portarlington	·02	·01	...	...	·50	·03	...	·02	1·60	·58
,,	Monkstown	..	·05	...	1·07	·24	·01	·03	·13	3·41	1·53
XXII.	Galway	·13	·03	...	...	·27	...	·12	·39	2·18	·94
,,	Ballinasloe	...	..	...	·61	·01	...	...	·41	1·66	1·03
,,	Doo Castle	...	·01	·10	·16	·05	...	·40	·30	2·21	1·02
,,	Waringstown	·52	·30	..	·09	·15	·08	·30	·17	3·36	1·61
,,	Leckpatrick	·30	·03	...	...	·03	·02	·02	·30	2·39	·70

SOLAR THERMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—I take the opportunity afforded by the recent very hot weather to send you some account of my Solar Thermometers. The maxima temperatures in sun, given in the table, are from a thermometer, "*in vacuo*," having the bulb and part of the stem blackened. The non-exhausted thermometer in the next column is of similar construction,

except that the air is left within the jacket, there being no occasion for the doubtful process of exhaustion. Thermometers constructed on this principle would, I think, from what I can judge, be far more reliable in every respect than the vacuum instruments.

The bright-bulb thermometer in the next column has an unblackened mercury bulb, enclosed in a non-exhausted jacket, and should give us an idea of the actual temperature within the jacket, without the influence of the receiving surface of the bulb when blackened. See *Meteorological Magazine*, Vol. III., page 18, on the results of a bright-bulb thermometer in the sun, compared with one in the shade.

I have for some little time been trying a solar thermometer, constructed from an idea of Mr. Pastorelli's, precisely similar to the non-exhausted one, only that the air is admitted at both ends of the instrument through two small orifices. The general result is readings lower by a few degrees than the thermometer with air within the jacket; but the wind appears to exert very little influence indeed, and the difference on the whole is remarkably uniform, as will be seen from the annexed simultaneous readings during July.

Mr. Stow has however, I am glad to find, adopted the excellent plan of sending round a Solar thermometer, as a standard of comparison, to all his observers, to test their instruments by, so this is, indeed, another great step towards comparing the sun temperatures of the different localities, and I for one at any rate shall be most anxious to do all in my power to forward this object. I only hope that we shall soon hear that something like a systematic comparison of the different stations has been begun, for it is now considerably more than a year since we had a line from Mr. Stow, in the Magazine, on the results of the different observations sent in.—Yours, very truly,

FRANCIS NUNES.

Heathfield Lodge, Chislehurst, Kent.
August 28th, 1871.

Thermometers at 5 ft.; Max. in Sun.

Days.	Ther. with air at both ends.	Non-exhausted.	Days.	Ther. with air at both ends.	Non-exhausted.
	deg.	deg.		deg.	deg.
July 1.....	119·0	119·2	July 17 ...	119·2	119·2
,, 2.....	88·7	89·5	,, 18.....	116·3	116.2
,, 3.....	115·2	115·7	,, 19.....	123·0	123·8
,, 4.....	108·4	109·3	,, 20.....	108·0	109·3
,, 5.....	114·0	114·0	,, 21	115·0	116·0
,, 6.....	112·7	112·0	,, 22.. ...	109·8	111·0
,, 7 ...	118·8	119·0	,, 23.....	117·7	118·6
,, 8.....	115·7	116·3	,, 24	110·0	110·0
,, 9	116·8	119·3	,, 25.....	114·3	114·8
,, 10.....	118·5	120·3	,, 26.....	116·0	116·5
,, 11.. ...	108·7	109·0	,, 27.....	119·3	120·0
,, 12.....	110·2	111·0	,, 28.....	106·5	107·3
,, 13.....	102·7	103·8	,, 29.....	117·7	118·0
,, 14.	116·7	116·5	,, 30	108·3	109·4
,, 15.....	120·7	122·2	,, 31... ..	113·8	114·3
,, 16	122·7	127·0			

Thermometers at 4 ft.					On Grass.
Shade.		Sun.			
Day.	Max.	Vac. Black Bulb Max.	Non-exhausted Blk.Bulb Max.	Non-exhausted Bright Bulb Max.	Vac. Black Bulb Max.
	deg.	deg.	deg.	deg.	deg.
1...	78·1	136·3	118·3	86·8	147·0
2...	83·8	142·0	124·7	93·8	150·0
3...	83·7	136·8	121·0	92·0	150·2
4...	72·1	128·5	111·3	83·0	139·3
5...	77·3	134·5	117·2	87·7	148·0
6...	80·3	131·2	118·5	91·7	145·5
7...	81·8	136·5	121·5	93·8	148·0
8...	81·0	133·5	118·5	93·0	147·0
9...	85·8	137·8	123·3	96·7	151·5
10...	89·4	136·5	123·2	97·3	148·2
11...	91·7	139·0	127·7	101·2	150·7
12...	91·0	138·4	126·0	100·2	146·5
13...	91·1	138·3	125·5	101·5	147·0
14...	84·6	134·5	121·3	96·3	145·0
15...	81·4	131·3	117·5	93·0	143·0
16...	83·0	128·8	116·8	92·5	140·5
17...	86·3	137·0	123·0	95·5	149·2

REVIEW.

Quarterly Weather Report of the Meteorological Office, with Pressure and Temperature Tables for the Year 1870. Vol. II., Part I., January to March, 1870. Quarto, 55pp., and 18 Plates.

We consider this number worthy on the whole of special praise, but to some parts we strongly object.

Foremost among the improvements is that indicated by the following paragraph :—

"In this volume the Committee are glad to be able to supply some information which might with advantage have been given in Vol. I. In the table for the five-day means, the height of the thermograph bulbs at each of the observatories is stated, but as this information gives no idea of the exposure of the screens, it has been resolved by the Committee to give views of each of the screens, with such explanations as may be required to give as correct an idea as possible of the value of the thermometrical and anemometrical observations published by them, and the local influences which may exert an effect in each case."

Regretting, as we always have regretted, and shall regret, that the bad precedent of Kew was taken as a type for placing the instruments, (*e.g.*, thermometers close ,to stone walls, and anemometers on lofty buildings,) we think that the Committee could hardly have improved upon the engravings and information they have supplied.

The "Quarterly Journal" is even more interesting than usual.

The Appendix contains two useful sets of tables. The first gives the mean monthly pressure at fourteen of the telegraphic reporting stations, between 1866 and 1870, and is (although it does not say so)

a modified continuation of a discussion published in the twelfth number of Admiral FitzRoy's Meteorological Papers. The results are satisfactorily accordant, especially considering that Admiral FitzRoy's values were all deduced from less than three years' observations, and some of them from less than a twelvemonth, while those now before us are based on five identical and consecutive years. Under these circumstances our readers will probably agree with us that the following figures are very satisfactory :—

Mean Pressure at Sea Level at the undermentioned Stations.

Period of Observation.	First Table. Various, between 1860 & 1863.	Second Table. Jan., 1866, to Dec., 1870.	Difference.
	in.	in.	in.
Nairn	29·775	29·811	+·036
Aberdeen	·800	·823	+·023
Leith	·834	·854	+·020
Scarborough	·885	·902	+·017
Yarmouth	·940	·941	+·001
Ardrossan	·820	·872	+·052
Holyhead	·913	·896	—·017
Valentia	·918	·915	—·003
Penzance	·966	·979	+·013
Plymouth	·962	·982	+·020
Portsmouth	·952	·968	+·016
London	29·958	29·961	+·003

The Appendix also contains a discussion by Mr. Gaster, of the returns of rainfall at the same stations during the same period. The telegraph stations being generally in the business centre of the various towns, there is naturally more difficulty in getting a suitable position for the rain gauges than for any other instruments. The Notes as to the position, or rather positions, for there were several removals, of the gauges go far towards increasing the value of the returns. The abstracts are drawn up in a very complete and useful form, which may often be copied with advantage.

One feature in the results is worthy of special notice, as exactly the reverse of what has been elsewhere obtained—viz., that at nearly all the stations, irrespective of position and of total fall, the winter months have the largest per-centages. We presume that this is an accidental circumstance, occurring through the averages being based on the short period of five years.

Another feature worth notice is the rainfall at Yarmouth. It is rather a singular fact that Mr. Symons has never published any returns from that town, but we have an impression that in some of those eccentrically compiled tables of mean annual rainfall upon whose failings Mr. Symons comments with such evident gusto, we have seen Yarmouth put down as 28 or 30 inches, and in the table now before us it is 29·81 in. Does this seemingly concurrent testimony indicate that the fall at Yarmouth really is nearly 30 inches? Because, if so,

the fact is very strange that with a level country, and a remarkably uniform mean rainfall of 23 or 24 inches, we seem to have an increase of 25 per cent. on reaching the coast at Yarmouth. Mr. Scott evidently mistrusts his Yarmouth observer's care in daily measurements, but if the observer neglected to empty his gauge regularly the effect would rather be to lessen than to increase his recorded total. Besides which, as we have already pointed out, the evidence is twofold.

And now we have to conclnde with a word of deep regret: none could have spoken in higher terms of the reproduced tracings of the self-recording instruments, as given in the first volume, than we did.* We can do so no longer. In the present number the scales are altered, and the Committee seem to be bent on a process of condensation which shows marvellous skill, but is, to our mind, as useless as writing the Ten Commandments in the space of a shilling, while it is worse than that amusement, because it will prevent many persons from examining the traces. Our editorial eyes may be somewhat dimmer than of yore, but we decline to strain them over the curves as now supplied.

THERMOMETER STAND EXPERIMENTS.

To the Editor of the Meteorological Magazine.

SIR,—In common, I believe, with many of your readers, I have been for some time looking anxiously for the promised abstract of the results of Mr. Griffith's experiments with thermometer stands at Strathfield Turgiss.

It seems a pity that the result of such a careful and elaborate series of comparative observations should not be made public as soon as possible. All admit the unsatisfactoriness of the present state of things, but, probably, few who have not given special attention to the subject, are aware of the extent to which the accuracy of our observations is affected by it, and how often readings which purport to be exceptional or extraordinary would be found to be simply the result of some peculiarity in the position of the thermometers, &c.

From some little experiments which I made on my own account during the hot weather of last August, I found that two thermometers placed only a few inches above the thermometers with which I usually take observations, but hung so as to rest against the vertical board of the thermometer stand instead of with their bulbs about three inches below it, as directed by Mr. Glaisher, generally registered a maximum temperature from 4° to 5° higher than the latter; this discrepancy being of course due to the fact that the lower series of thermometers were at all times exposed to a free current of air from all directions, while those hung against the board were, to a great extent, sheltered, especially from the southerly breezes which generally prevail during a period of great heat—the stand of course facing towards a northerly point during the hottest hours of the day.

It is not my present purpose to express any opinion as to the relative

* *Met. Mag.*, Vol. 5, p. 142.

advantages of the two methods of placing the thermometers, though, I think, common sense would suggest that thermometers intended to register the temperature of the air, should be placed so as to be freely exposed to the influence of the air, but merely to point out the great differences of reading that may result from what to many persons would appear but a trifling difference of position. For, if so large a difference as 5° may result from the cause I have mentioned, we can readily understand how still greater discrepancies might often be registered in the stands used by amateurs, in many of which the protection against the direct influence of solar radiation is very inadequate. There can be little doubt that many of the extraordinary high shade temperatures reported in the daily papers during our summer heats are to be put down to causes of this nature, and not to any peculiarity of climate.

This letter has run to a greater length than I intended, but I am sure that you, Mr. Editor, will agree with me that the subject is one which demands the attention of all who value accuracy of observation.

In the meantime—*i.e.*, until some uniform pattern of thermometer-stand can be agreed upon—the only remedy is that which you justly insist upon in a recent number of your magazine, viz., that every observer sending reports of exceptional temperatures should send therewith a full description of the thermometer-stand used by him as well as of his thermometers. Having said this I must not conclude without adding that my own stand is modelled as closely as possible after that known as the "Glaisher," or "Greenwich," being that in use by Mr. Glaisher at the Greenwich Observatory. It is of the dimensions recommended by Mr. Glaisher for ordinary observations, constructed of one inch deal throughout, and made to revolve on its post, so that the face of the stand carrying the instruments may always be kept turned from the sun. The thermometers which I use for regular observations are by Burrows, of Malvern, and have all been verified at Kew Observatory. The index error is, in most cases, so trifling (seldom exceeding 0·1°) that I have not thought it necessary in practice to apply the corrections supplied with the instruments, but as a guarantee of accuracy the practice adopted by Messrs. Burrows of supplying corrections with all their instruments cannot be too highly commended. Some of the thermometers used in the comparative observations to which I have alluded were unverified instruments purchased of Negretti and Zambra, but before making the observations I carefully compared these with my verified thermometers.—I remain, Sir, yours truly,

GEORGE T. RYVES.

Buildwas Parsonage, Ironbridge, Shropshire, Oct. 6, 1871.

[Mr. Ryves quite expresses the general opinion, as well as our own, respecting the delay in reporting on these experiments. Irrespective of the magnitude of the work, the completion of the preliminary portion of it has been grievously delayed. It is promised in a fortnight, and our readers may rely on promptitude when it rests with ourselves, so that we hope it will be completed and published long before Christmas.—ED.]

SEPTEMBER, 1871.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Town	5·28	+ 3·02	1·22	29	13	81·0	1	38·1	23	0	0
II.		Maidstone (Linton Park)	4·44	+ 2·22	1·38	24	16	81·0	2	40·0	23	...	...
,,		Selborne (The Wakes)	6·44	+ 4·00	1·06	30	11	76·3	2	36·8	25	0	0
III.		Hitchen	4·40	+ 2·54	1·38	29	13	73·0	1	39·0	20§	0	...
,,		Banbury	5·41	+ 3·04	1·60	29	13	75·0	1	32·5	23	0	...
IV.		Bury St. Edmunds (Culford)	4·40	+ 2·79	1·65	29	13	80·0	1	36·0	23	0	1
V.		Bridport	4·50	+ 2·18	·91	29	13	74·0	2	34·0	23	...	0
,,		Barnstaple	4·37	+ ·61	·95	29	14	74·0	1	39·0	23	..	...
,,		Bodmin	8·52	+ 4·85	1·53	9	16	71·0	2	44·0	22	0	0
VI.		Cirencester	6·70	+ 3·84	1·27	29	12	...	...	...	...	...	...
,,		Shiffnal (Haughton Hall)	5·27	+ 3·32	1·36	29	14	71·0	1	40·0	22	0	...
,,		Tenbury (Orleton)	7·25	+ 4·57	2·02	29	13	73·0	11	32·0	23	1	1
VII.		Leicester (Wigston)	4·50	+ 2·29	1·45	29	14	81·0	1	35·0	20‖	...	...
,,		Boston	3·79	+ 2·22	1·03	29	14	77·8	1	39·2	29	0	1
,,		Grimsby (Killingholme)	6·12	..	1·28	8	18	73·0	1	36·0	20	...	...
,,		Derby	4·92	+ 2·58	1·25	29	14	73·0	1	38·0	23	0	...
VIII.		Manchester	3·82	+ ·13	1·20	27	16	76·2	1	35·0	25¶	...	...
IX.		York	6·60	+ 4·27	1·90	27	13	74·0	1	39·0	25	...	...
,,		Skipton (Arncliffe)	6·04	+ 1·08	1·30	27	15	76·0	1	30·0	29	3	...
X.		North Shields	4·01	+ 2·31	1·08	27	18	71·0	1	38·0	29	0	0
,,		Borrowdale (Seathwaite)	5·53	— 7·68	1·37	3	11	...	...	...	...	...	...
XI.	WALES.	Cardiff (Town Hall)	...	...	...	...	...	...	...	...	...	...	...
,,		Haverfordwest	7·48	+ 3·77	2·54	29	15	71·5	1, 2†	33·0	22	0	3
,,		Rhayader (Cefnfaes)	4·15	+ ·31	1·10	29	11	68·0	...	34·0	...	..	...
,,		Llandudno	3·59	+ 1·25	·89	24	15	72·3	1	39·7	20	0	...
XII.	SCOTLAND.	Dumfries	2·63	— ·10	·60	9	11	70·5	11	32·0	29	0	...
,,		Hawick (Silverbut Hall)	1·95	...	·29	27	14	...	...	..		...	...
XIV.		Ayr (Auchendrane House)	2·08	— 1·65	·55	20	16	73·0	12	29·0	30	3	3
XV.		Castle Toward	1·61	— 3·01	·39	23	11	...	...	...	...	...	...
XVI.		Leven (Nookton)	1·44	— 1·04	·42	19	11	68·0	1	35·0	30	0	6
,,		Stirling (Deanston)	1·90	— 1·25	·38	19	14	68·0	11‡	27·5	30	2	4
,,		Logierait	1·19	...	·50	19	12	...	...	...	...	...	...
XVII.		Ballater	3·46	...	·70	21	10	70·0	15	27·0	30	3	..
,,		Aberdeen	2·17	...	·40	23	15	66·8	3	36·2	27	0	7
XVIII		Inverness (Culloden)	2·90	...	·72	23	9	67·8	1	36·1	30	4	0
,,		Portree	4·81	— 5·95	·80	21	18	...	...	..	...	...	...
,,		Loch Broom	1·76	...	·68	20	11	...	...	...	...	...	...
XIX.		Helmsdale	3·64	...	1·44	20	17	...	...	..	...	...	...
,,		Sandwick	6·99	— 3·33	1·33	21	16	65·7	1	31·5	30	0	1
XX.	IRELAND.	Cork	4·59	...	1·89	26	8	...	...	...	...	...	...
,,		Waterford	...	...	...	...	...	...	...	...	...	.	...
,,		Killaloe	2·02	— 2·14	·62	9	11	72·0	2	30·0	24	2	...
XXI.		Portarlington	1·60	— 1·68	·50	27	16	67·0	3	32·5	23	0	0
,,		Monkstown	3·41	+ 1·42	1·07	26	12	...	...	...	...	...	...
XXII.		Galway	2·18	...	·55	3	11	73·0	7	35·0	23	0	...
,,		Bunninadden (Doo Castle)	2·21	...	·40	29	15	63·0	5,6	25·0	29	0	4
XXIII		Bawnboy (Owendoon)	...	...	.	...	...	...	...	...	..	...	...
,,		Waringstown	3·36	...	1·01	8	12	75·0	11	30·0	24	3	5
,,		Strabane (Leckpatrick)	2·39	..	·38	7	18	69·0	3, 11	...	...	...	...

† And 11. ‡ And 14. § And 24. ‖ And 22. ¶ And 26, 29.

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

METEOROLOGICAL NOTES ON SEPTEMBER.

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

ENGLAND.

CAMDEN TOWN.—T on 2nd, L on 6th in the evening.

LINTON PARK.—A fine month, for although 3·52 in. of R fell during the last 8 days, it was all wanted, the rest of the month, as well as August, having been dry. T on 2nd, with sultry weather. Cool morning, approaching a frost, on 23rd. No very high winds; bar. steady the first 20 days, afterwards very low and fluctuating with frequent change of wind.

SELBORNE.—T and L at 11 a.m. on 6th; and at 7 p.m. on 10th, with high S. winds and heavy R. Wind early in the month S.W., about the middle N. and N.E., later very variable. The R of the last 8 days 4·50 in., caused the roads to be flooded on the 1st of October. On 30th, at 11.30 p.m., the L struck the ground on the terrace of Newton Valence Parsonage (one mile from Selborne), making a hole and scattering the gravel in all directions.

HITCHIN.—Wettest September since our record began (in 1849); lowest bar. since 1849; and lowest max. temperature since 1860, on 24th and 29th.

BANBURY.—T and L on 6th.

CULFORD.—T on 2nd, 6th, 27th and 29th. Heavy fall of R on 29th, amounting to 1·65 in., and R more or less every day from the 23rd to the end, on the morning of that day (23rd), the grass was crisp with frost.

BRIDPORT.—Cold and (at the latter part) stormy month, 3·16 in. of R fell during the 6 last days; gale from S.E. to S.W. on 10th; distant T and L on 11th and 16th; very heavy gale from S.E. to S.W. on 27th. Bar. fell ½ an in. between 9 a.m. on 26th and 10 p.m. on 27th, and rose ½ an inch by 9 a.m. on 28th. ·91 of R fell on 29th.

BODMIN.—This month has been remarkable for its abundant rainfall, and for the variable heavy gales from the 24th. Average bar. 29.81, average temperature 57°·2, being 1°·9 below the average for the month.

SHIFNAL.—Up to the 17th the month was warm (averaging 65°·0), from which day cold set in to the close, and the max. temperature only once (20th) reached 60°. The min. never fell to the freezing point. Up to the 23rd, with the exception of one day (6th, when 1·01 in. fell), there was but little R fell, but from the 23rd to the end it fell daily; on the 29th, 1·36 fell, making the total for the month 5·27, nearly three times the average. The winds were westerly to the 9th, when they changed to some point of E. till the end. The harvest, though delayed by the R, was all got in without injury by the end of the month; the swedes, and other green crops, abundant.

ORLETON.—Generally warm with much cloud, and R till 11th; great fall of R (1·72) on 6th; from 9th to 23rd no measurable R, but generally cloudy and cold. From the 23rd to the end very rainy; great falls of rain on 27th and 29th, (1·16 and 2·02 respectively), which caused the rivers to be flooded. Distant T on 6th and 9th, and L on 6th, 9th, and 30th. Temperature nearly 2°·5 below the average.

WIGSTON.—Easterly winds have prevailed during the latter part of the month, and the temperature much below the mean for the time of the year, which has checked the growth of turnips, mangolds, &c. The harvest was completed before the wet stormy weather of the last week of the month; the max. temperature of the 29th was only 49°·0.

BOSTON.—L seen on 2nd and 6th, T S on 27th, heavy gales on the coast on 26th, 27th, and especially on 29th, with loss of many vessels.

GRIMSBY, KILLINGHOLME.—The beginning and the end of the month very wet. Much sheet L on night of 6th. The great bulk of the harvest secured by the middle of the month.

YORK.—Slight auroræ between 9 and 10 p.m. on 4th and 15th, and at 8.30 p.m. on 7th; T S at 11 p.m. on 6th, with heavy fall of R.

NORTH SHIELDS.—Auroræ on 1st and 9th; T S on 6th.
SEATHWAITE.—T S on 29th.

WALES.

HAVERFORDWEST.—The month commenced fine and warm, a continuance of the weather of the previous month; some R fell at night, considerable quantities fell during the first 9 days, thence to the 20th the weather was delightful, a cold gloomy period then set in, the nights wintry cold, wind constantlv E. or N.E., and the month terminated with stormy weather and excess of R, 2·54 in. having fallen on the 29th, and the total for the month twice the average for this month.

CEFNFAES.—The month mostly dry and cold. Harvest of grain well secured, with generally average crops. Prevailing winds N.E. and N.W.

LLANDUDNO.—At 6.30 on 1st, a most beautiful setting-sun rainbow, the sky a splendid pink tint and colors of rainbow very brilliant. At 8.30 p.m., on 2nd, a splendid meteor, commencing like a straight line of magnesium light, and then breaking into balls of blue and crimson.

SCOTLAND.

DUMFRIES.—The first 9 days stormy, fine to 23rd, variable to the close. The harvest was concluded under the most favourable circumstances by the 23rd. Wheat nearly an average, oats above it, barley excellent. Potatoes a prolific crop, one-fourth to one-half diseased; turnips a splendid crop; pastures very verdant, and the country fresh and beautiful. R fell above, and temperature below, the average of the month.

SILVERBUT HALL, HAWICK.—A very mild month, slight frost on 28th and 29th. Potato disease very prevalent in this district, harvest operations about concluded, and the most of the grain crops gathered into the stackyard.

AUCHENDRANE.—This month nearly all the weather-tests are below our local September means, in the preceding months these tests were nearly all above our August means. During the wet and warm August, with a great bar. range and a very weak evaporation, followed by a cold and dry September with a small bar. range and rather full evaporation, the potato crops have suffered severely. The winds in August were Polar 6, Equatorial 18, Calms 7. This month the winds are Polar 11, Equatorial 7, Calms 12, with L and a great fluctuation of bar. and ther. on 30th. Rivers very low throughout the month, but grain crops well harvested. Dews on 13 nights and no T S.

CASTLE TOWARD.—This has been a very favorable month for the harvest, it being all cut and stacked in good order. The potato crop is very much diseased, in fact, more than half the crop being bad. Turnip crops look well, and pastures still good. We have had some light frosts in the morning, but nothing to injure the bedding plants, gardens looking quite gay and fruit stored fast.

DEANSTON.—From 1st to 9th unsettled, showery and windy; then till 18th, dry, bright and mild; from 18th to the end of the month, dull, rainy, windy, and cold; very sharp frosts on mornings of 25th and 30th. Dahlias and tender plants spoiled.

LOGIERAIT.—A very fine month and harvesting well completed. Potato disease universal; decided frosty nights on 27th and 29th.

BALLATER.—The early part of month dry and fine, latter part cold and wet, unfavorable for harvesting, and much of the crops in this district still unsecured. S on the hills on morning of 29th; severe frost on 30th, blackening potato stems, but no disease reported.

ABERDEEN.—The early part of the month (1st to 16th) very fine, warm and dry, the latter part dull, wet, and cold. Temp. in sun, *in vacuo*, on 4th, 128°·2, on grass on 26th, 24°·7.

PORTREE.—With the exception of the first eight days and from 19th to 22nd, which was wet and rather stormy, the weather was very fine during the month, and very favourable for the ingathering of the crops, which are now in the stackyard in good condition, except small patches here and there in very late places. The potato blight is generally very bad throughout the island. A strong gale from N.W. on 18th. Lunar halo on 27th.

LOCHBROOM.—This has been a remarkably fine month. Crops have been all secured in excellent condition, and much earlier than usual. In this district the potatoes are quite safe, but the disease has appeared in adjacent districts.

IRELAND.

MONKSTOWN.—A fine, cool month, the wet days, though few in number, being large in quantity, the fall on 26th (1·07) being the greatest since Oct. 8th, 1870.

DOO CASTLE.—On the whole a very fine harvest month; except in a few isolated cases it has been well secured. The oat crop very satisfactory, but the potatoes sadly diseased, one-third (of only a small yield) being rotten.

WARINGSTON.—Generally fine and dry, though cold; remarkable for the prevalence of easterly winds, which blew strongly almost the whole month. Temp. low; heavy fall of R (1·01) on 8th.

THE METEOROLOGICAL OFFICE.

To the Editor of the Meteorological Magazine.

SIR,—I cannot believe that the authorities of the Meteorological Office would have passed the paragraph to which you drew attention on page 127, unless there was some foundation for it. Strongly holding the opinion that the progress of science, as of other matters, is best promoted by friendly emulation, and that if all is to be under any one person's control little progress will be made, I am yet anxious impartially to consider the claim now put forward by the Meteorological Committee. Will you or some of your readers tell me upon what it is based?—Yours truly. C. H. GRIFFITH.

[We are unable to answer the above question. Admiral FitzRoy's report for 1857 contains a letter from the Royal Society, dated February 22nd, 1855, which certainly refers to land observations, but not to land observations in the British Isles. On page 26, it is stated that "data are still pressingly required" from British North America, the Mediterranean, Australia, New Zealand, and the West Indies. As, however, no steps have been taken either by Admiral Fitzroy, or the present Committee, to establish observatories in those localities where they were so "pressingly required," we fail to see the grounds for ignoring the instructions of the Royal Society, and concentrating all their efforts on a country not mentioned in the letter of 1855.—ED.]

RAINFALL OF SEPTEMBER 8th, 1871.

To the Editor of the Meteorological Magazine.

SIR,—Mr. Pratt, the Astrono-Meteorologist, predicted hail or rain storms on Sept. 8th, 9th. I registered, on the morning of the 9th, 0·54 in. of rain. May I ask if each of your correspondents will kindly favor me *(on a post card)*, with the quantity registered on the 9th, with the times of the commencement and end of the fall, also a brief note of the state of the weather on the preceding and following day. My object is to ascertain the geographical limits of the fall and its rate of progress. Results will be forwarded for publication.

Yours truly, W. R. BIRT.

Cynthia Villa, Walthamstow.